

This item is the archived peer-reviewed author-version of:

Bridging behavior science and gaming theory : using the Intervention Mapping Protocol to design a serious game against cyberbullying

Reference:

DeSmet Ann, Van Cleemput Katrien, Bastiaensens Sara, Poels Karolien, Vandebosch Heidi, Malliet Steven, et al.- Bridging behavior science and gaming theory : using the Intervention Mapping Protocol to design a serious game against cyberbullying

Computers in human behavior - ISSN 0747-5632 - 56(2016), p. 337-351

Full text (Publishers DOI): <http://dx.doi.org/doi:10.1016/J.CHB.2015.11.039>

To cite this reference: <http://hdl.handle.net/10067/1299850151162165141>

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/284878891>

Bridging behavior science and gaming theory: Using the Intervention Mapping Protocol to design a serious game against cyberbullying

ARTICLE *in* COMPUTERS IN HUMAN BEHAVIOR · JANUARY 2015

Impact Factor: 2.69 · DOI: 10.1016/j.chb.2015.11.039

READS

40

11 AUTHORS, INCLUDING:



[Ann DeSmet](#)

Ghent University

36 PUBLICATIONS 84 CITATIONS

[SEE PROFILE](#)



[Katrien Van Cleemput](#)

University of Antwerp

27 PUBLICATIONS 342 CITATIONS

[SEE PROFILE](#)



[Sara Bastiaensens](#)

University of Antwerp

19 PUBLICATIONS 55 CITATIONS

[SEE PROFILE](#)



[Maité Verloigne](#)

Ghent University

45 PUBLICATIONS 543 CITATIONS

[SEE PROFILE](#)

**Bridging behavior science and gaming theory: using the Intervention Mapping Protocol
to design a serious game against cyberbullying.**

Authors. Ann DESMET^a, Katrien VAN CLEEMPUT^b, Sara BASTIAENSENS^b, Karolien POELS^b, Heidi VANDEBOSCH^b, Steven MALLIET^b, Maité VERLOIGNE^a, Griet VANWOLLEGHEM^a, Lieze MERTENS^a, Greet CARDON^a, Ilse DE BOURDEAUDHUIJ^a

Affiliations. ^a *Ghent University, Faculty of Medicine and Health Sciences, Department of Movement and Sport Sciences*

^b *University of Antwerp, MIOS, Department of Communication Studies*

Corresponding Author

Ilse De Bourdeaudhuij, Faculty of Medicine and Health Sciences, Department of Movement and Sport Sciences, Watersportlaan 2, 9000 Gent, Belgium. Phone. +32.9.264.63.11. Fax. +32.9.264.64.84. E-mail: Ilse.Debourdeaudhuij@ugent.be

Bridging behavior science and gaming theory: using the Intervention Mapping Protocol to design a serious game against cyberbullying.

Abstract

Introduction. The Intervention Mapping Protocol (IMP) was applied to the design of a serious game against cyberbullying among adolescents (12-14y). **Method.** The IMP comprises 6 predefined steps. A systematic review assessed the cyberbullying problem and associated health risks (Step 1). Surveys and focus groups collected information on behavior and its determinants from adolescents (surveys, n=1979 and n=453; focus groups, n=69;), parents (surveys, n=48 and n=323) and educators (survey, n=451) (Step 1, 2). Meta-analyses analyzed effective methods for cyberbullying programs and serious games (Step 3). A survey (n=530) and focus groups (n=69 adolescents, n=8 adolescents) assessed preferences and program material appreciation (Step 4). Planned activities for step 5 (implementation) and step 6 (effectiveness) are reported. **Results.** Targeting positive bystander behavior (defending, reporting and comforting) was chosen as a viable approach to reduce cyberbullying. Bystander behavior differed by context and was predicted most by positive outcome expectations for the victims. Adolescents valued educator and parental support. Predictors for educator behavior and parental support are described. Serious game design was based on effective change methods and features, and took stakeholder and user preferences into account. **Conclusion.** Findings may aid professionals in evidence- and theory-based design of cyberbullying interventions and serious games.

Keywords: cyberbullying, serious game, bystanders, adolescence, Intervention Mapping

1. INTRODUCTION

Cyberbullying is commonly defined as intentionally and repeatedly sending or posting electronic messages or images to cause the victim harm (Kiriakidis & [Kavoura, 2010](#); [Tokunaga, 2010](#)). Cybervictimization rates among adolescents largely vary between 3% and 24% ([Hinduja & Patchin, 2012](#); [Olweus, 2012](#)), depending on the definition and timeframe that is used ([Olweus, 2012](#); [Tokunaga, 2010](#)). These varying prevalence rates were summarized in a recent meta-analysis across 80 studies in adolescents (aged 12-18 years), to a rate of 15% for victimization and to 16% for penetration of cyberbullying ([Modecki et al., 2014](#)). A systematic review suggested a curvilinear linear between age and cyberbullying victimization, with a peak in 7th and 8th grade, and decreasing towards later adolescence ([Tokunaga, 2010](#)). Other studies found a weak linear correlation between age and cyberbullying involvement ([Zych, Ortega-Ruiz, & Del Rey, 2015](#)). Both cyberbullying perpetration and victimization relate to numerous psychosocial problems ([Kowalski, Giumetti, Schroeder, & Lattaner, 2014](#)). Recent longitudinal research has shown that cybervictimization in adolescents which was stable at a one-year follow-up was associated with the highest levels of depressive symptoms and problematic alcohol use compared to non-stable victims or non-victims ([Gàmez-Guadix, Gini, & Calvete, 2015](#)). Cyberbullying prevention and intervention efforts are consequently needed to end or prevent a stable pattern of cybervictimization and reduce its harm among adolescents.

In traditional bullying prevention programs, several elements were considered as key ingredients for effectiveness: whole school programs, programs which lasted longer and consisted of more sessions, interventions using videos and devoting attention to environmental factors, e.g. by providing teacher and parent training ([Ttofi & Farrington, 2011](#)). Recent systematic reviews on cyberbullying prevention and intervention programs indicated that these elements were not frequently incorporated in current anti-cyberbullying programs ([Della Cioppa, O'Neil, & Craig, 2015](#); [Van Cleemput et al., 2013](#)). A recent review of cyberbullying prevention and intervention programs indicated a lack of evidence-based rather than evidence-informed programs, that used a whole-school approach, and that included components addressing several individual behavioral determinants and the social context (e.g. family) ([Della Cioppa, O'Neil, & Craig, 2015](#)).

For cyberbullying prevention and intervention programs, no clear key success factors have yet been established. One potential success factor suggested for cyberbullying prevention and intervention programs, was underpinning these by behavior change theories (Tokunaga, 2010). Behavior change theories explain the dynamics and determinants of health behavior, and relate these to methods and processes for change (Shegog, 2010). Behavior change theories have, indeed, shown to be a lever in increasing intervention effectiveness in other health promotion programs (Glanz & Bishop, 2010). Very few cyberbullying prevention and intervention programs, included in the review mentioned above, were founded in behavior change theories (i.e. Social Cognitive Theory, Theory of Planned Behavior), while a variety of other theoretical models were used by most programs, such as peer support models, cooperative and constructive learning theories (Van Cleemput et al., 2013). A similar hypothesis was made about serious game design: the key to serious game effectiveness may lie in its use of behavioral and motivational theory (Shegog, 2010).

Theories should, moreover, be implemented using standardized definitions. The precise application of theories in behavior change programs has often shown to be problematic, causing wide diversity in intervention effectiveness (Michie et al., 2011). Following standardized definitions of theories (e.g. Social Cognitive Theory) and standardized applications of theoretical concepts (e.g. guided practice), allows to assess the accurate implementation of scientific evidence and allows a reliable linking of mechanisms of action to the intervention effectiveness (Michie et al., 2011). In sum, while no evidence is yet available on key ingredients of these programs, behavior change theories may be critical drivers of success, but require a systematic implementation and standardized application to practice.

The Intervention Mapping Protocol (IMP) was designed by leading behavior change experts (Bartholomew, Parcel, Kok, Gottlieb, & Fernández, 2011) to aid in the systematic and stepwise application of theory to behavioral change programs. The systematic approach of the IMP necessitates a detailed description of intervention content, which meets recent demands for more thorough reporting (Michie, Fixsen, Grimshaw, & Eccles, 2009). It aims to increase both efficacy and effectiveness, by a reiterative process of evidence review, application of theory-based strategies, and stakeholder consultation in six well-defined steps (Bartholomew et al., 2011). The Intervention

Mapping Protocol was suggested as a model that can facilitate evidence- and theory-based serious health game design. It examines the steps that should be taken by game developers to acquire design information, and can provide a common basis for process decisions, and enable the cooperation between serious game developers and health professionals (Shegog, 2010).

1.1. Current study

The aim of this study was to describe the application of the Intervention Mapping protocol, developed by Bartholomew et al. (2011), to the design of a serious game against cyberbullying. The Intervention Mapping protocol aids in a systematic intervention design based on evidence and behavior change theories. As mentioned earlier, this may be a critical driver of success for cyberbullying intervention and prevention programs, whereas this particular theory-based design is currently not often used in cyberbullying programs.

Several theories have been reported in literature to understand or predict cyberbullying involvement, such as personal deficit models, stress coping models, computer-mediated communication models or behavior prediction models (for an overview, see DeSmet, 2015). The Intervention Mapping Protocol was not used as a theoretical framework to understand cyberbullying behavior, but as a method for evidence- and theory-based intervention design grounded in behavior change theories.

The study was hence innovative in using a systematic approach to design a cyberbullying prevention program underpinned by behavioral change theories. A similar approach to the Intervention Mapping protocol is described by the Behaviour Change Wheel (Michie et al., 2014). This approach was fairly new and not yet available in intervention design guidelines at the start of our project. Consequently, the choice was made to use IMP (Bartholomew et al., 2011; soon available in 4th edition, Bartholomew et al., 2016) as a well-validated approach in the design of behavior change interventions.

Our study is, furthermore, the first to apply this protocol to the design of a serious game intervention against cyberbullying. Games are tools that, if attuned correctly to the educational context (Bourgonjon, Valcke, Soetaert, & Schellens, 2010), are highly appreciated by adolescents compared to traditional teaching methods (Vogel, Vogel, Cannon-Bowers, Bowers, Muse, & Wright, 2006). And

lastly, this study is innovative in its evidence-based intervention components to address social environmental influences of educators and parents in cyberbullying.

