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Gamification of health education: Schoolchildren's participation in the development of a serious game to promote health and learning

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Gamification of health education

Schoolchildren's participation in the development of a serious game to promote health and learning

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Abstract

Purpose – The use of modern technology has many challenges and risks. However, by collaborating with schoolchildren, ideas to effectively promote health and learning in school can be identified. The purpose of this paper is to examine how a participatory approach can deepen the understanding of how schoolchildren relate to and use gamification as a tool to promote physical activity and learning.

Design/methodology/approach – Inspired by the concept and process of empowerment and child participation, the methodological focus of this study was on consulting schoolchildren. During a two-month period, 18 schoolchildren (10-12 years old) participated in workshops to create game ideas that would motivate them to be physically active and learn in school.

Findings – The phenomenological analysis resulted in one main theme, “Playing games for fun to be the best I can be.” This consisted of four themes with two sub-themes each. The findings offer insights on how to increase physical activity and health education opportunities using serious games in school.

Originality/value – The knowledge gained provides gamification concepts and combinations of different technological applications to increase health and learning, as well as motivational aspects suggested by the schoolchildren. The findings are discussed with health promotion and health education in mind.

Keywords Health promotion, Schools, Games, Education, Children, Empowerment

Paper type Research paper

Introduction

According to the Public Health Agency of Sweden (2014), the use of modern technology raises health risks related to physical, psychological, and social well-being. It has been suggested that today's children are expected to have a shorter lifespan than their parents, partly due to sedentary behavior (Kumanyika *et al.*, 2008). Thus, the low rates of physical activity among schoolchildren in Sweden might be putting them at risk of ill health. It is recommended that children perform at least 60 min. of moderate and vigorous physical activity daily (World Health Organization (WHO), 2010; CIF, Centrum för idrottsforskning (The Swedish Research Council for Sports Science), 2017); however, among Swedish children, only 22 percent of girls and 44 percent of boys achieve the recommended levels (Regeringskansliet (Government Offices), 2017). Physical activity provides health benefits to children (WHO, 2010), including positive effects on the musculoskeletal system and

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cardiovascular health (Janssen and LeBlanc, 2010), as well as positive effects on self-image (Goldfield *et al.*, 2011). Additionally, to acquire education in the best way possible, it is critical to be in good health (Rothon *et al.*, 2009), and multiple studies have detected associations between children's physical activity and academic performance (Käll *et al.*, 2014; Hillman *et al.*, 2014). Ericsson and Karlsson (2014) found that physical activity and adapted motor skills training in a nine-year intervention in compulsory upper secondary education improved schoolchildren's motor skills and academic achievement. According to the Swedish Government, an increase in physical activity is needed in the compulsory school curriculum and an increase in hours of physical activity has been proposed as part of the mandatory subject Physical education and health (Regeringskansliet (Government Offices), 2017). This is in line with the Swedish National Agency for Education (2011), which has concluded that learning goes hand in hand with schoolchildren's well-being. Moreover, there is support in the national Law of Education for health promotion within the context of education (SFS, 2010, p. 800). According to the World Health Organization, health promotion supports personal and social development by providing information, health education, and enhancing life skills to increase the options available for people to take greater control over their own health and to make choices conducive to health (World Health Organization (WHO), 1986). An important aspect of health promotion is to give different groups in society a "voice" and to let them be heard, thereby empowering them (Ghaye *et al.*, 2008). According to Koelen and Lindström (2005), empowerment can be defined as:

[...] a sense of control over one's life in personality, cognition and motivation. It expresses itself at the levels of feelings, in ideas of self-worth, and in feeling able to make a difference in the world around us (p. 11).

