



Prosocial digital games for youth: A systematic review of interventions

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ABSTRACT

Digital games aiming to improve children health behaviours have received increasing attention from scholars and practitioners due to their societal importance. However, there remains a very limited understanding on the scope, application and relevance of prosocial games on youth. This review systematically investigates the literature base of empirical examinations of prosocial digital game interventions for children and explores the measures applied and their effectiveness. According to PRISMA guidelines, a systematic literature search was performed using five academic databases (EBSCO, Ovid, ProQuest, Scopus and Web of Science). To assess risk of bias in the analysis of included studies Cochrane developed quality assessment framework RoB2 and ROBINS-I were applied. Eleven studies met the inclusion criteria. Discussion of the reviewed studies highlights a heterogeneity of measures and lack of a consistent framework, mixed but promising results, and implications of skills and attitudes impacting prosocial behaviours. Finally, it proposes an agenda for future research on prosocial digital games focused on implementing clear theoretical frameworks and analysing key game design attributes to enhance prosocial digital games' effectiveness.

1. Introduction

Video and computer games have been often criticised in the child development literature for their adverse psychological and behavioural effects (Passmore & Holder, 2014). Historically, research has been focused on violent video games and their negative effects on players (Anderson et al., 2010; Sherry, 2001). More recently, there has been a shifting trend to investigate how video games can have a positive impact on mental health, emotional intelligence and prosocial behaviour (Carrisoli & Villani, 2019; Harrington & O'Connell, 2016; Pine et al., 2020; Villani et al., 2018). In addition, the *Positive Technology* movement emerged in response to the growing interest on the potential of digital technologies to foster positive growth of individuals, groups and institutions (Gaggioli et al., 2017, 2019). However, there is scarce evidence about digital games designed to target specific positive social and emotional outcomes in youth. The purpose of this review is to fill this gap by investigating the state of research on the impacts of prosocial digital games on children.

Violence and aggression are negative social behaviours presented by children (Jolliffe & Farrington, 2006b; Muñoz et al., 2011) that can affect them, their peers and society more broadly. In contrast prosocial behaviours, such as helping and defending (Litvack-Miller et al., 1997), are

characterised by assisting or acting in someone else's interest (Findlay et al., 2006). Prosocial behaviour is defined as voluntary, intentional behaviour that results in benefits for another; the motive is unspecified and may be altruistic, non-altruistic or both (Eisenberg et al., 2007). Other examples of prosocial behaviours include volunteering, donating and comforting (Baumsteiger & Siegel, 2019).

Developmental research literature has shown that prosocial responding becomes relatively stable during late childhood and early adolescence, arising from complex developmental and psychological processes involving attentional and evaluative processes, moral reasoning, social competence, and self-regulation (Caprara et al., 2005; Liew, 2012; Viglas & Perlman, 2018). Thus, prosocial behaviour is critical to the study of individual differences, development, well-being, interpersonal relationships, and group functioning (Baumsteiger & Siegel, 2019; Pavey et al., 2011). To measure prosocial behaviour, researchers observe behaviour directly or measure behavioural intentions (Baumsteiger & Siegel, 2019). A meta-analysis of 47 experiments showed that moderate-to-large changes in prosocial intentions (readiness to help others) predict small-to-moderate changes in health behaviour (Webb & Sheeran, 2006), as well as intentions to engage in charitable giving (Baumsteiger & Siegel, 2019).

Previous research has identified relations between aggressive and

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prosocial behaviour finding negative prediction of aggressive behaviour on prosocial behaviour using longitudinal study design (Chen et al., 2010; Obsuth et al., 2015). In addition, the literature has found negative social behaviours (such as aggression) may reflect the lack of contextual opportunities to learn and practice prosocial behaviour alternatives (Dodge et al., 2006; Moffitt, 1993). Thus, preventive efforts may focus on the development of prosocial behaviours (Berger et al., 2015; Luengo Kanacri et al., 2020). Yet, most previous research focuses on understanding mechanisms that predict negative behavioural outcomes, such as aggression and bullying (Evans et al., 2014; Jiménez Barbero et al., 2012; Nocentini et al., 2015), while little empirical research focuses on understanding, developing and strengthening prosocial behaviours as preventive measures (Schonert-Reichl et al., 2011).