The IMP recognizes both individual and environmental, bi-directional, influences of behavior (e.g. peers, family relations, school policy), in line with an ecological model of health behavior ([Sallis, Owen, & Fisher, 2008](#)). An ecological model was also considered important for studying bullying and peer victimization, and for designing appropriate bullying prevention and intervention strategies ([Hong & Espelage, 2012](#)). This protocol was applied to several health behaviors, such as healthy diet and physical activity (e.g. [Verbestel et al., 2011](#)), sexual health (e.g. [Brown, Bayley, & Newby, 2013](#)), mental health promotion (e.g. [Kraag, Kok, Abu-Saad, Lamberts, & Fekkes, 2005](#)), and recently also to cyberbullying ([Jacobs, Völlink, Dehue, & Lechner, 2014](#)). The latter intervention transformed an existing intervention into an online tool, and aimed to enhance victim's coping strategies. It was founded in Rational, Emotional (Behavioral) Therapy. The program focused on improving individual coping behavior; environmental level influences were not included ([Jacobs et al., 2014](#)).

1.2. Theoretical foundation

Our study applied the IMP to design a serious game against cyberbullying among young adolescents (12-14y). As mentioned above, a socio-ecological approach was used. In line with the socio-ecological model, this game was intended as part of a wider school approach that would also address educator and parental behavior, who are important environmental agents in influencing adolescent behavior in cyberbullying. Its development was guided by the Reasoned Action Approach (also named integrated model, [Fishbein & Ajzen, 2010](#)), by Social Cognitive Theory ([Bandura, 2002](#); [Bandura, 2007](#)) and the Bystander Intervention Model ([Latane & Darley, 1970](#)). The MDA (Mechanics, Dynamics, Aesthetics) Framework was used as a game-based learning theory in game design ([Hunicke, LeBlanc, & Zubek, 2004](#)). Where evidence related to cyberbullying was lacking, insights from traditional bullying were used and additional research was conducted (e.g. behavioral determinants of bystander, educator and parental behavior). This paper describes the application of the Intervention Mapping Protocol to the design of the program (Step 1-4) and planned actions for implementation and evaluation (Step 5 and 6). This study provides result and process information at each design step.

Presented below is a detailed description of the design process, based on published or submitted findings (e.g. literature review, qualitative study, quantitative study among adolescents and educators, meta-analysis, initial concept test), and unpublished findings (e.g. quantitative study among parents, narrative preferences, usability tests, comparisons between behavior change techniques and game design methods).

The results of this design process will also provide a broad overview of insights in bystander behavior in cyberbullying, and of strategies to balance behavior change methods and gaming features in serious game design, to maximize both effectiveness and game engagement. These insights may aid professionals who wish to tackle cyberbullying, as well as professionals involved in serious game design.

In sum, there is a need for evidence- and theory-based cyberbullying prevention and intervention programs, using a whole-school approach, including components that address several individual behavioral determinants and the social context. Our study aims to meet this current lack in literature and practice.

2. METHODS AND RESULTS

The Intervention Mapping Protocol consists of six different steps: 1) needs assessment, 2) preparing matrices of change objectives, 3) selection of theory-informed intervention methods and practical strategies, 4) development of the intervention program, 5) planning for adoption, implementation and sustainability, and 6) development of an evaluation design. In the following sections, these steps are described. They are described consecutively, although the process is in fact iterative. The IMP steps are summarized in Table 1; the process of developing our program according to IMP is outlined in Fig. 1 and described in more detail below.

Table 1. Description of the Intervention Mapping Protocol steps and their objectives

IMP terms		PROGRAM OBJECTIVES	PERFORMANCE OBJECTIVES	CHANGE OBJECTIVES	CHANGE METHODS	APPLICATIONS OR STRATEGIES
IMP objective	Identify the health or quality of life problem	State the desired reduction in health problem/ define the health-promoting situation	Identify behaviors that can help achieve the health-promoting situation	Select determinants that influence these behaviors. A change in the determinants is needed to allow people to perform the target behavior.	Select behavioral change techniques relevant for changing specific determinants.	Select applications that are suitable for the change methods and change objectives
IMP step	Step 1 – Needs assessment	Step 1 – Needs assessment	Step 2 – Change matrices	Step 2 – Change matrices	Step 3 – Change methods and strategies	Step 3 – Change methods and strategies
Applied to our project (examples)	Cyberbullying and – victimization prevalence among 12-14 year olds, leading to psychosocial problems for all youngsters involved	<ol style="list-style-type: none"> 1. Reduce cyberbullying and – victimization prevalence 2. Reduction in depression, anxiety, suicidal behavior 3. Reduction in externalizing behaviors (smoking, alcohol consumption) 4. Increase school attachment 	<p>PO1. Assess whether the message is intended to hurt or will be perceived as hurtful</p> <p>PO2. Never join or reinforce the bully (full list in Table 2)</p>	<p>Knowledge, skills, self-efficacy, attitudes, outcome expectations, subjective norm for PO1 (e.g. express confidence in recognizing a bully’s intentions)</p> <p>Knowledge, skills, self-efficacy, attitudes, outcome expectations, subjective norm for PO2. (e.g. Express that assisting or laughing is just as</p>	<p>Immediate feedback</p> <p>Contingent reinforcement (rewards)</p> <p>Modeling</p>	<p>Serious game</p> <p>Curriculum material, using i.e. videos, cooperative learning</p>

				bad as the initial cyberbullying itself) (full list in Table 2)		
--	--	--	--	--	--	--

Legend. PO=Performance objectives



Figure 1. Overview of studies conducted per Intervention Mapping step

Although IMP provided the roadmap for program development, the specific information required for each step, needed to be collected by our research team, through literature search, expert consultation and/or additional research. A variety of research methods was used to collect the information needed in the development of the program, including a systematic literature review, focus groups, observational research, survey research, and meta-analyses. Several behavior change theories recommend using qualitative techniques to collect insights which are then validated in quantitative surveys (Bartholomew et al., 2011). This approach was also followed in our study. In some steps, several quantitative surveys were conducted, e.g. when vignettes or scenarios were used to further explore context-dependent behavior. Ethical approval was provided by the Ethics Committee of Ghent University Hospital, informed consent was obtained from participants for all research conducted. Results are described immediately after describing the methods for each step, to enhance clarity of data presentation, since each preceding step influenced the decisions in the next step. All surveys and qualitative research were conducted in Flanders.

2.1. STEP 1: NEEDS ASSESSMENT

The purpose of the first step was to define goals and priorities on which health problems to tackle, to find the population at risk and understand their environmental context. Next, this was translated into what is needed to change the behavior of the at-risk group into health-promoting behavior (Bartholomew et al., 2011). Priorities are set by looking at what is relevant, desirable to change, creates the highest burden and is also most changeable (Bartholomew et al., 2011). These priorities are formulated in program objectives, stating the desired change in health status.

Three studies were conducted as part of this first step: a literature review to assess mental health outcomes; a qualitative study to understand bystander behavior; and a quantitative study to understand contextual influences of bystander behavior.

2.1.1. Literature review

Previous reviews indicated that young-adolescents (7th-8th graders, circa 12-14 year olds) were most at risk for being a victim of cyberbullying (Kiriakidis & Kavoura, 2010; Tokunaga, 2010). A study

conducted among severely obese adolescents who were matched with a sample of normal-weight peers drawn from the Health Behaviour in School-Aged Children (HBSC) study, included 6th to 12th graders. This study also showed a higher risk of cybervictimization among the younger group of adolescents (DeSmet, Deforche, Hublet, Tanghe, Stremersch, & De Bourdeaudhuij, 2014a). The intervention was thus decided to focus on this age group of young adolescents (12-14 year olds).

To assess the health problem of cyberbullying, a systematic literature review was carried out for studies examining mental, physical health or behavioral harm in relation to cyberbullying among children or adolescents (Gunther, DeSmet, Jacobs, & De Bourdeaudhuij, 2016). Our literature review showed that the most severe health and quality-of-life outcomes related to cybervictimization were depression, suicidal ideation, psychosomatic complaints, substance abuse and low school attachment (Gunther et al., 2016).

2.1.2. Qualitative study

To overcome health problems related to cyberbullying, increasing positive bystander interventions may be a viable approach. In traditional bullying, bystander interventions were very successful in ending peer victimization and in reducing the harm for the victim, by providing social support to the victim (Rothon, Head, Klineberg, & Stansfeld, 2011; Tu, Erath, & Flanagan, 2012), by increasing the perception of school as a safe place (Gini, Pozzoli, Borghi, & Franzoni, 2008), and by not reinforcing the bully (Hawkins, Pepler, & Craig, 2001; Salmivalli, Voeten, & Poskiparta, 2011). The scarce studies on bystanders in cyberbullying showed that, as in offline bullying, many adolescents have witnessed cyberbullying, and that most bystanders witnessed passively and took no action (Huang & Chou, 2010; Salmivalli, 2010; Vandebosch & Van Cleemput, 2008). Further research was needed to explore how this behavior occurred in cyberbullying, and what influenced this behavior.

Consequently, data were collected from 61 adolescents in nine focus groups. The aim of these focus groups was to gain insight in social environmental influences of cyberbullying (bystander) behavior. A convenience sample of three secondary schools in Flanders was drawn. All 7th, 8th, and 9th graders received information and consent forms to take home. Fifty-three percent did not return forms; 27% did not provide consent. In total, nine focus groups were conducted with adolescents for whom both

youngster and parental consent was obtained. Groups were organized per grade. The full interview guide and more detailed information is reported elsewhere (DeSmet et al., 2014b). Focus group results confirmed targeting bystanders may be useful to reduce cyberbullying and its harm: adolescents reported similar bystanding behavior and consequences of bystander behavior as in traditional bullying. The intervention was thus decided to focus on increasing positive bystander behavior among these young adolescents. This positive behavior can consist of defending or comforting the victim, and of reporting to adults. The aim of the intervention was to also reduce negative bystander behavior, such as passive bystanding, joining, and assisting the bully (DeSmet et al., 2014b). Bystanders preferred to handle cyberbullying offline and in person, and comforting the victim was considered more feasible than facing the bully. Adolescents were not much inclined to report an incident, unless it was considered severe (repeated, physical threats or of sexual nature). Moral disengagement attitudes, in which victims are considered to have provoked the cyberbullying by their behavior or their looks, were very prominent. Self-reported bystander behavior heavily depended on contextual factors: what the level of popularity of the bully is, how close they are to the victim and whether the circumstances clearly justify a condemnation of the incident (e.g. racial remarks, attacking family). The results also indicated low perceived support from adolescents' environment to perform positive bystander behavior. School educators were perceived not to respond appropriately, and instead, to suspect that adolescents who reported, had been actively involved in the bullying themselves. Perceived support from parents for positive bystander behavior was also low. Comments and quotes from the adolescents are reported extensively in the paper describing this study (DeSmet et al., 2014b).