However, definitions of empowerment vary considerably depending on whether the emphasis is placed on the individual or collective approaches (Spencer, 2014). Rissel (1994) questioned empowerment as the Holy Grail of health promotion and, according to Tengland (2008), the use of the term empowerment carries a risk of manipulation. For example, when individuals are given control over things lacking in importance while others still control the important decisions, this can be termed empowerment tokenism. This is similar to Spencer (2014), who identified some tensions for existing theorizations of empowerment and questioned the relevance of official health discourses to young people's understandings of health. Nonetheless, the empowerment aspect is at the core of health promotion and translates into participation and agency involving stakeholders as equal partners (WHO, 1986). According to Diener and Biswas-Diener (2005), empowerment builds on humans' belief that the participants have the resources, energy, and competence needed to accomplish important goals. Ahlström (2010) found that schools with a high level of perceived student participation seem to have higher grades than schools with a low level of perceived student participation. This is echoed by the WHO, the United Nations, and experts in the strategic agenda offering direction in school health programs, where student participation is seen as central (Tang *et al.*, 2008). Paakkari and Paakkari (2012) stressed the importance of schoolchildren formulating their views about their health and validating themselves as knowledgeable about their own lives. They further state that for schoolchildren to increase their knowledge about health and become more health literate, there is a need for reflection to develop their meanings concerning their health.

Information and communication technology (ICT) can play an important role in health promotion opportunities for schoolchildren (Kostenius *et al.*, 2017; Lindqvist, 2017). Oprea and Stan (2012) and Tercyak *et al.* (2009) found that ICT creates opportunities for children to be informed and to build meaningful relationships and can be a venue to promote health and well-being. Along the same line, Bliss (2015) argued for using social media in health education in the classroom, thus enabling health educators to engage with the millennial

generation that has grown up using the internet and social media platforms. Digital games, which are designed to be played on a computer, video game console, mobile device or interactive television, are often seen as a suitable platform through which ICT can create such opportunities (Ilomäki, 2009). These types of digital games are often referred to as serious games, which was coined by Abt (1970) to describe the use of games for training and education and has been defined as any form of interactive computer-based game software for one or multiple players to be used on any platform and that has been developed with the intention to be more than entertainment (Ritterfeld *et al.*, 2009). Additionally, gamification is used for similar purposes and is defined as the use of game design elements in non-game contexts (Deterding *et al.*, 2011). According to researchers, the current trends in digital games can offer opportunities for disease prevention and health promotion in the areas of physical and mental health (Lister *et al.*, 2014; Turner *et al.*, 2016). Gamification components have been used to improve the effectiveness of health promotion (Cugelman, 2013), and there are some promising research works on the use of gamification aimed at promoting physical activity (Garde *et al.*, 2015). However, Glanz (2017) pointed out the many challenges in developing methods for teaching and learning in health promotion that is sufficiently appealing to compete with the information flow in the age of the internet and social media. Also, the digitalized lifestyle has many challenges and risks, such as low levels of connectedness in relationships, loneliness, sleeping problems, and depression (Cain and Gradisar, 2010; Laura and Chapman, 2009; van den Eijnden *et al.*, 2008). In opposition to the negative view of ICT, Plowman *et al.* (2010) concluded that the use of technology is not perceived by parents to be the threat to modern childhood that is claimed to be.

There seems to be a tension between modern technology as a health threat and, on the other hand, as an opportunity for health promotion and health education. Swedish schools have recently been criticized because of schoolchildren's deteriorating academic results (OECD, 2014) and the National Board of Health and Welfare (2016) stressed the need to promote health in school. These factors increase the importance of studying health-promoting technology in connection to health education. According to Nutbeam (2008), developing competencies for different forms of health action (e.g. personal, social, and environmental, including raising awareness of the social determinants of health and the recognition of empowerment) is an important aspect of health education. Therefore, a participatory research approach seems well-suited to collaborating with schoolchildren to overcome these health challenges. Also, when schoolchildren experience being listened to, being taken seriously, and have the opportunity to influence matters that concern them, their health and well-being increase (Kostenius and Öhrling, 2008).

Aim

This study aimed to examine how a participatory approach can deepen the understanding of how schoolchildren relate to and use gamification as a tool to promote physical activity and learning.