Within the narrow prosocial behaviour research, classroom-based social-emotional learning (SEL) (Mahoney et al., 2018) and prosocial behaviour programmes have demonstrated some positive impacts on children's social development and behavioural adjustments (Luengo Kanacri et al., 2020; Schonert-Reichl et al., 2011; Taylor & Glen, 2019). Nonetheless, mixed effects are prevalent (Durlak et al., 2011) and highlight the need of evaluating theoretical frameworks suitable for explaining prosocial behaviours in children, as well as the development of programmes that can increase observed prosocial behaviour and not only social skills, attitudes and intentions. In this context of school-based efforts requiring intensive resources, digital games have shown promising results as a less resource intensive delivery format (Institute of Digital Media and Child Development Working Group on Games for Health et al., 2016).

The term "digital games" have been used to include computer games, video games, serious games and game-based learning as per previous reviews (Boyle et al., 2016; Connolly et al., 2012). All et al. (2016) systematic review explains that digital games comprise a variety of types and genres of games that can be played using multiple digital technologies such as computers, consoles and mobile devices. A digital game has been defined as "a rule-based formal system with a variable and quantifiable outcome, where different outcomes are assigned different values, the player exerts effort in order to influence the outcome, the player feels attached to the outcome, and the consequences of the activity are optional and negotiable (Juul, 2003, p. 5, p.5)". A variety of digital games and their effects on children outcomes have been studied in the literature referring to different terminology and concepts on game studies. Computer games and video games, serious games and game-based learning are different types of game genres that should be defined. An updated review of empirical evidence of the impacts of games differentiates between computer games (commercial games) and serious games (used to train or change attitudes and behaviours more broadly in the areas of health, public policy and advertising as well as education and training) (Boyle et al., 2016). The term "video games" is also used to classify commercial games not necessarily played in desktop or tablet computers, but also on game consoles and devices (Harrington & O'Connell, 2016). Furthermore, video games for health (G4H) use sophisticated technology for promoting and assessing health and well-being (Institute of Digital Media and Child Development Working Group on Games for Health et al., 2016). Additionally, digital game-based learning (also mentioned as digital educational games (Stefanidis et al., 2019)) refers to the usage of the entertaining power of digital games to serve an educational purpose (Acquah & Katz, 2020; All et al., 2016). In this context, the current review uses the term "digital games" to refer to any type of technology-based game that promotes prosocial skills and behaviours.

Previous literature reviews have evaluated a plethora of interventions aiming to improve children and adolescent's health and wellbeing with serious games (Holtz et al., 2018) digital games (Parisod et al., 2014) as well as digital game-based learning (Acquah & Katz, 2020; Hainey et al., 2016; Pellas et al., 2019). However, the application of digital games in the area of children's prosocial skills and behaviours is still very limited (Hainey et al., 2016). There is no systematic review solely examining the application of digital games to promote prosocial skills and behaviours.

This review fills this gap by systematically identifying and synthesising evidence from empirical pre-test post-test studies evaluating prosocial games' effects on prosocial skills and behaviours in youth under 19 years old. Two research questions guided this study:

RQ1: Which constructs have been measured to test the effects of prosocial digital games on prosocial skills and behaviours?

RQ2: What is the evidence on prosocial digital games effectiveness on prosocial skills and behaviours?

This study makes important contributions by presenting a current overview of the effectiveness of digital games on prosocial behaviours and providing a roadmap for future game research and practice.

2. Materials and methods

Following PRISMA guidelines (Moher et al., 2015), a systematic literature search was performed. Articles were extracted in August 2019 using five academic databases: EBSCO (All Databases); Ovid (All Databases); ProQuest (All Databases); Scopus; and Web of Science (All Databases). Other articles were added using the forward-backward search strategy. Similar method can be found in Pang et al. (2017). Only articles written in English, published in peer-reviewed journals and conferences were extracted.