2.1.3. Quantitative study

A quantitative survey using vignettes was conducted among 453 adolescents (Bastiaensens et al., 2014). Method information is provided elsewhere (Bastiaensens et al., 2014). The cyberbullying scenarios described in the vignettes, varied by the identity of other bystanders, the severity of the bullying and the reactions of other bystanders. This survey confirmed the influence of circumstances on youngster's intentions to perform positive bystander behavior. As noted in the qualitative study, bystanders showed higher behavioral intentions to help the victim when they witnessed a more severe

incident. Furthermore, they found an interaction effect between the severity of the incident and the identity of other bystanders. When witnessing a highly severe incident, bystanders were more inclined to help the victim when other bystanders were good friends than when these were mere acquaintances. When witnessing an incident of lower severity, however, a reverse relationship was present: bystanders were more inclined to help when other bystanders were acquaintances than when these were good friends. Adolescents were more likely to join in with the bully if their good friends were also joining in.

In sum, adolescents reported that bystanders can aid in ending cyberbullying and reducing its harm. Qualitative and quantitative studies showed the behavior is context-dependent. Some behavioral determinants, such as moral disengagement attitudes, appeared important, but require further exploration in a quantitative determinant study.

Based on these findings, program goals were formulated to reduce cyberbullying and to reduce the health risks related to cyberbullying. The program aims to reduce these levels of health risks to levels similar to those of adolescents not involved in cyberbullying: 1) reduce internalizing problems of depression, anxiety and suicidal behavior 2); reduce externalizing problems of smoking and alcohol abuse; and 3) increase school attachment (perceived safety and truancy). These levels in a non-involved population were derived from the Flemish Health-Behaviour in School-Aged Children study (Hublet, Vereecken, & Maes, 2012). These program goals are expected to be achieved by changing adolescent bystander behavior. To understand how to change this behavior, several studies on individual determinants and environmental influences were conducted, and described in step 2.

2.2. STEP 2: PREPARING MATRICES OF CHANGE OBJECTIVES

The purpose of this second step was to investigate which behaviors (i.e. performance objectives) can reduce the public health problem and help attain the program objectives, and which determinants influence these behaviors (i.e. change objectives). These change objectives form the basis of the intervention. As findings from the first step revealed the significant role of bystanders in ending cyberbullying and reducing the harm for the victim, further research in subsequent steps of the

protocol focused on bystander behavior. Surveys were conducted among adolescents to explore determinants of positive bystander behavior, and among parents and educators to explore determinants for supporting this positive behavior. Performance and change objectives were designed for adolescents, for parents and for educators. The change objectives indicate what is needed to enable adolescents to show positive bystander behavior, and what needed to change for educators and parents to show support for adolescents' positive bystander behavior.

2.2.1. Adolescents.

A survey among 1979 adolescents was conducted to assess which behavioral determinants predicted the intention to perform positive defending behavior (i.e. assertive defending, comforting or reporting). Method information is provided elsewhere (Authors, submitted). The theoretical model composed of the Reasoned Action Approach, Social Cognitive Theory (see DeSmet et al., 2014b), and the Bystander Intervention Model, guided the questionnaire development and analysis. Multilevel analysis indicated positive bystander behavior was mostly predicted by adolescents' intentions to act as a positive bystander, which in turn was mostly predicted by the expectation that their actions would benefit the victim. Intention to perform positive bystander behavior (e.g. also predicted by social skills, moral disengagement attitudes, mother's awareness of activities, coping skills) did not completely translate into behavior, since other factors also predicted behavior independently of behavioral intention. Girls more often showed positive bystander behavior. When the victim was a good friend, adolescents more often acted as a positive bystander. More positive attitudes towards comforting and less positive attitude towards passive bystanding, predicted positive bystander behavior, as did having a higher sense of self-efficacy towards being able to end cyberbullying. School and class variables did not contribute to explaining positive bystander behavior, after taking individual characteristics into account. Performance objectives (specific behaviors we wish to obtain through the intervention), were set for the adolescents, taking into account what they considered acceptable and feasible. This meant a gradient of behaviors, where easy behaviors could be performed for any incident, while more risk-taking behaviors would depend on the identity of the victim and on the circumstances. First, the adolescent needs to assess the situation as cyberbullying and in all cases:

never blame the victim, never join in or reinforce the bully, and always comfort the victim. Next, if the victim is a friend, the bystander should defend the victim. If the bullying may have been provoked, or is of more serious nature, the bystander should report to adults (Table 2, first column). As a next step, IMP prescribes to cross behavioral determinants with every performance objective, to find elements ('change objectives') that need to change in order for the person to be able to perform the target behavior. Determinants identified in our survey were thus crossed with the formulated performance objectives, and are listed in Table 2.

Table 2. Matrices of change for bystanders

Performance Objectives (bystanders)	Knowledge	Skills and Self-efficacy	Attitudes and Outcome Expectations	Perceived Social Norms
PO1. Assess whether the message is meant to hurt	K1a. Define which typical elements in online / GSM messages show a bully's wish to hurt	SSE1. Express confidence in recognizing a bully's intentions	OE1. Believe that recognizing whether something is meant as funny or nasty can help in better responding to cyberbullying	PSN1. Recognize that others also assess whether the message is intended to hurt or not
PO2. NEVER: laugh or say something to the bully to show you agree	<p>K2a. Express that assisting or laughing is just as bad as the initial cyberbullying itself</p> <p>K2b. Recognize that by not laughing, you can stop the bully</p> <p>K2c. Describe how laughing makes the victim feel worse</p> <p>K2d. Recognize that by showing a strong will and not to join, you will increase in popularity status</p>	<p>SSE2a. Express confidence in understanding a victim's emotions</p> <p>SSE2b. Express confidence in resisting the social pressure of the bully to join in</p>	<p>OE2a. Judge that cyberbullying is not justified, for no-one</p> <p>OE2b. Believe that by not laughing, you can stop the bully</p>	PSN2. Recognize that others do not expect you to laugh or join in
PO3. ALWAYS comfort the victim	K3a. Recognize that by comforting the victim or providing advice, you are	SSE1. Express confidence in being able to comfort or provide advice to the	OE3. Expect that by comforting the victim,	PSN3. Recognize that your friends expect you to comfort or provide advice

	making the victim feel better	victim		they will feel better		to the victim
	K3b. Describe ways to comfort a victim that is in line with your personality (esp. boys)					
PO4-PO5. Defend your friends	K5a. Recognize assertive reactions as a witness can stop cyberbullying	SSE5a.	Express confidence in resisting peer pressure to not defend	OE5a. Judge that everyone deserves to be defended		PSN5a. Recognize that your parents approve of assertive reactions on behalf of friends who are cyberbullied
	K5b. Describe number of assertive strategies on how to defend the victim	SSE5b.	Recognize how a victim feels after having been cyberbullied	OE5b. Expect that defending will lead to feelings of pride, while not defending will lead to feelings of shame and guilt		PSN5b. Recognize that your friends expect you to assertively react when they are cyberbullied
				OE5c. Expect that when others watched you defend, you will be considered strong		
				OE5d. Expect that by defending, you will not risk being the next victim (e.g. getting support of your friends before defending)		
PO6. Talk to friends of bully and victim to understand the situation	K6a. Describe strategies on how to collect more information to clarify the	SSE6.	Express confidence in talking to friends of bully and victim to gather	OE6. Expect that talking to the bully's or victim's friend will clarify the situation and make it		PSN6. Recognize that others also collect information when the

	situation	information	easier to decide what to do	situation is unclear
PO7. Do not blame the victim	<p>K7a. State that cyberbullying is never right or justified, even if you don't like or know the victim well</p> <p>K7b. Recognize that by blaming the victim, you are making it worse for them</p>	<p>SSE7. Express confidence to refrain from sensing the bullying is justified because of some victim's traits</p>	<p>OE7. Believe that by not blaming the victim, you are helping them to feel better</p>	<p>PSN7a. Recognize that your parents and friends expect you not to blame the victim</p>
PO8-PO9. Tell an adult	<p>K8-9a. Recognize that telling an adult is also a viable strategy for a bystander and not only for the victim</p> <p>K8-9b. Describe strategies on how you would tell an adult about someone else being cyberbullied</p> <p>K8-9c. List who you could turn to and confide in when you want to report someone being cyberbullied</p>	<p>SSE8-9. Express confidence in talking to an adult when witnessing someone is being cyberbullied</p>	<p>OE8-9a. Expect that talking to adults will help end the cyberbullying</p> <p>OE8-9b. Expect that when talking to teachers, they will quickly and effectively intervene</p> <p>OE8-9c. Expect that when talking to parents, they will not overreact and will support positive bystander behavior</p>	<p>PSN8-9a. Recognize that your parents expect you to tell them when someone is being cyberbullied</p> <p>PSN8-9b. Recognize that your teachers expect you to tell them when someone is being cyberbullied</p> <p>PSN8-9c. Recognize that your friends will tell an adult also when someone is being cyberbullied</p>

Legend. PO=Performance objectives; K=Knowledge; SSE: Skills and self-efficacy; OE: Attitudes and Outcome expectations; PSN: perceived social norm

2.2.2. Parents.

Two studies were conducted to find predictors of parental advising behavior in relation to how adolescents should respond to cyberbullying, and whether this advising behavior also took into account context-specific information. For the surveys among parents of 7th-9th graders, two convenience samples were drawn of respectively one school community (two schools in total), and two school communities (consisting of six schools in total) in one province of Flanders. For both studies, parent questionnaires were distributed via their children at school in a closed envelope. Parents could return the completed questionnaire in a separate, sealed envelope via their child to school, or fill out the questionnaire online. For the first study among parents, 323 valid questionnaires were returned (response rate 40%). Linear regression analyses were conducted to find predictors of parental advising behavior. The dependent variables in this analysis were the extent of parents advising their children to: 1) provide support and comfort the victim; 2) assertively defend the victim; 3) report to teachers; and 4) stand by passively. The independent variables were individual behavioral determinants such as knowledge on cyberbullying's harm, (moral disengagement) attitudes, outcome expectations, subjective norms, self-efficacy and parenting styles. This first study showed that parents would most often advise their children to report to a teacher, followed by providing social support to victims. Parents were less inclined to advise their children assertive defending, and parents' intentions were lowest to advise passive bystanding. Parents advised reporting to teachers because it is an easy advice, they feel some action is needed, but advising to defend is considered difficult ($R^2=23\%$). Parents who more often advise assertive defending are less concerned about protecting their own child and have more positive attitudes of defending ($R^2=32\%$). Those who are more inclined to advise comforting, are most driven by a desire to take responsibility, resolve bullying and create a positive climate for their children's development, while also having a negative attitude towards passive bystanding ($R^2=28\%$). Parents who more often advise to stand-by passively are mostly influenced in this decision by hoping to protect their own child, avoiding conflicts with their child and not being driven by creating a positive climate or reducing the bullying ($R^2=25\%$). These parents may be

reached by convincing them they can only protect their child by improving the overall peer climate and reducing cyberbullying in general.

