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Exergames as a Teaching Tool in Physical Education?

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Video games are often highlighted as risk factors in relation to physical inactivity and increasing levels of obesity. Now a new type of video game, the exergame, has entered the market. In recent years, several countries have increasingly foregrounded exergames as a possible activity for use in school PE and as perhaps improving young people's knowledge, skills, attitudes, and behaviors in relation to health and physical exercise. The purpose of this study is to explore Swedish PE teachers' perceptions and use of exergames and also the barriers to and reasons for using exergames based on a survey containing closed- and open-ended questions. A total of 493 teachers (10% of all Swedish PE teachers) answered the questionnaire. The responses were coded and entered into SPSS, allowing for both descriptive data and cross-table analyses. The results show that 80 percent are familiar with exergames, 17 percent are recreational exergamers, and a few (3%) have tried using exergames in physical education and health. The reasons for introducing exergames are generally as follows: encouraging physical activity, offering different types of movement, and having fun. The barriers to introducing exergames are mainly: financial, prioritizing other activities, and the teachers' own knowledge. The majority of the PE teachers are generally positive to introducing exergames as a teaching aid into their subject. However, this requires developing the teachers' own knowledge of exergames. The choice of teaching content and the introduction of new activities and teaching tools also involve critically examining the games, and this, in turn, entails didactic reflection.



Keywords: Exergames, Physical Education, artefact, teaching tools, PE teacher

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Introduction

Too much time spent playing computer and video games is said to lead to physical inactivity and obesity, calling attention to the problems associated with the sedentary lifestyle young people develop due to computer gaming and too little time outdoors (Carvalho et al., 2007; Vandewater et al., 2004). Almost every day the media report on how computer gaming, watching TV, fewer young people participating in organized sport, and less time for physical activity at school lead to poor health and obesity in society. Both the media and research frequently paint a gloomy picture of the health-related consequences associated with the time young people spend playing computer and video games (Dietz, 2004; Ebbeling, Pawtak, & Ludwig, 2002; Jerome, 2007; Marcus, 2005). At the same time other studies with similar samples find no clear correlations in these regards (Biddle et al., 2004; Telema et al., 2005; Wang et al., 2006), so the issue is quite ambiguous.

In addition, computers are also said to be an important source of knowledge, where IT skills are viewed as essential in the future and experienced computer users enjoy, and will continue to enjoy, significant advantages in society (Swedish National Board for Youth Affairs, 2007). Using IT currently occupies an important role in education and is increasingly used as a learning tool in many subjects (Hallerström & Tallvid, 2008). The most recent Swedish curricula for the compulsory school, preschool class and the recreation centre 2011 (Lgr 11) and for the upper secondary school (Gy 2011) (Swedish National Agency for Education, 2011) underscore the use of IT as a teaching tool, but it is not known whether and how IT is used in PEH. Computers, cell phones, and computer games are currently integral to the daily lives of our students. Amid this paradox, a new kind of computer game has arrived on the scene that focuses on body movement (one's own movement), rather than just sitting in front of a screen. These interactive games, known as exergames (such as Wii Fit, Wii Sports, Dance Dance Revolution, Your Shape), incorporate exercise and body movement using balance boards, step boards, exercise bikes, or dance pads, or by using the controller as a racket to play games, such as tennis. Physical activities and body movements are the central theme of these games, which encourage exercise. In recent years, several countries, including the United Kingdom, Canada, Australia, and the United States, have foregrounded exergames as a possible tool to employ when teaching physical education.

The case for and against exergames in schools. In both academic and popular texts, a range of arguments for and against the use of exergames in schools have been put forward (Quennerstedt et al., in review). These arguments can be understood in relation to on the one hand health and on the other sport.

Papastergiou (2009) similarly argues that exergames can provide “potential benefits as educational tools for HE and PE, and that those games may improve young people’s knowledge, skills, attitudes and behaviors in relation to health and physical exercise” (p. 603).