2.1. Key search terms

The following search terms were used for this review:

*gamif** OR *gameful* OR "serious game*" OR "digital game" OR "electronic game*" OR "videogame" OR "video game" OR "computer games" OR "video games" OR "simulation games" OR "games-based learning" OR "online games" OR "virtual reality" OR "augmented reality" OR "mixed reality" OR "virtual-reality" OR "augmented-reality" OR "mixed-reality" OR "immersive games"
AND
school OR *children* OR *childhood* OR "primary education"
AND
evaluation OR *impacts* OR *outcomes* OR *effects* OR *engagement* OR *affect*
AND
"social emotional" OR "social cogniti*" OR "prosocial" OR "pro-social" OR *empath** OR *sensitivity* OR *sensibility* OR *sympathy* OR *fellow** OR *like-mindedness* OR "like mindedness" OR *benevolen** OR *altruism** OR *compassion**

The asterisk allowed for the inclusion of term variations (e.g., singular vs plural).

The systematic search was focused on interventions targeted to children. Nonetheless, the exclusion criteria (see Fig. 1) considered interventions targeted to adolescents to be included in the systematic review to amplify the scope of the research. Many times, target audiences of studies include both children and adolescents together. The definition of the threshold of adolescence varies between locations and jurisdictions, yet this period begins with puberty and ends when adult identity is accepted ("Age limits and adolescents," 2003). The Adolescent Health Committee (2002–2003) has defined this period of development corresponding roughly to the period between the ages of 10 and 19 years ("Age limits and adolescents," 2003). In this study, all interventions targeted towards people younger than 19 years have been included.

2.2. Procedure

The combined total of records downloaded from all databases was 812. From the initial records collected, 275 duplicate records were removed, leaving 537 unique sources. All downloaded records were imported into Endnote X9. After duplications were removed, titles and abstracts of the remaining papers were reviewed for eligibility. Additional studies found by forward-backward search were included. Fig. 1