For the second study among parents, 159 valid questionnaires were returned (response rate 26%), of which, 48 parents were selected at random for analysis. This study consisted of open-ended questions and the purpose was to explore context-specific behavior using scenarios. A content analysis was performed on these data. The answers were analyzed via thematic analysis in Nvivo software. Both questionnaires were anonymous. The findings from the second study confirmed parents mostly advised to report or provide informational and emotional support. For more severe incidents (repeated incidents, physical threats), positive bystander behavior was less often recommended than for less severe incidents, presumably to reduce risk for their own children, although this is where it is most needed. Based on these results and on literature, performance objectives were designed for parents, such as understanding that reducing all cyberbullying is the only way to protect their child against cyberbullying, to not ignore and advise to stand-by passively, but instead advise to comfort and take positive action, and lastly to only advise to report to adults when parents are certain this will lead to actions. As was done for adolescents, change matrices were derived from crossing the performance objectives with their behavioral determinants (Appendix Table A1).

2.2.3. Educators.

Among educators, an anonymous online survey was conducted in Flanders. Method information is provided elsewhere (DeSmet et al., 2015). The purpose of this study was to assess how educators responded to cyberbullying. First, cluster analyses were performed on this survey data, revealing four educator clusters. The two largest clusters less often used recommended strategies, such as talking to pupils, and these clusters mainly consisted of teachers. The other two clusters more often used several recommended strategies (i.e. conversations with pupils, enlisting professionals for support, parental involvement, providing supportive victim advice), were much smaller, and comprised more other educators, such as principals, school counsellors, or educators in combined roles (DeSmet et al.,

2015). These findings indicated a need for educator training, which should be tailored to job position, since teachers showed different training needs than other educators.

Furthermore, linear regression analyses were conducted to find predictors of the target behaviors for educators (not elsewhere published). Dependent variables were the extent to which educators took the following actions when aware of a cyberbullying incident, such as 1) talking with pupils; 2) enlisting professionals for support; 3) and involving parents. Independent variables were school and educator characteristics such as educator age and position, having a school policy against cyberbullying; and individual behavioral determinants such as problem perception, (moral disengagement) attitudes, outcome expectations, subjective norms, self-efficacy and student-educator relationship skills. First, taking appropriate educator actions against cyberbullying (i.e. talking with pupils ($R^2=32\%$), enlisting professionals for support ($R^2=28\%$) and involving parents ($R^2=33\%$)) was predicted by positive outcome expectations, having a school policy against cyberbullying, perception to possess good educator-pupil relationship skills, subjective norm that others expected them to act and high problem perception of cyberbullying at their school. Younger educators showed these appropriate actions less often than older educators. Based on these results and on literature, performance objectives were designed for educators, such as talking with pupils about what has happened, involving parents of bully and victim, consulting professionals in case of severe cyberbullying, installing and being informed of an anti-cyberbullying policy, and not disciplining the bully or ignoring the incident. Change matrices were derived from crossing the performance objectives with their determinants (Appendix Table A2).

2.3.STEP 3: SELECTION OF THEORY-INFORMED INTERVENTION METHODS AND PRACTICAL STRATEGIES

In a third step of the Intervention Mapping Protocol, theoretical methods are chosen to influence the change objectives. For each change objective, the appropriate theoretical method known to impact this type of behavioral determinant is chosen (Bartholomew et al., 2011). Next, these methods are commonly matched with practical strategies, e.g. videos.

The choice of theoretical methods occurred in two phases: one prior to pilot testing a prototype, and one after this pilot test, when the concept and methods needed to be revised.

In a first phase of our project, behavior change techniques and game design methods were chosen separately. The choice of behavior change techniques was based on a summary of methods provided in the Intervention Mapping handbook (Bartholomew et al., 2011), and on change techniques proven effective in serious health games in a meta-analysis. Game design methods were chosen based on the same meta-analysis, and on the game developers' expertise. The meta-analysis comprised 54 game studies for health promotion (DeSmet et al., 2014c). A detailed method description of this meta-analysis is provided elsewhere (DeSmet et al., 2014c). This meta-analysis showed games were best non-tailored, or tailored to both socio-demographic (e.g. age, gender) characteristics and information on lifestyles or change needs (e.g. severity of health problem). Moreover, they should be founded on game theories, or game and behavioral change theories. Moderator analyses were conducted on an update of this meta-analysis, comprising 58 game studies. These analyses revealed that using more behavior change techniques did not relate to higher effectiveness, and that using more game-experience enhancing features even related to lower effectiveness. Presumably, more challenging games created a higher cognitive load and reduced the fun of the games. The use of particular game features (e.g. mechanics, aesthetics, narrative) did, however, relate to higher game effectiveness, such as using a simple challenge, or a challenge that adapts to the players' proficiency, and not using personal goal-setting. Some features related to higher effectiveness for some outcomes (e.g. knowledge), but not others (e.g. attitudes). Games should thus always be designed with the specific behavior and behavioral determinant outcome in mind (Authors, submitted). Based on the Intervention Mapping Protocol and the meta-analytic findings, behavior change methods employed in a first prototype of the game were enactive mastery learning, modeling, positive self-reevaluation, perspective taking, conditioning (rewards), and immediate feedback. These change methods are most appropriate for changing attitudes and outcome expectations, which were the strongest predictors of positive bystander behavior. Game design elements were first-person control, personalization of

avatars, a mystery-themed story, mission-based levels with increasing level of difficulty, rewards and feedback. There was no pre-determined time limit for achieving the game goal.

These behavior change techniques (BCT) and game design elements were revised in a second prototype of the game. This revision took into account how behavior change strategies can be best balanced with game design principles, to maintain both effectiveness and game engagement. User feedback on the first prototype indicated behavior change strategies and game design methods needed to better balanced and integrated. This game-specific application of behavior change strategies is currently not included in the Intervention Mapping Protocol. These behavior change techniques (BCTs) and game design features (GFs) needed to form an integrated part in the game. The MDA (mechanics, dynamics, aesthetics) framework of applied game design (Hunicke et al., 2004) was used to implement the behavior change techniques in a challenging and motivating virtual environment. An overview of behavior change or gaming methods was constructed based on meta-analytic, review or experimental findings. This overview aided in a shared understanding of game methods between game developers and behavior change professionals, and supported the evidence- and theory-based choice from both disciplines (Table 3). Step 4 (2.4.3) will discuss how these BCTs and GFs will be applied in the second prototype.

Table 3. Overview of behavior change techniques (BCTs) and gaming features (GFs) applied in games, organized in categories of BCTs

BCT / GF	TECHNIQUE OR FEATURE	TARGET OUTCOME	CONDITIONS	EFFECTS ON TARGET OUTCOME	GAME ENGAGEMENT
BCT	Individual tailoring (Matching <i>content</i> parts of the intervention to user characteristics)	Behavior and behavioral determinants	Tailoring needs to be performed on aspects relevant to the behavior change (Bartholomew, Parcel, Kok, Gottlieb, & Fernàndez, 2011)	Tailoring related to higher effects, but only when tailored to socio-demographics, in a meta-analysis of 54 serious health game studies (DeSmet et al., 2014c)	Tailoring is assumed to increase the extent to which game-based learning is experienced as fun (Lieberman, 2009).
GF	Personalization (Matching <i>visual</i> parts of the intervention to user characteristics)	Behavior and behavioral determinants	Personalization may act as self-modeling, but requires that the model is reinforced for positive behavior (Bartholomew et al., 2011)	Personalizing game looks to user characteristics related to lower effectiveness, in a meta-analysis of 58 serious health game studies (Authors, submitted)	In only half of the studies, having virtual characters or environments positively impacted emotional and cognitive engagement according to a systematic review of educational games. It is, however, unclear whether these avatars were personalized (Jabbar & Felicia, 2015)
		Behavior and behavioral determinants	Personalization needs to be integrated in feedback, showing how their healthy or unhealthy behavior changes their looks	There was no effect of merely using highly realistic avatars on behavior, but there was an effect when these avatars changed in relation to their target behavior, as a form of feedback, in an experimental	

				game study on smoking cessation (Song, Kim, Kwon, & Jung, 2013)	
BCT / GF	Information on the link between health outcome and the desired behavior (General information on health risk related to the behavior)	Behavior	Needs to be combined with either: personal goal-setting/intention formations; OR providing information on consequences, and use of follow-up prompts	One of the most effective techniques to change behavior, but only in combination with other techniques, in a meta-analysis of 101 studies to promote a healthy diet and physical activity (Dusseldorp, van Genugten, van Buuren, Verheijden, & van Empelen, 2014)	Built-in, supportive learning tools positively impacted both emotional and cognitive engagement in a systematic review of educational games (Jabbar & Felicia, 2015)
BCT / GF	Providing information on consequences (Information on costs and benefits of performing or not performing the behavior)	Behavior	Needs to be combined with information on health-behavior link, and follow-up prompts	One of the most effective techniques to change behavior, but only in combination with other techniques, in a meta-analysis of 101 studies to promote a healthy diet and physical activity (Dusseldorp et al., 2014)	Built-in, supportive learning tools positively impacted both emotional and cognitive engagement in a systematic review of educational games (Jabbar & Felicia, 2015)
			Not effective when studied as a single component	This related to lower effects, in a meta-analysis of 44 studies for weight-loss among obese populations (Dombrowski et al., 2012)	

BCT	<p>Use of follow-up prompts</p> <p>(Contacting the user after the intervention is complete)</p>	Behavior	Needs to be combined with information on health-behavior link, and providing information on consequences	One of the most effective techniques to change behavior, but only in combination with other techniques, in a meta-analysis of 101 studies to promote a healthy diet and physical activity (Dusseldorp et al., 2014). May replace the need for prompting goal review.	No information on game engagement.
BCT	<p>Personal goal-setting and intention formation</p> <p>(Encouraging the person to decide to act or set a general goal)</p>	Behavior / behavioral determinants	Requires high motivation to change in target group (Sheeran, Webb, & Gollwitzer, 2005)	Using personal goal-setting and planning related to lower effectiveness in serious games, in a meta-analysis of 58 serious health game studies (Authors, submitted)	No information.
BCT / GF	<p>Setting graded tasks, ‘scaffolding’</p> <p>(Setting easy tasks which become increasingly difficult until target behavior is reached)</p>	Skills, self-efficacy	The target behavior needs to be dividable in smaller, increasingly difficult tasks	Scaffolding levels related to a lower effectiveness on self-efficacy, in a meta-analysis of 58 serious health game studies (Authors, submitted)	Scaffolding related to more emotional and cognitive engagement, but feedback was also counted under this feature in a systematic review of educational games (Jabbar & Felicia, 2015)
BCT / GF	<p>Providing instruction</p> <p>(Telling the person</p>	Behavior	Needs to be combined with providing feedback	58% of interventions with feedback and instructions were effective, versus 14% that only	Giving instructions on what health behavior is expected, is similar to expected game

	how to perform a behavior)			gave feedback, in a meta-analysis of 101 studies to promote a healthy diet and physical activity (Dusseldorp et al., 2014)	behavior, when stating game rules and goals, and could be integrated here. Game rules and goals are essential parts of the motivational appeal of a game (Prensky, 2007)
			Also effective when studied as a single component	Providing instructions was effective in achieving weight-loss in dietary interventions, in a meta-analysis of 44 studies for weight-loss among obese populations (Dombrowski et al., 2012)	
BCT / GF	Narrative / using imagery, scenario-based information (A coherent story with beginning, middle and plot resolution)	Knowledge, attitudes	Should not reduce interactivity of the game; imagery should use familiar analogies, plausible scenario with a cause and an outcome (Bartholomew et al., 2011)	A narrative did not relate to game effectiveness on behavior or its determinants, in a meta-analysis of 58 serious health game studies (Authors, submitted)	A narrative positively impacted mostly emotional engagement in a systematic review of educational games (Jabbar & Felicia, 2015)
BCT / GF	Feedback (Giving information on the extent to which they are achieving the behavior, or the extent to which the	Behavior and behavioral determinants	Needs to be individual, specific and immediate (Bartholomew et al., 2011)	Only tested the effect of immediate feedback, games providing feedback were borderline significantly more effective in changing behavior, in a meta-analysis of 58 serious health game studies (Authors,	Feedback aims to enhance the experience and help you progress in the game (Prensky, 2007).