Method

Inspired by the concept and process of empowerment and child participation described in the introduction, this study focuses on collaborating with schoolchildren. Participation is a central component of efforts to empower individuals, groups, or organizations (Ghaye *et al.*, 2008). Participatory research has been proven to be successful in several research projects linked to health and well-being among schoolchildren, in both health care settings and the educational arena (Curtin and Murtagh, 2007; Lindqvist *et al.*, 2014; Ståhlberg *et al.*, 2016). According to Cooperrider and Whitney (2005), handling problems by posing positive questions can be a base for positive change and development, which they refer to as appreciative inquiry. Ghaye *et al.* (2008) argued for appreciative inquiry; posing positive

questions about what works well and finding strengths in the presence to capture opportunities to promote health. Therefore, the basic idea for this project was to explore the strengths and opportunities of gamification using serious games to promote learning and health in general, and physical activity in particular, from schoolchildren's perspectives.

Participants

The research project was performed in a municipality of approximately 70,000 inhabitants in the Northern part of Sweden. The primary school with 100 schoolchildren in pre-school to fifth grade was situated in a rural area. The principal and the teacher for fifth to sixth grade were informed face to face about the study by the first and third authors and agreed to participate in the study. The participating teacher was female and had several years of teaching experience. The class consisted of 18 schoolchildren aged 10-12 years old, including ten boys and eight girls, and all 18 children agreed to participate.

Ethics

The study was performed in accordance with the principles of the Swedish law for research ethics (SFS, 2003, p. 460) and the World Medical Association's (2015) Declaration of Helsinki. The study was approved by the Regional Ethical Board before the start of the research project (2015/296-31Ö). Informed consent was collected from all participating children, and the parents also gave their permission. The parents of the schoolchildren were invited to a meeting, at which the first and third authors gave the parents verbal and written information about the study. The information explained the aim of the research and stated that participation was voluntary and that the children could end their participation without providing any reasons for doing so.

Data creation

To deepen the understanding of how schoolchildren relate to and use gamification as a tool to promote physical activity and learning, schoolchildren were invited to take on the assignment of planning a health-promoting intervention to be used in the future. Their assignment was to create an intervention to increase physical activity and learning using serious games in school suitable for children a few years younger than them. During a 2-month period, the schoolchildren participated in workshops to create game ideas that would motivate them to be physically active and learn in school. Three workshops took place where the researchers met the schoolchildren, and the teacher and the schoolchildren worked on the assignment in between these workshops. All children were active in the group discussions and highly engaged in contributing to their assignment. The first workshop started out with the first and third authors initiating a brainstorming session with the schoolchildren and teacher about what a good game might include and what should be avoided. Smaller groups were formed, and the first workshop ended with a short presentation from each group and feedback from the rest of the class, the teacher, and researchers. The second workshop began with a status report from each group and feedback from peers, the teacher, and the third author. The schoolchildren were asked to make a movie to present their ideas and were instructed to emphasize the learning aspects of their games and consider how the games might be included in the ordinary curriculum. At the final workshop, the schoolchildren presented their films to the class, the teacher, and all three authors. After each film presentation, a brief discussion was held, focusing on feedback and clarifying questions.

Before the workshops with the schoolchildren, the third author had spoken with the teacher about the participatory approach with an appreciative inquiry. The process was explicitly based on the importance of all children having space to contribute and focusing on the possibilities instead of the problems. This was followed up in the schoolchildren's

logbooks, where they documented their work and had the opportunity to reflect on their process orally with the teacher. Different viewpoints were handled with an inclusive approach, for example, adding an extra aspect to the game to satisfy everyone's needs. Although discussions were vivid at times, all children contributed parts to the game ideas and were proud of their final game ideas. The presentations reflected their interest and engagement in their assignment and subject matter.