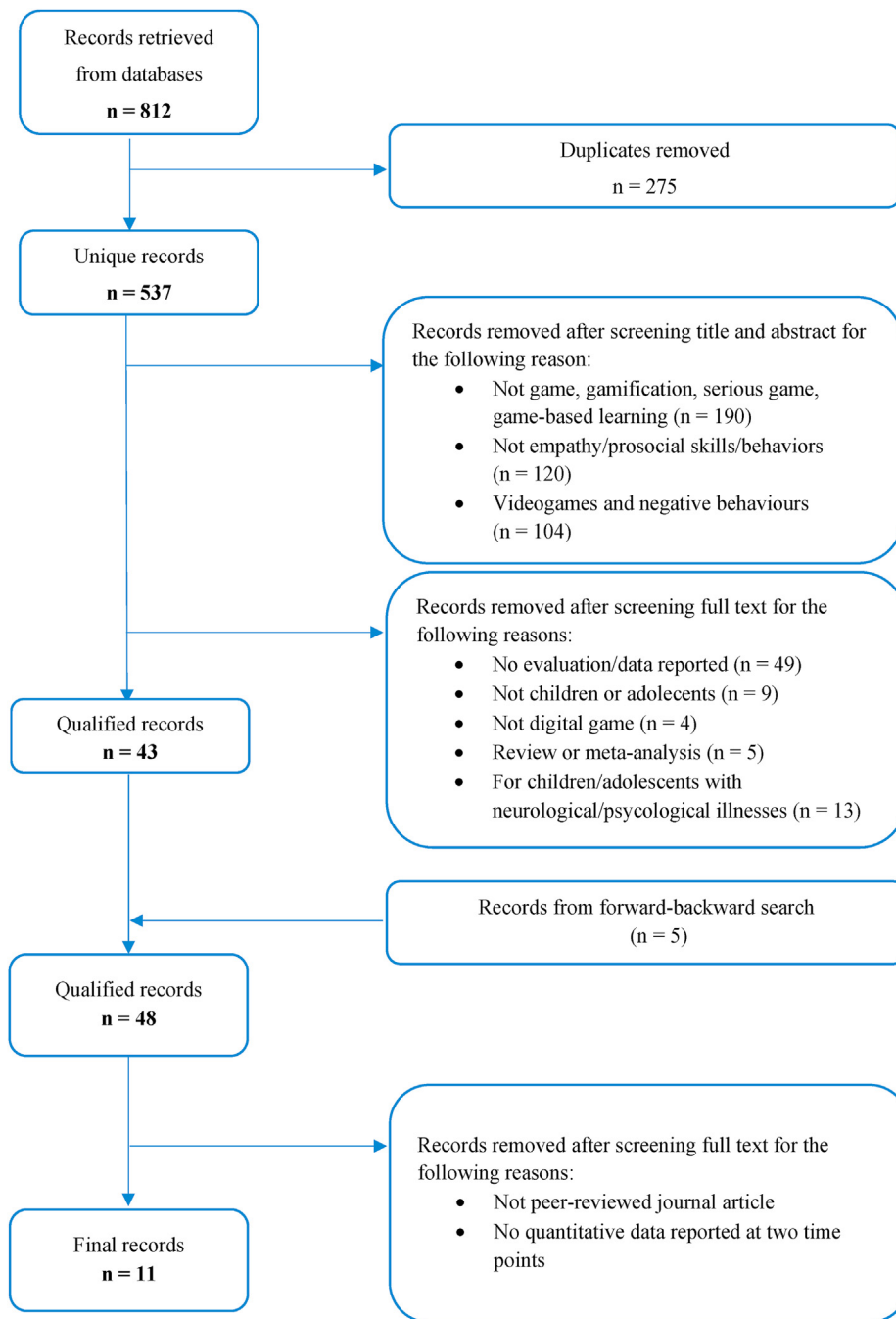


Fig. 1. Flowchart of the systematic literature search process.

summarises the exclusion and inclusion process. The resulting sample contained eleven qualified records.

2.3. Data extraction, coding framework and quality assessment

Following PRISMA guidelines a coding framework was developed to enable a standardised method for extraction of the specific information from qualified records (Table 1 and Table 2). To assess the risk of bias in included studies, the Cochrane developed quality assessment framework Risk of Bias tool Ver. 2 (RoB2) (Sterne et al., 2019) for randomized controlled trials (RCTs), or Risk Of Bias In Non-Randomized Studies - of Interventions tool (ROBINS-I) (Sterne et al., 2016) were applied to each paper at study level. The risk of bias tools define six dimensions of bias to

assess risk of bias including Bias arising from the randomization process, Bias due to deviations from intended interventions, Bias due to missing outcome data, Bias in measurement of the outcome, Bias in selection of the reported result, and Overall bias (Sterne et al., 2019). For definitions and details please refer to Sterne et al. (2016) and Sterne et al. (2019). Each dimension has associated questions which are assessed for lower risk of bias or higher risk of bias, with an overall risk-of-bias judgment of low/high/some concerns or moderate. Trained coders extracted data from each record according to the published details contained in the publication. All records were cross checked by at least two independent coders to ensure reliability of data extracted. Any discrepancies were discussed and resolved with the support of a third and fourth reviewer.

Table 1
Study characteristics.

N	Author, year	Title	Location of study	Study Design	Target skills/ behaviours	Sample size	Sample Age	Results	Risk of Bias
1	Bachen et al. (2012)	Simulating REAL LIVES: Promoting global empathy and interest in learning through simulation games	USA	RCT	Global empathy	N = 301	14–15 years	Positive	Some concerns
2	Boduszek et al. (2019)	Prosocial video game as an intimate partner violence prevention tool among youth: A randomised controlled trial	Barbados	RCT	Empathy (affective and cognitive responsiveness)	N = 172	9–17 years	Mixed	Some concerns
3	Craig et al. (2016)	Enhancing Children's Social Emotional Functioning Through Virtual Game-Based Delivery of Social Skills Training	USA	RCT	Social Skills Training	N = 47	7–11 years	Positive	Some concerns
4	DeRosier and Thomas (2019)	Hall of Heroes: A Digital Game for Social Skills Training with Young Adolescents	USA	RCT	Social Skills Training	N = 29	9–13 years	Positive	Some concerns
5	DeSmet et al. (2018)	The efficacy of the Friendly Attac serious digital game to promote prosocial bystander behaviour in cyberbullying among young adolescents: A cluster-randomized controlled trial	Belgium	RCT	Positive bystander behaviour in cyberbullying	N = 216	13–14 years	Mixed	Some concerns
6	Hilliard et al. (2018)	Perspective taking and decision-making in educational game play: A mixed-methods study	USA	RCT	Ethical thinking, moral decision-making, empathy	N = 131	11–13 years	No change	Some concerns
7	Ingram et al. (2019)	Evaluation of a virtual reality enhanced bullying prevention curriculum pilot trial	USA	Non-randomized quasi-experimental	Positive bystander behaviour in bullying	N = 118	11–14 years	Mixed	Moderate
8	Sanchez et al. (2014)	The acceptability and efficacy of an intelligent social tutoring system for children with social skills challenges	USA	RCT	Social Skills Training	N = 36	8–12 years	Positive	Some concerns
9	Sanchez et al. (2017)	Improving Children's Mental Health with a Digital Social Skills Development Game: A Randomized Controlled Efficacy Trial of Adventures aboard the SS GRIN	USA	RCT	Social Skills Training	N = 69	7–11 years	Positive	Some concerns
10	Tsai and Kaufman (2014)	Interacting with a computer-simulated pet: Factors influencing children's humane attitudes and empathy	Canada	Non-randomized quasi-experimental	Empathy, humane attitudes	N = 51	9–11 years	Positive	Moderate
11	Vannini et al. (2011)	FearNot!: a computer-based anti-bullying-programme designed to foster peer intervention	UK, Germany	Non-randomized quasi-experimental	Positive bystander behaviour in bullying	N = 1133	7–11 years	Mixed	Moderate