In terms of health, most arguments in the literature are about the benefits of including exergames in PE in relation to fitness and, in the long run, helping combat obesity (Papastergiou, 2009). The games can, according to several studies, provide a tool to increase physical activity levels to improve the fitness and health of young people (Fogel et al., 2010; Graves et al., 2010; Jacobs et al., 2011; Sell et al., 2010). In this endeavor, increased heart rate, energy expenditure, and weight control seem to stand out as important educational intervention objectives (Graves et al., 2007, 2010; Jacobs et al., 2011, Quinn, 2011), and the targets of the intervention are primarily children with sedentary lifestyles (Cunningham et al., 2010; Hansen & Sanders, 2010). For this to be possible, the activities and, in this case, the exergames have to be fun and enjoyable and thus motivate and sometimes trick the children into exercising (Cunningham et al., 2010; Graves et al., 2010; Staiano & Calvert, 2011). Health-related arguments against the use of exergames in schools revolve around how the games can be damaging to some students’ self-image (Song et al., 2011) and become a problematic tool in the constant control and management of people’s bodies in a risk-based society (Millington, 2009; Vander Schee & Boyles, 2010). Vander Schee and Boyles (2010) also problematize how students’ bodies become commercial spaces in education as the schools become dependent on companies providing suitable products.

In relation to sport, some studies argue that exergames can help students learn motor skills like balance, eye–hand coordination, and agility that can be transferred to real sports (Papastergiou, 2009). It is also contended that exergames provide a fruitful alternative activity in relation to “traditional” competitive, often team-based, sports (Fogel et al., 2010). Fogel and colleagues (2010), for example, conclude that in their study students became more physically active when exergames were used in PE compared to their standard sports-based PE program. Exergames can thereby encourage students who otherwise would exclude themselves from traditional sporting activities. There are also arguments, mainly in popular literature, against using exergames in PE in that they involve neither teamwork, nor play, nor social interaction as “real” sports potentially do (for an overview, see Quennerstedt et al., in review).

In both research and popular literature, there are also economic arguments against using exergames in schools, namely, the cost of purchasing, updating, and repairing games (Quennerstedt et al., in review).

However, in the research in this field to date, no one has yet explored the implications of introducing the artefact exergames, or their use as a teaching tool for students to acquire knowledge of and learn about their bodies and health; rather, these games have been viewed as a modern way to exercise or encourage physical activity. Therefore, the use of exergames has primarily become a physiological question of energy expenditure, rather than a question of knowledge of and learning a school subject (Quennerstedt et al., in review).

This article presents a study that is part of a larger research project financed by the Swedish Research Council - *Video Games as Health Promotion* - which aims to examine exergames in terms of their educational value. The purpose of this article is to describe how Swedish PE teachers perceive and use exergames in their teaching, as well as to elucidate potential obstacles and reasons for using the games in their teaching based on a questionnaire study.

The Swedish school system and Physical Education. Over the past three decades, Swedish schools have undergone major changes, including transitioning from a rule- to a goal-driven school system, from having been controlled nationally to being controlled in recent years by the individual municipalities as well as by other responsible organizations (private enterprises). The school system has also become market adjusted, competitive, and where students have many educational options (Lindblad, 2011). Students begin to attend the nine-year Swedish compulsory school at the age of seven, while the three-year upper secondary school is voluntary (Swedish National Agency for Education, 2011). As this change evolved, teacher training also went from educating teachers to specialize in a single subject with a broad in-depth knowledge of physical education to training teachers to teach two subjects. During some periods, teacher education was geared to set subject combinations, but in recent years, it has been possible to take different combinations that include the subject physical education and health, PEH (Lundvall & Meckbach, 2003; Larsson, 2009).

Physical education was previously rule-driven, which meant that the curriculum and syllabi clearly specified the amount of time allocated to teaching and content. However, with the implementation of the goal-driven school, the name of the subject changed from physical education to physical education and health, PEH, and the subject content was no longer specified in the different types of schools. Instead, various goals now had to be achieved through teaching, and it was up to the teacher to interpret the new steering documents and provide an education that enabled students to accomplish specific goals upon completion of the nine-year compulsory school and of the course at upper secondary school, respectively (Lundvall & Meckbach, 2008; Quennerstedt &

Öhman, 2008). In Swedish schools, the subject PE has changed in terms of content, as well as what constituted the legitimacy of the subject, the name of the subject, and how it is taught. The steering document has been influenced by both research and social changes (Lundvall & Meckbach, 2010). The nature of the subject has transitioned from physical exercise to a subject aimed more at health and lifelong learning (Quennerstedt, 2008). This latter change is in line with developments in several other countries, including the United Kingdom (Fisher, 2005), Germany (Balz & Neumann, 2005), Australia, New Zealand, and the United States (Evans & Davies, 2004).