Analysis

The data consisted of five films, five logbooks, and the authors' field notes from the workshops. A life-world phenomenological analysis inspired by van Manen (1990) was used to understand ideas concerning how to promote physical activity and learning in school with serious games from the perspective of the participating schoolchildren. According to van Manen (1990), seeking meaning on different levels creates a holistic approach that entails capturing the meaning of the complete picture of the data and also from the individuals' perspectives. This was done in a back and forward motion, going between the collective and the individual expressions throughout the analyzing process. First, all three authors viewed the digital presentations live at school and then once more after reading the logbooks. The three authors made notes to formulate an initial understanding of the schoolchildren's ideas individually before the first discussion of the findings. In collective reflections, similarities and differences were noted and discussed. The schoolchildren's ideas were diverse, but there were similarities, which were combined into different themes that reflected specific aspects of the schoolchildren's ideas about how to promote physical activity and learning with serious games in school. As described by van Manen (1990), the authors tried to recover the embodied meaning of the text capturing a deeper understanding of the phenomenon – gamification as a tool to promote physical activity and learning. This was done by answering the question “what is it like?” (p. 46) and the answer was communicated in the themes. After repeated discussions, themes and sub-themes were formed, not only representing both the similarities and the great variety of the schoolchildren's ideas but also deepening the understanding of how the schoolchildren relate to the phenomenon. When formulating themes, representative and illustrative quotations from the films and logbooks were used to exemplify the themes, giving voice to the participating schoolchildren (Mitra, 2004) and enhancing the study's credibility (Polit and Beck, 2004).

Findings

The analytical process resulted in one main theme, which included four themes with two sub-themes each, describing schoolchildren's ideas about how to promote health and learning with serious games in school. The main theme, “Playing games for fun to be the best I can be,” included four themes with two sub-themes each: living in a fantasy world; being the king of the hill; moving to get ahead; and getting extra for free (Table I).

Table I.

Main theme, themes, and sub-themes emerging from the phenomenological analysis to deepen the understanding of how schoolchildren relate to and use gamification as a tool to promote physical activity and learning

Main theme	Themes	Sub-themes
Playing games for fun to be the best I can be	Living in a fantasy world	Seeing it is living it A little scary is fun
	Being king of the hill	Feeling successful Believing in myself
	Moving to get ahead	Excelling on the go Measuring is cool and fun
	Getting extra for free	Learning for fun Being better than a couch potato

Living in a fantasy world

The schoolchildren's ideas of living in a fun fantasy world included the sub-themes "seeing it is living it" and "a little scary is fun."

Seeing it is living it

For the schoolchildren, pretending was based on seeing something and giving evidence for its existence. For example, the schoolyard could be transformed into alternative fantasy worlds. The children's ideas included experiencing a jungle in the Amazon and a forest land where there were berries to pick and fish to catch when viewing the schoolyard through a visual device. The schoolchildren described how a fantasy world could be so realistic that you are unable to tell the difference. One child explained that in the triathlon game, "you swim, bike and run [...] in different places around the world." According to the children, a fantasy world could also be unrealistic, playing with the way the real world looks. For example, the fantasy world could include mushrooms that look real but appear in unrealistically large dimensions.

A little scary is fun

The schoolchildren's ideas included scary elements, as the excitement of being a little scared is fun, according to the children. The schoolchildren suggested staging scary scenarios, such as having to stay alive during a virus outbreak, having to tame wild animals to survive or finding your way in an old abandoned village with the feeling of an imminent threat. Being hunted and running to be safe were described by the schoolchildren as a scary but fun aspect of a game. Also, living your worst nightmare while knowing it is a dream but pretending it is real added a scary element to the game. Scary details were described, such as a poisonous spider, a dangerous snake, an angry robot dog, or an evil person to run away from. The schoolchildren used sound effects like music to highlight suspense and sudden screams to increase the scary feeling. The children also pointed out the importance of avoiding profanity, nudity, and blood to keep the scary elements to a limit suitable for the schoolchildren in mind. One child explained "[...] a little violence (is okay) but not like Indiana Jones."

Being king of the hill

The schoolchildren's ideas of being king of the hill included the sub-themes "feeling successful" and "believing in myself."

Feeling successful

According to the schoolchildren, being the best you can be was a central aspect of the gaming experience. When the player handled problems and succeeded in managing challenges, rewards were to be offered. The children described the feeling of success, for example, when solving a problem of orienting yourself in new surroundings and reaching the entrance to a new safer place or when receiving money when selling the fish you caught. One of the schoolchildren's ideas included a motivational factor of becoming older and more mature by being successful in the game and, thus, allowing useful benefits, for example, earning money to get further ahead in the game. One child explained, "When you turn sixteen you can start building cars [...] to go faster."