3. Results

The final eleven studies and main characteristics are presented in [Table 1](#). Most interventions were conducted in North America, Europe and one in Barbados ([Boduszek et al., 2019](#)). Studies were published between 2011 and 2019 due to the novelty of digital games for prosocial behaviours. Sample size ranged from 29 ([DeRosier & Thomas, 2019](#)) to 1133 ([Vannini et al., 2011](#)). Most interventions were randomized ($n = 8$) and three studies used quasi-experimental non-randomized designs ([Ingram et al., 2019](#); [Tsai & Kaufman, 2014](#); [Vannini et al., 2011](#)). Further, study quality assessment was usually moderate due to non-specified randomization methods in most RCTs. Yet, double-blind rules were applied in some cases.

[Table 2](#) details all applied measures and corresponding effects. Six papers demonstrated some level of effectiveness, four papers showed mixed results, while only one study featured no effects. To answer *RQ1*, outcome measures are classified in five categories (socio-emotional skills, attitudes toward self and others, prosocial behaviours, conduct problems and emotional distress; academic performance was excluded for being out of scope in this review) as per previous systematic review on social-emotional learning interventions for children ([Durlak et al., 2011](#)). To answer *RQ2*, categorised measures are analysed regarding their positive, negative or not significant outcomes. Of importance, generally, studies may use different scales for the same construct. Additionally, studies apply different types of reporting, including self-report, parent report and peer-nomination to evaluate outcomes.

Studies yielded positive significant results on social-emotional competencies, attitudes about the self, others, and school, and enhanced children and young adolescents' prosocial behaviours, in line with traditional non-digital social-emotional learning programmes ([Durlak](#)

[et al., 2011](#)), while mixed results are also prominent. Socio-emotional skills include affective, cognitive and social skills ([Durlak et al., 2011](#)). Six studies yielded positive results in socio-emotional skills measures, including empathy, social literacy and prosocial skills (see [Table 2](#)). In contrast, affective empathy had mixed results, only one ([Boduszek et al., 2019](#)) of three studies measuring this outcome found positive effects. The second category combines attitudes towards the self and social topics including self-perceptions, school belonging, and conventional beliefs about helping others ([Durlak et al., 2011](#)). Six studies yielded positive results in attitudes measures (see [Table 2](#)). In contrast, self-efficacy had mixed results, where [Craig et al. \(2016\)](#) and [DeSmet et al. \(2018\)](#) found positive effects and [Sanchez et al. \(2017\)](#) found no effects. The third category of measures, prosocial behaviours, includes performance of behaviours observed by parents, teachers, peers or facilitators, excluding hypothetical situations and self-reported measures which are treated as social emotional skill outcomes ([Durlak et al., 2011](#)). Five studies included prosocial behaviour measures, four yielding positive results in observed social skills and adaptive social behaviour, observed behavioural strength and positive bystander behaviour (see [Table 2](#)). Results demonstrate these games promoted and positively influenced children's observed prosocial behaviours in everyday real-life scenarios. Additionally, three studies measured negative behaviour measures (conduct problems). Conduct problems and emotional distress are secondary measure categories in this review. Conduct problems included all variables related to different types of negative social behaviours ([Durlak et al., 2011](#)). Two studies yielded significant results, showing reduction in bullying perpetration and bullying victimization (both self-reported) (see [Table 2](#)).