	behavior is having an impact on outcome)			submitted)	
		Behavior	Needs to be combined with providing instructions	58% of interventions with feedback and instructions were effective, versus 14% that only gave feedback, in a meta-analysis of 101 studies to promote a healthy diet and physical activity (Dusseldorp et al., 2014)	
		Knowledge	Should be automated and immediate	An experimental serious game study on malaria prevention knowledge compared no feedback, to player-controlled feedback, and automated immediate feedback. The automated feedback group outperformed the other conditions (Hartjes & Baumann, 2012)	Game duration was longer in the automated feedback group, but this did not affect their satisfaction with the game, which was similar across conditions.
BCT	Prompting review of behavioral goals (Encouraging users to review or reconsider previously set goals	Behavior	Requires personal goal-setting	Is effective, but can be replaced by the combination of info on health-behavior link, info on consequences, and use of follow-up prompts, in a meta-analysis of 101 studies to promote a healthy diet and	No information.

or intentions)

physical activity (Dusseldorp et al., 2014)

BCT / GF	Classical and operant conditioning (Intrinsically pleasant -or unpleasant-outcomes, social or material rewards linked to the achievement –or failure- of specified behaviors)	Behavior, attitudes, skills, self-efficacy	Time interval between behavior and response needs to be short; needs to be tailored to the individual; and needs to be seen as a consequence of behavior (Bartholomew et al., 2011)	No relation of rewards (e.g. point scoring) with effectiveness in serious games, in a meta-analysis of 58 serious health game studies (Authors, submitted)	Only in half of the papers, rewards positively impacted emotional engagement, according to a systematic review on educational games (Jabbar & Felicia, 2015)
BCT / GF	Enactive mastery experiences (Practicing in a simulated setting with increasingly difficult tasks)	Skills, self-efficacy	Requires feedback, and user willingness to accept feedback (Bartholomew et al., 2011)	The degree of interactivity and control did not significantly relate to game effectiveness on behavior or its determinants, in a meta-analysis of 58 serious health game studies (Authors, submitted)	Having control and choices positively impacted mostly emotional engagement in a systematic review of educational games (Jabbar & Felicia, 2015)
GF	Challenge (The game problems a player is trying to solve)	All behavioral determinants, and in particular knowledge,	Adjusted to the player’s mental capabilities, or remain simple if adjustments are not possible	Simple challenges, and more difficult challenges adjusted to the players’ performance, yielded higher effects than difficult, non-adjusted	All papers studying the presence of a challenge reported this had a positive impact on cognitive engagement, in a systematic

skills, self-
efficacy

challenges, in a meta-analysis
of 58 serious health game
studies (Authors, submitted)

review of educational games
(Jabbar & Felicia, 2015)

BCT: behavior change technique; GF: gaming feature

2.4. STEP 4: DEVELOPMENT OF THE INTERVENTION PROGRAM

In step 4 of IMP, all information from the previous steps was combined to create the program material. Information from step 4 was also used to revise earlier made decisions in step 3.

2.4.1. Story preferences.

The first survey among 530 adolescents elicited game preferences prior to development and consisted of a sub-sample of the survey among 1750 adolescents, described in step 2. Adolescents who finished early with the first survey, received a second, very brief, survey, in which they were asked to describe what a game would look like if they were the designers. In this sample, 38.8% were 7th graders, 46.7% were boys. A content analysis of these stories was performed using thematic analysis in Nvivo. The stories adolescents wrote, showed a preference for a detective theme (e.g. solve a murder); where the world had to be saved from a disaster in the future (e.g. virus that wipes out the world population); solving a mystery (e.g. solve the mystery of the empty city and the missing people); conquering the bad ones (e.g. squirrels who wish to master the world); imitating real life (e.g. buying a house, going to work, have pets and children), and taking place in a large city (e.g. Boston, New York, London).

This input was provided to a professional story writer, who created the story of ‘The Messenger’, used in the first prototype. The story is set in 2043 and features an anonymous cyberterrorist, whose identity is about to be revealed by a journalist, Barbara West. Barbara unfortunately gets killed in a cyber-attack, leaving behind a husband, Professor West, and their 13-year old son/daughter, Rafa (i.e. personalized to the player’s gender). Professor West, grief-struck, designs a time-travel machine to return to the date before the cyber-attack and, together with his son/daughter, to prevent his wife from getting killed. By an unforeseen power disruption, Rafa lands 30 years back in time, without professor West. He/she recognizes the setting (school) from clues his/her mother left behind and realizes this place is related to the cyberterrorist. The activities in the game, aimed at improving class climate and reducing cyberbullying, will help Rafa solve the mystery of the identity of the cyberterrorist, and prevent the person from turning into a cyberterrorist. When this is achieved, Rafa returns to the future, to a reunited family and a world without cyberterrorism.

2.4.2. Pilot test of the concept for prototype 1.

Next, game story, characters and layout were pilot tested in focus groups with 69 adolescents. Four schools were contacted. These schools were a convenience sample, but were selected to represent different educational types, grades and regions. Participants were selected at random among those who had provided informed consent. The concept test was guided by theories on narratives in health communication (Transportation Theory, Extended Elaboration Likelihood Model), behavior change (Social Cognitive Theory) and media enjoyment (Flow theory, Identification). The story was well-liked, but the looks of the characters and setting needed adjusting to teenage preferences (e.g. clothing outdated, colors too gloomy) (Van Cleemput et al., 2016).

2.4.3. Pilot test of prototype 1.

Finally, a prototype of a first game level was pilot tested with 8 adolescents (4 boys, 4 girls), using a convenience sample of 4 schools. A retrospective think-aloud method and semi-structured questionnaire were used to collect the data. Results showed adolescents found it difficult to understand what was expected of them in the gameplay. Addressing all change objectives (e.g. subjective norm, attitudes) with the appropriate strategies, highly complicated the game. Furthermore, many behavioral change strategies (e.g. modeling, self-reevaluation) fit best with a story-driven game. Our story-driven game, however, reduced the interactivity and control, as it had a linear structure in which players were guided via their choices towards one story ending, the plot.

2.4.4. Design of prototype 2

Given that the story-driven game in its current form had low interactivity, but that a game without the story would reduce the opportunity to address all behavioral determinants appropriately, it was decided to split the intervention into several components: 1) a background narrative was used to create the mood and context (e.g. improve mood in classroom), whereas an in-game narrative (e.g. social media page with degrading comments and pictures) influenced gameplay; 2) a more interactive game was used, and game mechanics and behavior change techniques were used mainly to increase knowledge, skills, and to a smaller extent, subjective norm; 3) supplemental non-game material was created for

use in a classroom or by the adolescents privately, to address the other behavioral determinants of e.g. attitudes and self-efficacy.

The adjusted overall game objective consisted of scenarios of potential cyberbullying, where the player needs to select the appropriate response as a bystander. The game is a 2,5 D puzzle-adventure game in which the player has to uncover the identity of a mystery cyberbully by correctly applying positive bystander strategies in a classroom context. The player's response affects the victim's mood, the classroom climate and the bully's level of bullying. Hints are provided when the player's score drops down. At certain stages in the game, extra activities ('missions') will be provided, when change objectives require more than choosing the right strategy. Examples are assessing the situation and collecting information from the victim's or bully's friends; finding an adult to report to and being able to describe the incident to the adult (Fig. 2). Mechanics involve a discussion system in which the player needs to assess the situation, character development where characters can evolve to several participant roles in cyberbullying, and a reputation system where the classroom climate is set as a final game objective.



Figure 2. View of a mission in prototype 2

The overview of behavior change techniques (BCTs) and game design features in Table 3 aided the choice of methods for prototype 2. This overview showed that feedback (BCT1) was an essential condition for effectiveness to many other behavior change methods, and also supported game

engagement. To not interrupt game flow, feedback will be divided into: 1) individual, immediate, non-specific feedback, in the form of pleasant or unpleasant sounds which also present a type of classical conditioning for the behavior; and 2) individual, delayed, specific feedback, which gives more detailed, textual feedback when a level was completed. This feedback will also include information on the consequences (BCT2) for cyberbullying and the victim, of the behaviors chosen by the player. Quantitative analyses of determinants of bystander behavior showed that seeing positive consequences for the victim of their bystander actions, was a crucial predictor. Given that feedback is ineffective without providing clear instructions (BCT3) on what is expected, this information will also be provided, together with the game rules. These instructions moreover include information on the link between the behavior required of the player in the game, and the desired outcome, i.c. ending cyberbullying and its harm (BCT4). These effects on emotions will also be noticeable in a mood slider and scene lighting. The game will use enactive mastery experiences (BCT5), giving opportunities for high user control (GF1). Although the level of user control did not relate to effectiveness in our meta-analysis of serious health games, the solid theoretical support for this method and the positive effect on game engagement motivated the choice to include this in the game. The game may be tailored on content by gender (BCT6), since our research on determinants of bystander behavior showed that boys had different issues than girls.

The game will be personalized on looks by gender and certain lifestyle preferences (e.g. clothing) (GF2). This choice of game feature was motivated by a potential positive effect on game engagement. Given personalization's negative effect on knowledge, care will be taken to reduce the prominence of personalization in the game parts that address knowledge. The challenge (GF3) consists of a relatively simple question-and-answer format, to reduce cognitive load. No explicit rewards are provided, other than the auditive and textual feedback. Personal goal-setting, and goal monitoring, despite being effective methods in other health interventions, were not used here, since they related to lower effectiveness in serious health games, and could not be linked to game engagement. The number of gaming features was kept low, since the meta-analysis indicated that using more immersive features reduced effectiveness.