Believing in myself

The schoolchildren's ideas included role models and the possibility to become a star with the right amount of effort. One child explained, "I want to be like Usain Bolt," and another child wrote "Much work and sacrifice but it is all worth it for the shiny gold medal." According to

the schoolchildren, trusting in your competence in handling challenges was a central aspect of the games. Also, the freedom of choice was highlighted. One child wrote, “You do not have to take on a challenge, you can also choose to run freely.”

Moving to get ahead

The schoolchildren’s ideas of moving to get ahead included the sub-themes “excelling on the go” and “measuring is cool and fun.”

Excelling on the go

According to the schoolchildren, movement can be used to excel. The children described being physically active as a motivator, a tool to get ahead, and an activity to learn from and to keep healthy. Motivation to move included, for example, running to avoid being caught by a scary robot, biking to win a gold medal, moving about in the forest while picking berries or bear hunting, and walking in the jungle to find a treasure. The intensity and the duration of the physical activity made a difference. For example, when participating in sports, effort should be matched with rewards. Also, the schoolchildren used moving around while playing as an argument for having fun while playing a game and doing something useful at the same time. One group of children wrote an argument for a game in which physical activities are built into the game: “If you want to play games, but your mom tells you to get up and move around, then you can play our game.”

Measuring is cool and fun

The measuring aspect was described by the schoolchildren as cool and fun. The children suggested several gadgets to use to not only increase motivation to move but also make the gaming experience fun. They described how wearing clothes with electronic sensors to detect real movement could be incorporated into the game to maneuver a character. According to the children, step counters and wristband sensors were useful for measuring movement and fun gadgets that could be part of a game. One child said, “You get movement assignments to level up.” According to the schoolchildren, measured movement data could be used to visualize progression and set new goals.

Getting extra for free

The schoolchildren’s ideas concerning getting extra for free included the sub-themes “learning for fun” and “Being fit, fast and strong.”

Learning for fun

According to the schoolchildren, there are connections between playing a game and learning. The children’s main focus was making learning exciting and fun, which could be achieved in several different school subjects. Examples included using situations in the game when buying and selling or using movement data from a game in mathematics. In biology class, the children suggested using data from sensors to learn about the human body and reflecting on how to take care of your body with nutritious foods and physical activity. Also, the children suggested that knowledge about the animals and plants encountered in the games can offer interesting biology assignments. One child said, “We can make fact sheets about the fishes you catch (in the game).” The children described using the environment in the game to learn more about the real world, by finding places on the world map and learning about cultures and languages. One child suggested, “In English class, we can pretend you are being interviewed by a reporter in English to practice to talk” (the participating children’s native language is Swedish, and English is a mandatory subject in Swedish schools). Also, the schoolchildren highlighted the aspect of exploring within the

game, for example, time travel and space travel. In that way, the children could see new sights and learn new things, such as history and geography, which could add to the educational value of the game.

Being better than a couch potato

The schoolchildren's ideas included rewards to make them feel healthy, fast, and strong. The games included healthy choices, and the players earned extra points in the games for eating healthy foods and snacks. One game idea included searching for food and cooking food to survive, learning about basic nutrition. According to the schoolchildren, avoiding being inactive and unengaged was a positive factor, and physical activity and effort should be rewarded. According to the schoolchildren, being physically active through activities such as biking, running, walking long distances, climbing, and swimming rendered big awards. One group of schoolchildren explained how their game would promote health: "To swim you have to be in good shape, but above all have to have a strong will [...] when biking you need good stamina and be purposeful."