4. Discussion

The purpose of this review was to investigate prosocial digital games empirical evaluations, measures applied and effectiveness. This is the first systematic review investigating effectiveness of digital games on developing prosocial skills and behaviours in children. This review makes important contributions. First, it identifies and analyses results on skills and attitudes influencing prosocial behaviours. Second, it demonstrates prosocial digital games generally provide mixed but encouraging results. Third, it identifies the diversity of measures applied and lack of a consistent framework in prosocial digital games. Fourth, an agenda for future research to advance the field is proposed.

4.1. Prosocial skills and attitudes that influence prosocial behaviours

Socio-emotional skills and attitudes towards self and others are important factors influencing prosocial behaviour outcomes. Extensive research indicates development of socio-emotional skills is associated with better well-being in children (Eisenberg, 2006; Guerra & Bradshaw, 2008), however, several researchers have questioned the extent to which the promotion of socio-emotional skills in children can actually improve their behavioural outcomes (Duncan et al., 2007; Durlak et al., 2011). This review showed important positive results in diverse skills and attitudes measures, as well as some mixed results. Only six studies measured empathy and only two measured affective and cognitive dimensions separately, crucial to understanding empathy interactions with different behaviours (Jolliffe & Farrington, 2006a) and to allow analysis and comparison with previous research. Boduszek et al. (2019) mixed results are in line with previous gamified interventions for children that have yielded positive change in affective empathy while no change in cognitive empathy was observed (Saleme et al., 2020). Previous literature suggests affective empathy has a stronger influence than cognitive empathy in negative social behaviours such as bullying (Jolliffe & Farrington, 2006b; Muñoz et al., 2011). In contrast, Barlińska et al. (2018) found only cognitive empathy activation increased the likelihood of prosocial bystander behaviour, while affective empathy did not affect prosocial behaviour outcomes. Such discrepancy warrants future research investigating if cognitive or affective empathy have a significant influence on prosocial behaviours. Four of six game evaluations increased empathy, warranting future research on the potential of prosocial games to promote empathy as an important factor mediating prosocial behaviours. Additionally, attitudes such as self-efficacy had mixed results (Craig et al., 2016; DeSmet et al., 2018; Sanchez et al., 2017). Social self-efficacy or self-confidence is essential for translating social skills (knowledge) learned through prosocial games and interventions into improved social behaviours in real-world scenarios (Craig et al., 2016; Ollendick & Schmidt, 1987). Moreover, some studies assessed only skills and attitudes measures (Bachen et al., 2012; Boduszek et al., 2019; Tsai & Kaufman, 2014) while others only addressed outcome behaviours (DeRosier & Thomas, 2019; Sanchez et al., 2014; Vannini et al., 2011). Thus, prosocial digital games may use a theory mapping technique (Eldredge et al., 2016) to ensure constructs mediating behavioural outcomes are mapped and as a result included in the actual game design.

4.2. Promising outcome effects

Overall, most studies observed positive change in at least one up to several prosocial skills, attitudes, or behaviour variables. However, small effects were predominant in the sample. Even though prosocial measures increased only to a small degree in many cases, the effects found are important (Price et al., 2006). Some studies measured programme deliveries that lasted a few days (Bachen et al., 2012; Boduszek et al., 2019), while others divided the programme in longer periods of time to maximise exposure over several weeks (Craig et al., 2016; DeRosier & Thomas, 2019; Ingram et al., 2019; Sanchez et al., 2014, 2017; Tsai &

Kaufman, 2014; Vannini et al., 2011), generally one session per week, yielding further positive behavioural results (Craig et al., 2016). Moreover, compared to other types of interventions for children that aim to influence behaviours such as physical activity or healthy eating, prosocial behaviour and its mediators (i.e. empathy, social self-efficacy, attitudes) comprise psychological processes and can be considered difficult-to-influence variables (Prentice & Miller, 1992). As Prentice and Miller (1992) explain, the social psychological literature presents several examples of the minimalist approach to demonstrating an important effect and even modest changes already observed reliably precede behavioural change in other effective programmes (O'Leary-Barrett et al., 2016).