Not all change objectives could be addressed via this game. Especially methods to change attitudes and self-efficacy were considered difficult to implement in a game with predetermined choices and rewards. These other change objectives are planned to be addressed via practice material, made available on a dedicated website. The material can be used in a classroom, but similar versions will be available for adolescents who wish to use these at home. Methods used here will be e.g. project work (guided practice), cooperative learning for classroom material and videos (modeling, vicarious reinforcement). The environmental conditions to facilitate adolescent behavior will also be addressed in supporting material made available on a dedicated website. Most used methods here will be modeling via video's and active (problem-based) learning. The same narrative will be used here as in the game to create a sense of immersion in the fantasy world, even when provided outside of the game context. A recent study employing a similar approach showed good usability for this method (Brand et al., 2015). A full description of methods and strategies is available upon request from the authors.

2.5. STEP 5: PLANNING FOR ADOPTION, IMPLEMENTATION AND SUSTAINABILITY

Although listed as step 5, implementation planning runs throughout the whole development process. To ensure that the finished product would be feasible to use in practice, a group of stakeholders was set up at the onset of the project. The stakeholder group was composed of representatives of schools, school counselors, governmental department of education, parent associations, youth advisory centers, youth helplines, youth TV channels, and umbrella organizations in health promotion. They convened at least twice per year and aided in decisions on e.g. whom to target, which situations to take into account, which skills adolescents need the most, what is feasible in average gameplay duration, how to distribute the program, and how to promote the program.

Stakeholders' perceptions confirmed that middle school students should be the primary target for the intervention. They suggested not to frame the game as a game against cyberbullying, but to approach this problem from a different, broader topic such as social life and communication. This suggestion was reflected in our choice of game narrative, where solving cyberbullying is merely an instrumental part to solving a mystery and getting Rafa's life back on track. Stakeholders emphasized that the game should be diverse to fit different learning styles, different cultures and should also appeal to youngsters

in different school types, such as vocational or technical education. They mentioned that cyberbullying language and even emoticons were culturally dependent. Emoticons and cyberbullying phrases were aimed to be generic and appeal to a broad audience, which was also pilot tested. Stakeholders advised against the use of mini-games which would contain educational content, whereas the overall game would be merely fun without providing educational content. Combining fun and education in each intervention component was crucial. This was monitored for each part (e.g. game and classroom material includes both fun and educational aspects).

Stakeholders' input also affected decisions on game distribution and promotion. It was decided to make the program available via schools to increase reach, but with the possibility to be played in the adolescents' own privacy, to increase practice. Stakeholders requested to provide a 'save' option to enable adolescents to continue their game play at home and improve their skills, which will indeed be provided. To be able to run the game on school computers, the stakeholder group advised not to use high-end graphics, and we decided to design the game in two-dimensional (2D) instead of 3D view. Representatives from schools recommended to start with a smaller program on which to gradually add components, instead of immediately installing a whole-school program. Stakeholders, however, also agreed that a supportive network at school and supplementary classroom material were basic conditions for the game to be effective. Homeroom teachers should have a crucial role in providing the context for the game. A school manual should clarify that this package is intended as a method of prevention and not as acute care when a cyberbullying incident has taken place. This is, however, often when schools decide to adopt a prevention approach, when instead, a remediation approach is needed. These stakeholder comments were integrated in the classroom material and accompanying manual for schools. Although the material is designed to integrate the game in a whole-school program, based on stakeholders' suggestion, the game will also be available as a stand-alone version that schools can use within their existing approach. The manual will clearly state which objectives are met by the game, and which components are needed in the school's own complementary approach in order to reach all change objectives.

2.6. STEP 6: DEVELOPMENT OF AN EVALUATION DESIGN

As for step 5, evaluation runs throughout the whole development process by conducting formative research, assessing feasibility, with end users. A final part of formative research is planned with the adolescents and schools, to tweak the game and extra material on usability, player experience, game appeal, comprehension, and fit with their culture in the language and visuals used. In a next phase, a quasi-experimental study is planned to evaluate the efficacy of the program in addressing the change objectives. Schools will be randomly assigned to either control or intervention condition. Effects on change and program objectives will be measured using validated questionnaires at pre-and post-intervention. A process evaluation among users playing the game and using the material is scheduled concurrently. These tests will take place in Fall 2015.

3. DISCUSSION

This study showed a meticulous, evidence-based planning process of a cyberbullying prevention program for adolescents. A recent review of cyberbullying prevention and intervention programs indicated a lack of evidence-based programs, that used a whole-school approach, and that included components addressing several individual behavioral determinants and the social context (e.g. family) (Della Cioppa et al., 2015). Our cyberbullying prevention program attempts to meet this current lack in literature and practice.

Evidence-based design of behavioral change interventions begins by understanding the changeable determinants of this behavior and their importance (Bartholomew et al., 2011; Glanz & Bishop, 2010). These steps were conducted and detailed information was presented here, to enable other professionals to start from a ready available list of change objectives and methods, and hence avoid duplication of efforts. The Intervention Mapping Protocol (IMP) process is costly and time-consuming (see e.g. Van Empelen, Kok, Schaalma & Bartholomew, 2003; Reinaerts, De Nooijer & De Vries, 2008), with commonly 3-4 years of research preceding the actual availability of program material (see e.g. De Craemer et al, 2014). Especially investigating the determinants of behavior has been reported as a bottle-neck (Godin, Gagnon, Alary, Levy & Otis, 2007), and sharing this central research, as done

here, can shorten the time needed for other professionals to develop their intervention. This can consequently leave more time for evaluation of longer-term intervention effects (e.g. health outcomes such as depression, suicidal ideation) or effects in community implementation, where IMP-developed interventions may be especially effective (Reinaerts et al, 2008), due to their continuous user and stakeholder involvement (Klesges, Estabrooks, Dzewaltowski, Bull, & Glasgow, 2005). Since these long-term and community implementation effects are often hard to document in the time available for most project developments, it would advance research into cyberbullying interventions to continue from existing evidence, and instead, devote more time and resources to effect evaluation. If our program material, which will be tested in step 6, proves effective, not only the central research presenting determinants and methods, but also the finalized program may inspire other professionals in future research or interventions. Since cultural differences may exist in how cyberbullying occurs or is perceived (Ortega et al., 2012), a verification of findings in a different cultural context may be appropriate prior to founding the intervention design on our evidence. Future research in cross-cultural settings would therefore be useful.

Applying the IMP resulted in decisions which changed the project's course. Firstly, this approach triggered the decision to target bystanders, as a group which possesses better social and coping skills than either victim or (victim-) bullies (Campbell et al, 2012; Völlink, Bolman, Dehue, & Jacobs, 2013), and who may effectively reduce the harm and prevalence of cyberbullying (Hawkins et al., 2001; Williford, Elledge, Boulton, DePaolis, Little & Salmivalli, 2013). Although victims and perpetrators also require interventions, changing bystander behavior was perceived as creating the highest potential impact from a public health perspective. Only a few cyberbullying intervention and prevention programs so far have included components on changing bystander behavior, either indirectly by using peer educators (Palladino, Nocentini & Menesini, 2012; Wölfer, Schultze-Krumbholtz, Zagorscak, Jäkel, Göbel & Scheithauer, 2013), or by directly targeting bystander behavior, as in the KiVa program (Williford et al., 2013). This latter program aimed to increase bystanders' awareness, empathy skills, anti-bullying attitudes and self-efficacy to defend and support the victim. Changes to bystander behavior were not measured, but the program's very small yet

significant effects suggested that changing bystander behavior can indeed reduce cyberbullying and – victimization in elementary school children. Effects in the age group most at risk for cyberbullying and –victimization (i.e. 12-14 year olds), were not significant, and the KiVa program may need to be adjusted to increase effectiveness here. Possibly, other behavioral determinants than those included play a role. Indeed, our results among 12-14 year olds showed that although anti-bullying attitudes were important, the most predictive determinants of positive bystander behavior were positive outcome expectations towards this behavior. Applying the IMP approach, which encourages using several behavioral change theories, and the need to assess all core behavioral determinants and their relative importance in changing the target behavior (Bartholomew et al, 2011), resulted in the following recommendations for bystander behavior change programs in cyberbullying: 1) emphasizing the benefits for victims, 2) reinforcing negative attitudes towards passive bystanding and positive attitudes towards comforting, 3) increasing self-efficacy to end cyberbullying and reducing the effect of incident factors on self-efficacy to intervene; 4) strengthening social skills, and 5) reducing moral disengagement; 6) increasing maternal awareness of cyber-activities; 7) reducing self-protective motives; and 8) reducing cognitive avoidance coping skills.

Secondly, the IMP acknowledges the importance of assessing environmental influences. Our results on environmental influences suggest effectiveness of cyberbullying programs may be further improved by a strong involvement of parents and educators. Adolescents mentioned their bystander behavior was influenced by (a lack of) support from educators and parents for positive behavior (Authors, 2014a). Our study contributes to cyberbullying intervention research by its theory- and evidence-based approach in addressing the behavior of parents and educators. While several existing interventions have included components for teachers (see e.g. Wölfer et al., 2013, and Van Cleemput et al., 2013, for a full overview), the theoretical or evidence basis for these components is often not described. Our study is hence, to our knowledge, the first to do so, using behavioral change theories in predicting and changing educator behavior. Our findings showed especially teachers need support in appropriately handling cyberbullying. Positive outcome expectations, problem perception and basic skills in pupil-educator relations need to be reinforced, whilst moral disengagement attitudes should be countered.

Even fewer current interventions for cyberbullying have included a parent component (Ortega-Ruiz, Del Rey, & Casas, 2012; Williford et al., 2013; Wölfer et al., 2013), despite the widespread assumption that targeting parents may be very important in cyberbullying, since this often takes place at home (Vandebosch, 2014). Parent material should emphasize that protecting one's child can only be achieved by promoting a positive classroom climate. Attitudes and positive outcome expectations towards supporting positive bystander behavior, and the perception that others expect them to support this behavior, also need to be addressed in material for parents.

A last novel aspect of this study lies in the application of the IMP to the development of a serious game against cyberbullying. IMP has been effectively used before in the design of two serious games for sexual health (Brown, Bayley, & Newby, 2013; Tortolero et al., 2010), in a serious game for asthma self-management (Bartholomew et al., 2000), and evaluation is currently underway for a serious game on energy-balance related behaviors (Spook, Paulussen, Paulissen, Visschedijk, Kok, & Van Empelen, 2015). A serious game is assumed to derive its effectiveness from coupling fun and educational strategies (Prensky, 2007). In our project, we observed that the choice of some behavioral change methods which are in general appropriate for health promotion interventions, conflicted with methods needed to maintain the fun value of serious games. More attention may be needed in the IMP guidelines on how to choose behavior change techniques, not only fitting with the target behavioral determinants, but also fitting with the specific application (e.g. videos, games). The overview provided in this paper of how behavior change techniques can fit with game design elements, may aid in bridging the communication gap between game developers and behavior change professionals. In educational games to increase curriculum-related knowledge, some attempts have been made in frameworks to match learning strategies with game features (see e.g. Carvalho et al., 2015). More efforts are needed to also establish such frameworks for behavior change games.