Artefacts, such as balls, maps, and gymnastic equipment, have always been available as teaching tools in PE, both to stimulate learning and as learning tools for students in their quest for knowledge (Almqvist, 2005; Quennerstedt et al., 2011a). In recent years, various technological artefacts have been introduced into PE teaching, including heart-rate monitors, pedometers, and video analyses (cf. Elbæk, 2012). Many researchers (cf. Almqvist, 2005; Heath & Luff, 2000) hold that the use of artefacts is an important part of human action and learning. From this starting point, a new learning aid, the artefact exergames, may accordingly be an interesting topic of study, with a focus on PE teachers' knowledge of and attitude toward exergames.

Material and method

As part of this project, in autumn 2011 the study was presented in its entirety in the Swedish journal *Idrott & Hälsa* (Sport & Health; Quennerstedt et al., 2011b), a periodical for Swedish PE teachers. This issue of the journal also included a questionnaire for PE teachers at both compulsory and upper secondary schools. In other words, the questionnaires were available to all journal subscribers and everyone with access to the journal at all Swedish schools. The teachers' questionnaire included background questions (gender, age, degrees, and type of school at which the individual taught), as well as five questions about exergames and an additional question about exergames in relation to the reasons for using them in their teaching. The responses here were based on statements answered using a five-point scale. The responses were coded and entered into the statistics program SPSS 20.0, after which statistical processing was carried out to create tables and conduct analyses. We primarily use the results to create descriptive data and cross-table analyses. The comparison of percentages regarding gender, age, and the type of school (compulsory school or upper secondary school) the teachers work at was done using a chi-square test or Fisher's exact test (FET) in relation to the variables. The software used for statistical calculation was SPSS 20.0. The results from this teachers' questionnaire are presented below.

Results

Teachers in the study. A total of 493 teachers answered the questionnaire, corresponding to 10 percent of all PE teachers with a teaching degree in Sweden (Gibbs et al., 2013). Of the respondents, 41 percent were men and 59 percent women, most of whom were between the ages of 30 and 59. Almost all respondents (98%) had completed teacher training in PEH. Over half were “single-subject teachers,” 44 percent taught two subjects, and 4 percent had a different teacher-training background with a varying number of credits in PE. In all, 313 (63%) teachers worked in compulsory schools and 153 (31%) in upper secondary schools, while the rest stated that they worked in both types of schools, at college/university level, or that they were students or no longer worked as a teacher.

How teachers view exergames. Almost 80 percent of teachers were familiar in some way with the games Nintendo Wii, Kinect, or Move, especially with the first of these games. One in six teachers were recreational exergamers and 17 teachers (3%) had tried using exergames in their teaching. Teachers who indicated that they had tried exergames in their teaching stated that they were used as: an optional activity, circuit training, a class activity where everyone participated in front of a screen, an option for students who do not want to participate in a large class, or for students with a disability.

We were interested in identifying what obstacles or potential teachers associated with using exergames in their teaching. According to the majority of teachers, the obstacles to introducing the games into their teaching were due to financial concerns and their prioritizing other activities. Half the teachers considered their own knowledge an obstacle, while the other half did not. Almost 70 percent did not consider lack of space or time or their attitude toward the games an obstacle.

When asked about the reasons or potential for using exergames in their teaching, teachers who taught in compulsory and upper secondary schools chose from different responses because the reasons were related to the course objectives of the respective type of school with teaching based on Lgr 11 or Gy 2011. The response options were statements, and the respondent put a cross next to one of the following descriptions: “no potential,” “some potential,” “considerable potential,” “huge potential,” “don’t know.”

The compulsory school teachers’ reasons (Figure 1) for using exergames in their teaching were primarily that there was considerable and huge potential (> 30%) for the games to *encourage physical activity*, and for students to *perform various*

movements and have fun. They also felt the games had some potential (> 30%) for students to *learn physical activities*, get *all-round exercise*, be able to *assess different movements* and *their view on health*, as well as *assess and consider their lifestyle* based on the games. However, it is worth noting that more than one in five teachers chose the response “don’t know” and almost as many did not answer the question at all.