In contrast to recent research on cooperative commercial games were gaming was not associated with changes in prosocial behaviour (Lobel et al., 2017), this review shows that bespoke digital games designed to promote prosocial skills and behaviours can have positive effects on observed behavioural outcomes. Nonetheless, considering the mixed results found, it is important to highlight that positive results in skills and attitudes did not reflect in positive results in behavioural outcomes in some cases. For instance, Ingram et al. (2019) and DeSmet et al. (2018) games to promote prosocial bystander behaviour in cyberbullying presented positive results in skills and attitudes, yet, they had no significant effects on most conduct problem outcome measures (except for bullying perpetration in Ingram et al. (2019)). These results are in line with previous systematic reviews that have investigated the effectiveness of bullying and cyberbullying interventions, finding limited effects in bullying perpetration and victimization (Evans et al., 2014) and very little evidence on effectiveness (Nocentini et al., 2015). Furthermore, the evaluation of these bullying prevention games used self-reported measures of intentions to perform the behaviour instead of using prosocial behaviour measures (observed behaviour) to evaluate the effects, in contrast with Vannini et al. (2011) that measures positive bystander behaviour by peer-nomination. Previous non-digital prosocial programmes literature shows behaviour outcome data from other sources yields significantly higher effects than those from student self-report measures (Durlak et al., 2011). Thus, future prosocial game evaluations should strive to include behaviour outcome measures to yield stronger and more precise results.

Additionally, it is important to highlight studies that transformed existing Social Skills Training school-based programmes (SSTs) into digital games, as they yielded prevalent positive results in the sample (Craig et al., 2016; DeRosier & Thomas, 2019; Sanchez et al., 2014, 2017). The literature supports the benefits of SST programmes as a universal, integrated intervention approach for children to participate in social-emotional learning (SEL) (Durlak et al., 2011). Especially because SEL programmes promote the integrated training of emotion, cognition, communication, and behaviour skills (Lemerise & Arsenio, 2000). Thus, future research should investigate the benefits and effectiveness of converting validated SSTs into digital games to more broadly deliver effective prosocial skills and behaviour training for youth, especially in school settings.

4.3. Heterogeneity of measures and lack of framework

The narrow sample size of 11 studies in this review is evidence of the lack of empirical testing in digital game interventions aiming to promote prosocial skills and behaviours. Similar prosocial game interventions have reported on game design features and processes, or preliminary non-rigorous evaluations (Kors et al., 2016; Ramesh et al., 2018), overlooking behavioural outcomes. In this sample, diversified outcome measures and lack of a consolidated framework limit the comparability between studies and generalisability of findings, impeding objective assessment of intervention effects via meta-review. Additionally, the scarcity of empirical testing and mixed results evidence a need to incorporate observed behaviour measurement and not only attitudes and skills measures. Furthermore, the lack of double-blinding and reliance on

Table 2
Outcome measures and effects.^a

N	Study	N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
		Measures	Empathy	Affective empathy	Cognitive empathy	Interpersonal generosity	Social literacy	Prosocial skills	Positive bystander behaviour (self-report)	Self-efficacy	Social satisfaction	Intention to act as positive bystander	School belonging	Humane attitudes	Interest on learning about other cultures	Positive youth development	Commitment to moral action	
		Reporting	Socio-emotional Skills							Attitudes								
1	Bachen et al. (2012)	self-report	+												+			
2	Boduszek et al. (2019)	self-report		+	n.s.													
3	Craig et al. (2016)	parent & self-report					+			+	+							
4	DeRosier and Thomas (2019)	parent-report																
5	DeSmet et al. (2018)	self-report		n.s.				+	n.s.	+		+						
6	Hilliard et al. (2018)	self-report, observed behaviour		n.s.	n.s.	n.s.										n.s.	n.s.	
7	Ingram et al. (2019)	self-report	+									+	+					
8	Sanchez et al. (2014)	parent-report																
9	Sanchez et al. (2017)	self-report					+			n.s.	+							
10	Tsai and Kaufman (2014)	self-report	+											+				
11	Vannini et al. (2011)	self-report & peer nomination																

a(+/-) positive/negative significant change (n.s.) not significant change (*) Positive effect found in German sub-sample. Not significant in UK sub-sample (Vannini et al., 2011).

self-report measures weaken methodological quality and generalisability of findings. Future research should strive to have more rigorous design, higher methodological standards and perform theory-backed empirical evaluations to demonstrate the quality of the interventions in this novel field of work.