In sum, there is a need in literature and practice for evidence-based intervention design, targeting several determinants and social context factors. Our study was innovative in specifically targeting bystander behavior in cyberbullying. Based on evidence and theory, the program addresses several determinants which were the strongest predictors for this behavior in the age group most at risk for

cyberbullying (12-14y). Doing so, our program aims to be effective in an age group in which previous programs aiming to change bystander behavior have shown limited success. Moreover, this evidence and theory-based approach was also applied to addressing social context influences, whereas these components or the evidence-base for these components are often not described in other programs. And lastly, the program used a format, namely a game, that has a high appeal to our target group. Our study presented a systematic method for selecting game features and behavior change techniques to optimize both the motivational appeal and effectiveness of the serious health behavior change game.

4. CONCLUSIONS

This paper presented an evidence- and theory-based development of a serious game against cyberbullying among adolescents, by promoting positive bystander behavior. Based on systematic reviews, qualitative and quantitative studies among adolescents, parents and educators, performance objectives were designed to aid in the attainment of the desired reduction in cyberbullying and its harm. Studies were guided by several theories, such as the socio-ecological approach, Reasoned Action Approach, Social Cognitive Theory, and Bystander Intervention Model. Meta-analyses and an overview of effective methods assisted in the translation of these performance objectives into a concrete game application. User and stakeholder consultations helped refine the serious game ideas and implementation plan. The insights and evidence presented in this article may help in the development of other evidence- and theory-based cyberbullying prevention and intervention programs, and in the design of serious games.

Reference List

- Bandura A. (2002). Selective Moral Disengagement in the Exercise of Moral Agency. *Journal of Moral Education* 31, 2, 101-19.
- Bandura, A. (2007). Health promotion from the perspective of social cognitive theory. *Psychology & Health* 13, 4, 623-649.
- Bartholomew, L. K., Gold, R. S., Parcel, G. S., Czyzewski, D. I., Sockrider, M. M., Fernandez, M., Shegog, R., and Swank, P. (2000). Watch, Discover, Think, and Act: Evaluation of Computer-Assisted Instruction to Improve Asthma Self-Management in Inner-City Children. *Patient Education and Counseling* 39, 269-280
- Bartholomew, L. K., Parcel, G. S., Kok, G., Gottlieb, N. H., & Fernández, M. E. (2011). *Planning Health Promotion Programs. An Intervention Mapping Approach, 3rd Edition*. Jossey Bass.
- Bartholomew Eldridge, L.K., Markham, C.M., Ruiter, R.A.C., Fernández, M.E., Kok, G., Parcel, G.S. (2016). *Planning Health Promotion Programs: An Intervention Mapping Approach, 4th Edition*. Jossey Bass.
- Bastiaensens, S., Vandebosch, H., Poels, K., Van Cleemput, K., DeSmet, A., & De Bourdeaudhuij, I. (2014). Cyberbullying on social network sites. An experimental study into bystanders' behavioural intentions to help the victim or reinforce the bully. *Computers in Human Behavior*, 31, 259-271.
- Bourgonjon, J., Valcke, M., Soetaert, R., & Schellens, T. (2010). Students' perceptions about the use of video games in the classroom. *Computers and Education*, 54, 4, 1145–1156
- Brand, L., Beltran, A., Buday, R., O'Connor, T., Hughes, S., Baranowski, J., Diep, C., Shirong, A.L., Baranowski, T. (2015). Prose Fiction as a Narrative Companion for a Vegetable Parenting Videogame. *Games for Health Journal*, 4, 4, 305-311

- Brown, K., Bayley, J., & Newby, K. (2013). Serious Game for Relationships and Sex Education: Application of an Intervention Mapping Approach to Development. In S. Arnab, I. Dunwell, & K. Debattista (Eds.), *Serious Games for Healthcare: Applications and Implications* (pp. 135-166). Hershey PA: IGI Global.
- Campbell, M., Spears, B., Slee, P., Butler, D., & Kift, S. (2012). Victims' Perceptions of Traditional and Cyberbullying and the Psychosocial Correlates of Their Victimization. *Emotional and Behavioral Difficulties*, *17*, 389-401.
- Carvalho, M.B., Bellotti, F., Berta, R., De Gloria, A., Islas Sedano, C., Baalsrud Hauge, J., Hu, J., Rauterberg, M. (2015). An Activity Theory-Based Model for Serious Games Analysis and Conceptual Design. *Computers & Education*, *87*, 166-181
- De Craemer, K., De Decker, E., De Bourdeaudhuij, I., Verloigne, M., Duvinage, K., Koletzko, B., Ibrügger, S., Kreichauf, S., Grammatikaki, E., Moreno, L., Iotova, V., Socha, P., Szott, K., Manios, Y., Cardon, G., and The Toybox Study Group. (2014) Applying the Intervention Mapping protocol to develop a kindergarten-based, family-involved intervention to increase European preschool children's physical activity levels: the ToyBox-study. *Obesity Reviews* *15*(Suppl 3), 14-26
- Della Cioppa, V., O'Neill, A., & Craig, W. (2015). Learning from Traditional Bullying Interventions: A Review of Research on Cyberbullying and Best Practice. *Aggression and Violent Behavior*, *23*, 61-68
- DeSmet, A., Deforche, B., Hublet, A., Tanghe, A., Stremersch, E., & De Bourdeaudhuij, I. (2014a). Traditional and cyberbullying victimization as correlates of psychosocial distress and barriers to a healthy lifestyle among severely obese adolescents – a matched case-control study on prevalence and results from a cross-sectional study. *BMC Public Health*, *14*, 224-236

- DeSmet, A., Veldeman, C., Poels, K., Bastiaensens, S., Van Cleemput, K., Vandebosch, H. et al. (2014b). Determinants of Self-reported Bystander Behavior in Cyberbullying Incidents amongst Adolescents. *Cyberpsychology Behavior and Social Networking*, 17, 207-215.
- DeSmet, A., Van Ryckeghem, D., Compernelle, S., Baranowski, T., Thompson, D., Crombez, G., Poels, K., Van Lippevelde, W., Bastiaensens, S., Van Cleemput, K., Vandebosch, H., & De Bourdeaudhuij, I. (2014c). A Meta-Analysis of Serious Digital Games for Healthy Lifestyle Promotion. *Preventive Medicine*, 69, 95-107.
- DeSmet, A. (2015). *Understanding adolescent bystander behavior in cyberbullying and the potential of serious games to promote prosocial behavior and other healthy lifestyles*. Ghent, University Press.
- DeSmet, A., Aelterman, N., Bastiaensens, S., Van Cleemput, K., Poels, K., Vandebosch, H., Cardon, G., De Bourdeaudhuij, I. (2015). Secondary school educators' perceptions and practices in handling cyberbullying among adolescents: a cluster analysis. *Computers & Education*, 88, 192-201.
- Dombrowski, S. U., Sniehotta, F. F., Avenell, A., Johnston, M., MacLennan, G., & Araújo-Soares, V. (2012). Identifying active ingredients in complex behavioural interventions for obese adults with obesity-related comorbidities or additional risk factors for co-morbidities: a systematic review. *Health Psychology Review*, 6, 7-32
- Dusseldorp, E., van Genugten, L., van Buuren, S., Verheijden, M. W., & van Empelen, P. (2014). Combinations of Techniques That Effectively Change Health Behavior: Evidence from Meta-CART Analysis. *Health Psychology*, 33, 12, 1530.
- Fishbein, M., Ajzen, I. (2010). *Predicting and Changing Behavior. The Reasoned Action Approach*. New York, USA; East Sussex, UK: Psychology Press.

- Gómez-Guadix, M., Gini, G., & Calvete, E. (2015). Stability of cyberbullying victimization among adolescents: Prevalence and association with bully–victim status and psychosocial adjustment. *Computers in Human Behavior, 53*, 140-148.
- Gini, G., Pozzoli, T., Borghi, F., & Franzoni, L. (2008). The role of bystanders in students' perception of bullying and sense of safety. *Journal of School Psychology, 46*, 617-638.
- Glanz, K. & Bishop, D. B. (2010). The Role of Behavioral Science Theory in Development and Implementation of Public Health Interventions. *Annual Review of Public Health, 31*, 399-418.
- Godin, G., Gagnon, H., Alary, M., Levy, J. J., & Otis, J. (2007). The degree of planning: an indicator of the potential success of health education programs. *Promot Educ 14*, 3, 138-142.
- Gunther, N., DeSmet, A., Jacobs, N., & De Bourdeaudhuij, I. (2016). Comparing outcomes of cyberbullying and traditional bullying: a narrative systematic review of mental, physical and behavioural negative outcomes (pp. 54-76). In T. Völlink & F. Dehue (Eds.), *Cyberbullying: from theory to interventions*. London and New York: Routledge.
- Hartjes, L. B. & Baumann, L. C. (2012). Evaluation of a Web-Based Malaria Risk Reduction Game for Study Abroad Students. *J Am Coll Health, 60*, 403-414.
- Hawkins, D. L., Pepler, D. J., & Craig, W. M. (2001). Naturalistic Observations of Peer Interventions in Bullying. *Social Development, 10*, 512-527.
- Hinduja, S. & Patchin, J. W. (2012). Cyberbullying: Neither an Epidemic Nor a Rarity. *European Journal of Developmental Psychology, 9*, 539-543.
- Hong, J. S. & Espelage, D. L. (2012). A review of research on bullying and peer victimization in school: An ecological system analysis. *Aggression and Violent Behavior, 17*, 311-322.
- Huang, Y. & Chou, C. (2010). An Analysis of Multiple Factors of Cyberbullying among Junior High School Students in Taiwan. *Computers in Human Behavior, 26*, 1581-1590.