Discussion

Our comprehensive understanding of how schoolchildren relate to and use gamification as a tool to promote physical activity and learning make up the main theme "playing games for fun to be the best I can be." The children's ideas included physical activity, enjoyment, and learning in a social setting that connects reality and virtual reality (VR). These findings encompass "the three divides – health, education, and digital" (p. 289) that were mentioned by Kickbusch (2001) as areas to overcome when aiming to promote health literacy. The schoolchildren's ideas to promote physical activity were designed with elements of VR, leveling, measuring devices for positioning, and accelerometers to detect movement. These results can be compared with Hakulinen *et al.* (2013) findings on the motivational effect of achievement badges. The findings also suggest that aspects of a game that evoke scared feelings can be motivating, echoing the work of Garde *et al.* (2015), who found that the mobile game MobileKids Monster Manor was able to promote physical activity in children. Also, the schoolchildren's game ideas highlighted cooperation skills, the enjoyment factor, and how games can be integrated into school subjects, for example, Mathematics, Biology, and English. These findings can be compared with studies on digital games that highlighted opportunities for disease prevention, health promotion, and increased learning (Lister *et al.*, 2014; Turner *et al.*, 2016; Ritterfeld *et al.*, 2009).

Although the assignment given to the schoolchildren was to promote physical activity, the game ideas included a wider array of health-promoting activities and learning opportunities, such as nutrition. This spillover effect has also been noted by Leech *et al.* (2014), who described health behavioral clustering as a synergistic effect: when making one health-promoting behavioral change, the prevalence of other healthy choices increased. According to Busch *et al.* (2013), knowledge of health behavioral clustering can be used when designing school-based interventions using transfer-oriented learning, thus targeting multiple health-promoting behaviors simultaneously.

The schoolchildren described the fun of feeling successful and believing in themselves, echoing Bandura's (1993) social cognitive theory. In this theory, self-efficacy is a fundamental belief in the individual's ability to achieve a goal and might be altered by direct mastery experience, vicarious experience, and social persuasion (Bandura, 1993). If you believe you can achieve something, you will be much more successful in doing so, even when faced with obstacles (Bandura, 2004). Our findings show that when the players handled problems and succeeded in managing challenges, they perceived a feeling of success. Furthermore, vicarious experiences might be applicable, since our findings show that role models and the possibility of becoming a "star" were motivating factors.

Previous studies confirmed that self-efficacy mediates the causal pathway between interventions and children's physical activity levels (Haerens *et al.*, 2008).

The schoolchildren's ideas included viewing their games with physical activity as an opportunity to increase motivation, a tool to get ahead, and an activity to learn from and to keep healthy. This finding is in line with the work of Oprea and Stan (2012) and Tercyak *et al.* (2009), who argued that ICT can be a venue for promoting health and well-being. According to the schoolchildren, living in a fantasy world can be fun and motivating. The children explained how fantasy triggers our inner need to explore and break the limitations of what is possible. This result is consistent with a study conducted by Yee (2005) that identified the need for players to discover things that most other players have not. When we are young, everything seems new, and we are motivated to explore and learn. As we grow older and things become more familiar and known, we often lose the engagement and motivation for everyday things. Living in a fantasy world can, therefore, be a great motivating tool (Malone, 1980). In this alternative world, there are new things to explore, new wonders, and new skills and abilities. The fantasy world is a way to level the playing field, with real-life backgrounds and social situations playing a smaller role; instead, it is imagination and investment into this new world that matters. The fantasy world can offer many things that would seem too out of place to be accepted in the real world. Having to solve a math problem to purchase something or to complete a quest might not seem so out of place in the fantasy world, whereas doing the same in the real world would require greater effort. This finding is consistent with the work by Garris *et al.* (2002) that describes how immersion and completing tasks related to the fantasy world can increase motivation. They further state that the fantasy world provides a different level of immersion, different interactions, and the possibility to train in social situations repeatedly, so that when these situations occur in real life, there may be a more adept response. For example, Pokémon GO, which is a mobile game that uses augmented reality with fictional creatures that can be captured and trained, has had an unprecedented response. Components from Pokémon GO might enhance the efficacy of physical activity interventions (Lindqvist *et al.*, 2018). For some, the fantasy world is a world of opportunities, while for others, it may be more difficult to become immersed in the fantasy world. It is, therefore, important to engage the schoolchildren and collect their ideas about effective environments for motivation and engagement in school (Cook-Sather, 2006).