4.4. Future research on prosocial digital games

Durlak et al. (2011) framework of outcome measure categorization was crucial to identify deficiencies in outcome measurement, were many studies in the sample lacked socio-emotional skills, attitudes, and more importantly, observed behaviour measures. Moving forward, a clear framework for the measurement of prosocial game effectiveness is warranted in order to yield comparable results. Additionally, future research should analyse theory application in the design and evaluation of the prosocial game interventions in order to understand effectiveness and aid future programme design (Pang et al., 2017). Researchers increasingly recognise the importance of creating evidence-based games that are designed using theory and validated data in order to address health and wellbeing behaviours (Verschuere et al., 2019). There is potential for digital games to shift from a game design orientation based on user experience towards a more objective assessment (Verschuere et al., 2019) to demonstrate what works and what doesn't.

Equally, it is essential to collect deeper knowledge of the most effective components of programmes. Future research should focus on analysing game attributes (Dietrich et al., 2018) and other game design characteristics to collect insights for future prosocial game development. Game designers and practitioners may analyse this sample of games to consider several game design attributes that may be replicated and incorporated in new digital game interventions. Additionally, this review

calls for more innovative and immersive game solutions, similar to Ingram et al. (2019) who created an immersive experience using virtual reality (VR) simulation which yielded positive results in empathy and willingness to intervene as a bystander. Despite promising work using immersive technologies such as VR to tackle complex social scenarios such as refugee crisis (Kors et al., 2016), underaged drinking where results showed positive outcomes (Dietrich et al., 2019) and other mental health and social impact issues (Gaggioli et al., 2019), these all require more objective assessment. Similarly, this review presented a lack of evidence on immersive augmented reality (AR) technologies applied to prosocial games, yet the literature shows that this technology presents cognitive and engagement benefits for primary and secondary school game-based interventions (Pellas et al., 2019; Saleme et al., 2020). More importantly, future research should investigate the role of advanced technologies such as artificial intelligence (AI) in the area of prosocial digital games. In a recent study Stefanidis et al. (2019) examined whether an AI adaptation mechanism could improve the performance of students in a prosocial game. The mechanism adjusts game content, maintaining a player engagement profile for corrective feedback and positive reinforcement game elements, in order to increase the chances of players achieving specific prosocial skills learning objectives (Stefanidis et al., 2019). Considering positive results were found in a small-scale experiment, AI technologies may serve as a useful mechanism for prosocial digital game adaptation and personalization.

5. Conclusion

The aim of this systematic literature review was to summarize and critically assess the current empirical literature. Heterogeneity in evidence and reporting did not allow to draw direct comparisons between

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Moral reasoning	Behavioural emotional strength (observed)	Social skills (observed)	Adaptive social behaviour	Helping behaviour	Positive bystander behaviour (observed)	Communication, Cooperation	Empathy skills (observed)	Bullying victimization	Bullying perpetration	Cyber bullying victimization	Cyber bullying perpetration	Cyber bullying witnessing (bystander)	Relational aggression	Mental well-being (Quality of life)	Psychosocial Distress, Anxiety
Attitudes	Prosocial Behaviours							Conduct Problems						Emotional Distress	
		+	+			n.s.	n.s.								
	+														
								n.s.	n.s.	n.s.	n.s.	+		+	
n.s.					n.s.								n.s.		
	+														
									n.s.						
						+	*		n.s.	n.s.					

studies. Yet, mixed but encouraging results in this review suggested that researchers and practitioners should consider using prosocial digital games to promote a variety of prosocial behaviours and skills that are crucial for young people social-emotional development and the well-being of society.

Declaration of competing interest

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