- Hublet, A., Vereecken, C., & Maes, L. (2012). Studie Jongeren en Gezondheid HBSC. Universiteit Gent. Downloaded 14-11-2014 from www.jongeren-en-gezondheid.ugent.be.
- Hunicke, R., LeBlanc, M., and Zubek, R. (2004). MDA: A formal approach to game design and game research. Proceedings of the AAAI Workshop on Challenges in Game AI, 4.
- Jabbar, A. I. A. & Felicia, P. (2015). Gameplay Engagement and Learning in Game-Based Learning: a Systematic Review. *Review of Educational Research, published ahead of print*, 1-40.
- Jacobs, N. C., Völlink, T., Dehue, F., & Lechner, L. (2014). Online Pestkoppentoppen: systematic and theory-based development of a web-based tailored intervention for adolescent cyberbully victims to combat and prevent cyberbullying. *BMC Public Health*, 14, 396.
- Kiriakidis, S. P. & Kavoura, A. (2010). Cyberbullying. A review on the Literature on Harassment Through the Internet and Other Electronic Means. *Fam Community Health*, 33, 82-93.
- Klesges, L.M., Estabrooks, P.A., Dzewaltowski, D.A., Bull, S.S., & Glasgow, R.E. (2005). Beginning with the Application in Mind: Designing and Planning Health Behavior Change Interventions to Enhance Dissemination. *Annals of Behavioral Medicine*, 29, Suppl, 66-75
- Kraag, G., Kok, G., Abu-Saad, H. H., Lamberts, P., & Fekkes, M. (2005). Development of a stress management programme-Learn Young, Learn Fair-for fifth and sixth formers in the Netherlands using Intervention Mapping. *International Journal of Mental Health Promotion*, 7, 37-44.
- Kowalski, R. M., Giumetti, G. W., Schroeder, A. N., and Lattaner, M. R. Bullying in the Digital Age: A Critical Review and Meta-Analysis of Cyberbullying Research Among Youth (2014). *Psychological Bulletin* 140, 4, 1073-1137
- Latane, B. & Darley, J. M. (1970). *The unresponsive bystander: Why doesn't he help?* New York: Appleton-Century-Crofts

- Lieberman, D. A. (2009). Designing Serious Games for Learning and Health in Informal and Formal Settings. In U. Ritterfeld, M. Cody, & P. Vorderer (Eds.), *Serious Games. Mechanisms and Effects* (pp. 117-130). New York: Routledge.
- Michie, S., Ashford, S., Sniehotta, F. F., Dombrowski, S. U., Bishop, A., & French, D. P. (2011). A refined taxonomy of behaviour change techniques to help people change their physical activity and healthy eating behaviours: The CALORE taxonomy. *Psychology & Health, 26*, 1479-1498.
- Michie, S., Fixsen, D., Grimshaw, J. M., & Eccles, M. P. (2009). Specifying and reporting complex behaviour change interventions: the need for a scientific method. *Implementation Science, 4*, 40.
- Michie, S., Atkins, L., West, R. (2014). *The Behaviour Change Wheel. A Guide to Designing Interventions*. Silverback Publishing.
- Modecki, K.L., Minchin, J., Harbaugh, A.G., Guerra, N.G., & Runions, K.C. (2014). Bullying Prevalence Across Contexts: A Meta-Analysis Measuring Cyber and Traditional Bullying. *Journal of Adolescent Health, 55*, 602-611
- Olweus, D. (2012). Cyber Bullying: an Overrated Phenomenon? *European Journal of Developmental Psychology, 9*, 520-538.
- Ortega, R., Elipe, P., Mora-Merchan, J.A., Genta, M.L., Brighi, A., Guarini, A., Smith, P.K., Thompson, F., & Tippett, N. (2012). The Emotional Impact of Bullying and Cyberbullying on Victims: A European Cross-National Study. *Aggressive Behavior, 38*, 342-356
- Ortega-Ruiz, R., Del Rey, R., & Casas, J. A. (2012). Knowing, Building and Living Together on Internet and Social Networks: The ConRed Cyberbullying Prevention Program. *International Journal of Conflict and Violence, 6*, 2, 302–312.

- Palladino, B.E., Nocentini, A., & Menesini, E. (2012). Online and offline peer led models against bullying and cyberbullying. *Psicthema*, 24, 4, 634-639.
- Prensky M. (2007). *Digital Game-Based Learning: Practical Ideas for the Application of Digital Game-Based Learning*. Edition 2007 ed. St. Paul, MN: Paragon House.
- Reinaerts, E., de Nooijer, J., & de Vries, N. K. (2008). Using intervention mapping for systematic development of two school-based interventions aimed at increasing children's fruit and vegetable intake. *Health Education*, 108, 4, 301-320.
- Rothon, C., Head, J., Klineberg, E., & Stansfeld, S. (2011). Can social support protect bullied adolescents from adverse outcomes? A prospective study on the effects of bullying on the educational achievement and mental health of adolescents at secondary schools in East London. *Journal of Adolescence*, 34, 579-588.
- Sallis, J. F., Owen, N., & Fisher, E. B. (2008). Ecological models of health behavior. In K.Glanz, B. K. Rimer, & K. Viswanath (Eds.), *Health behavior and health education: Theory, research and practice* (pp. 465-486). San Francisco, CA: Jossey-Bass.
- Salmivalli, C. (2010). Bullying and the peer group: a review. *Aggression and Violent Behavior*, 15, 112-120.
- Salmivalli, C., Voeten, M., & Poskiparta, E. (2011). Bystanders Matter: Associations Between Reinforcing, Defending, and the Frequency of Bullying Behavior in Classrooms. *Journal of Clinical Child and Adolescent Psychology*, 40, 668-676.
- Sheeran, P., Webb, T. L., & Gollwitzer, M. (2005). The Interplay Between Goal Intentions and Implementation Intentions. *Journal of Personality and Social Psychology*, 31, 87-98.
- Song, H., Kim, J., Kwon, R. J., & Jung, Y. (2013). Anti-smoking educational game using avatars as visualized possible selves. *Computers in Human Behavior*, 29, 2029-2036.

- Shegog, R. (2010). Application of Behavioral Theory in Computer Game Design for Health Behavior Change. In: Cannon-Bowers, J. and Bowers, C (eds). *Serious Game Design and Development: Technologies for Training and Learning* (196-232). IGI Global
- Smith, P. K., Mahdavi, J., Carvalho, M., Fisher, S., Russell, S., & Tippett, N. (2008). Cyberbullying: its nature and impact in secondary school pupils. *Journal of Child Psychology and Psychiatry*, 49, 376-385.
- Spook, J., Paulussen, T., Paulissen, R., Visschedijk, G., Kok, G., & Van Empelen, P. (2015). Design Rationale Behind the Serious Self-Regulation Game Intervention “Balance-It”: Overweight Prevention Among Secondary Vocational Education Students in the Netherlands. *Games for Health Journal*, 4, 5, 387-400.
- Tokunaga, R. S. (2010). Following You Home from School: a Critical Review and Synthesis of Research on Cyberbullying Victimization. *Computers in Human Behavior*, 26, 277-287.
- Tortolero, S. R., Markham, C. M., Peskin, F. M., Shegog, R., Addy, R. C., Escobar-Chaves, L., & Baumler, E. R. (2010). It's Your Game: Keep It Real: Delaying Sexual Behavior with an Effective Middle School Program. *Journal of Adolescent Health* 46, 169-179.
- Ttofi, M. M. & Farrington, D. P. (2011). Effectiveness of school-based programs to reduce bullying: a systematic and meta-analytic review. *J Exp Criminol*, 7, 27-56.
- Tu, K. M., Erath, S. A., & Flanagan, K. S. (2012). Can Socially Adept Friends Protect Peer-Victimised Early Adolescents against Lower Academic Competence? *Journal of Applied Developmental Psychology*, 33, 24-30.
- Van Cleemput, K., Bastiaensens, S., Vandebosch, H., Poels, K., Deboutte, G., DeSmet, A. et al. (2013). *Zes jaar onderzoek naar cyberpesten in Vlaanderen, België en daarbuiten: een overzicht van de bevindingen*. Universiteit Antwerpen, Universiteit Gent. Downloaded 14-11-2014 from

<http://wise.vub.ac.be/fattac/mios/FA%20white%20paper%201%20Zes%20jaar%20onderzoek%20naar%20cyberpesten.pdf>

Van Cleemput, K., Bastiaensens, S., Poels, K., Vandebosch, H., DeSmet, A., De Bourdeaudhuij, I., and the Friendly Attac team (2014). De internationale aanpak tegen cyberpesten. Een overzicht van wetenschappelijke studies waarin programma's rond cyberpesten geëvalueerd worden <http://wise.vub.ac.be/fattac/mios/D2.6%20Evidence-based%20interventions%20against%20cyberbullying.pdf>

Van Cleemput, K., Vandebosch, H., Poels, K., Bastiaensens, S., DeSmet, A., & De Bourdeaudhuij, I. (2016). The development of a serious game on cyberbullying: a concept test (pp. 93-109). In Völlink, T., Dehue, F. & McGuckin, C. (Eds.), *Cyberbullying: from theory to interventions*. London and New York: Routledge.

Vandebosch, H. & Van Cleemput, K. (2008). Defining Cyberbullying: a Qualitative Research into the Perceptions of Youngsters. *CyberPsychology & Behavior*, *11*, 499-503.

Vandebosch, H. (2014). Addressing Cyberbullying Using a Multi-Stakeholder Approach: The Flemish Case. In: S. van der Hof et al. (eds.), *Minding Minors Wandering the Web: Regulating Online Child Safety, Information Technology and Law*. Series 24, (pp. 245-262). The Hague, The Netherlands: Asser Press.

van Empelen, P., Kok, Gerjo, Schaalma, H. P., & Bartholomew, L. K. (2003). An AIDS Risk Reduction Program for Dutch Drug Users: An Intervention Mapping Approach to Planning. *Health Promotion Practice*, *4*, 402-412.

Verbestel, V., De Henauw, S., Maes, L., Haerens, L., Marild, S., Eiben, G. et al. (2011). Using the intervention mapping protocol to develop a community-based intervention for the prevention of childhood obesity in a multi-centre European project: the IDEFICS intervention. *Int J Behav Nutr Phys Act*, *8*, 82.

- Vogel, J.J., Vogel, D.S., Cannon-Bowers, J., Bowers, C.A., Muse, K., & Wright, M. (2006). Computer gaming and interactive simulations for learning: A meta-analysis. *Journal of Educational Computing Research*, 34, 3, 229-243.
- Völlink, T., Bolman, C.A.W., Dehue, F., & Jacobs, N. (2013). Coping with Cyberbullying: Differences Between Victims, Bully-victims and Children not Involved in Bullying. *Journal of Community & Applied Social Psychology*, 23, 7-24.
- Williford, A., Elledge, L. C., Boulton, A. J., DePaolis, K. J., Little, T. D., and Salmivalli, C. (2013). Effects of the Kiva Antibullying Program on Cyberbullying and Cybervictimization Frequency Among Finnish Youth. *Journal of Clinical Child & Adolescent Psychology*, 1-14.
- Wölfer, R., Schultze-Krumbholz, A., Zagorscak, P., Jäkel, A., Göbel, K., and Scheithauer, H. (2013). Prevention 2.0: Targeting Cyberbullying @ School. *Prevention Science*, 1-9.
- Zych, I., Ortega-Ruiz, R., Del Rey, R. (2015). Systematic Review of Theoretical Studies on Bullying and Cyberbullying: Facts, Knowledge, Prevention, and Intervention. *Aggression and Violent Behavior*, 23, 1-21