With this study, we have tried to respond to contemporary health risks due to an increase in sedentary lifestyle. The findings offer insights on how to increase physical activity and health education opportunities using serious games in school based on the schoolchildren's experiences. Furthermore, the knowledge gained might provide gamification concepts and combinations of different technological applications, as well as motivational aspects suggested by the schoolchildren, to increase health and learning. We would like to echo Percoco (2017), who found that blogging was a successful way to bring the health education curriculum out of the classroom and into the twenty-first century. Whether inside or outside the classroom, interactive technology can be a fruitful venture to develop health education. Additionally, according to Young *et al.* (2013), promoting health in schools might aid schools and policy-makers to reach educational, social, and economic targets.

Discussion of method

To ensure the trustworthiness of this research, the four criteria proposed by Lincoln and Guba (1985) and the COREQ guidance on reporting qualitative research (Tong *et al.*, 2007) were followed. Both males and females participated, as well as individuals with different experiences (e.g. different levels of physical activity and experience with games). This approach provided diversity and ensured that we gained insights on different aspects of schoolchildren's ideas concerning the development of an intervention to increase physical activity and learning using serious games in school. The study focused on a small sample in

a limited geographical area, which may reduce transferability. However, to facilitate the reader to judge the transferability of the results, the context, the research process, the participants, and the results have been described in detail by Öhman (2005). All of the children wanted to participate, and all of the parents gave their informed consent. The parents were invited to a scheduled performance in which the children presented their work from a school project. At that time, the first and third authors also informed the parents about the upcoming research project and obtained 100 percent informed consent. During the process, it was apparent that without specific assignments focusing on physical activity and how to use the game in a school subject, the schoolchildren only focused on the fun factor. Therefore, collaborations between the schoolchildren and the teacher and other school staff are important for the success of interventions to increase physical activity and learning using serious games in school. This finding concurs with Mitra (2009), who emphasized the participatory aspect of building youth-adult partnerships for school improvement and educational development. The method in itself can be seen as a health-promoting activity; Warne (2013) found that students' possibility to participate in the classroom and the school's work environment is an important factor for supporting and promoting health in school.

Conclusions and future research

This study shows that, when given the opportunity to participate, the schoolchildren had useful ideas on how to use gamification with serious games as a tool to promote physical activity and learning. These ideas can be introduced when the proposed increase in physical activity in compulsory school curriculum is implemented, as suggested by the Swedish Government (Regeringskansliet (Government Offices), 2017). The findings can be useful in health education, developing schoolchildren's competencies for making healthy lifestyle choices and being health conscious in school and other contexts in society. This study makes a small but meaningful contribution to appreciative inquiry research, as an example of a strength-based focus design, as described by Reed (2007). However, further studies are needed to understand the consequences of appreciative inquiry as this strength-based focus may appear to be obvious, creating a risk of it being taken for granted. Additionally, we would like to echo Jonsson *et al.* (2017) stressing the importance of an environment supporting physical activity in which schoolchildren can satisfy their needs for autonomy, competence, and relatedness. Currently, the findings from this study are being implemented in a health-promoting intervention using children's active school transportation. The theoretical framework consists of social cognitive theory (Bandura, 2004), gamification, and empowerment. Informed by Spencer's (2014) suggestion, we keep in mind that there are different forms of empowerment that intersect to produce and reproduce relations of power, offering different and sometimes competing possibilities for health promotion with children and young adults. However, empowering aspects of a participatory research approach are in need for further research, especially in the area of technology as an enabling tool for health promotion. Therefore, we agree with Mitra (2004, 2005), who argued for inviting schoolchildren to have an active role in their education, from decision making to taking on leadership roles as getting their feedback goes beyond just listening. Finally, a participatory approach used in this study, inspired by Ghaye *et al.* (2008), can be a win-win opportunity, as the schoolchildren not only shared their experiences and ideas to promote physical activity and learning but also reflected on their health-promoting practices.

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Further reading

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