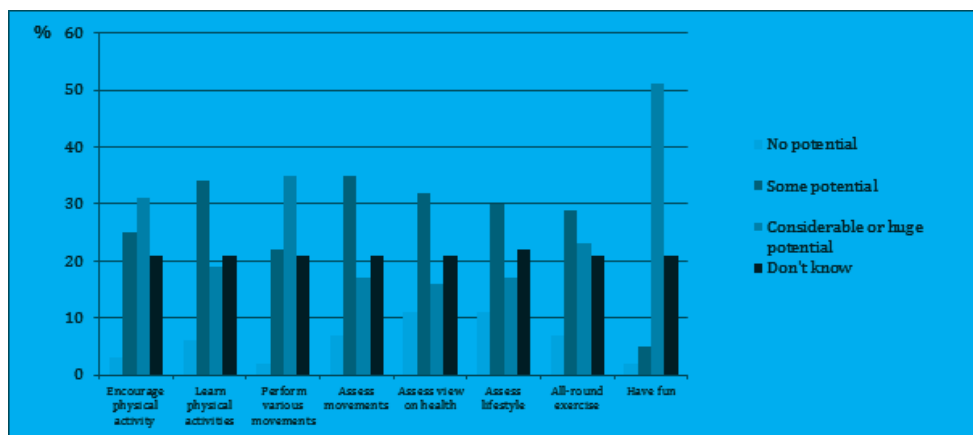


Figure 1. Compulsory school teachers’ responses to what they consider reasons for using exergames in their teaching.

The principal reason (Figure 2) cited by upper secondary school teachers (one in four respondents) for the use of exergames in their teaching was that there was great potential for the games to *encourage physical activity*. They also felt there was some potential (> 20%) for the games to enable students to *perform physical activities*, *improve their physical condition and health*, *form an ethical opinion on both gender equality* and *gender patterns*, and for the games to be able to *adapt the students’ movements ergonomically*. However, one in four teachers felt that the games did not help the students perform physical activities safely. Also noteworthy in this context is that almost half chose the response “don’t know” or did not answer the question at all.

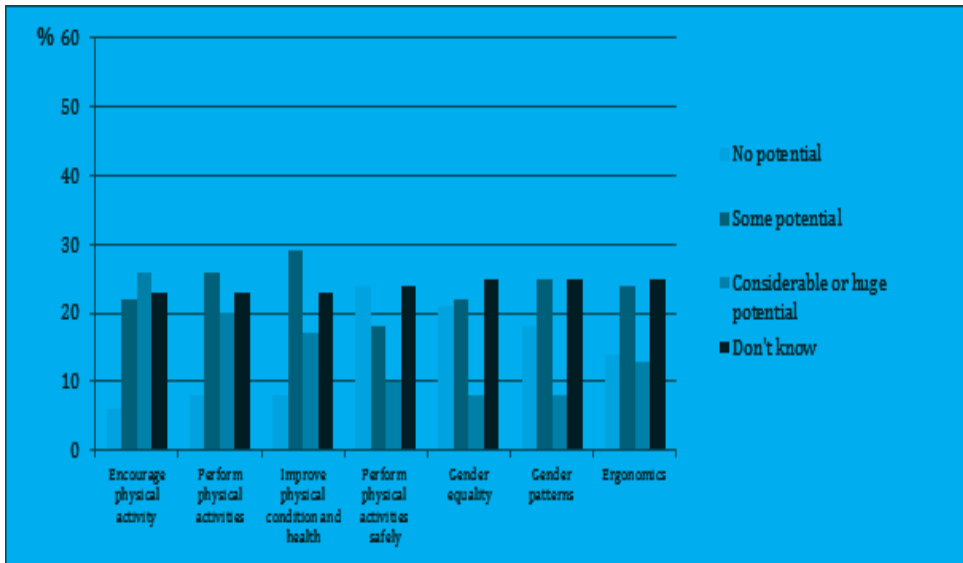


Figure 2. Upper secondary school teachers' responses to what they consider reasons for using exergames in their teaching.

Statistical analysis. In-depth analysis of the questionnaire responses shows statistical correlations for the variables *gender*, *age*, *familiar with the games*, and *playing recreationally* in relation to obstacles and reasons. We found no correlations regarding the variable *use exergames in the teaching*. The results of this analysis will be presented below. In the tables for the variable *reason*, we have merged the responses “some,” “considerable,” and “huge” potential throughout and refer to all of them as potential. In addition, we have chosen to eliminate the choice “don't know” and instead focus on those who see no potential as well as those who do see potential.

Age and gender. Almost as many women are familiar with the games as men. If we also consider the age factor, we can see a trend showing that younger teachers (20–39 years) are familiar with the games than older teachers (> 40). Regarding obstacles, men and women cite essentially the same reasons for not introducing exergames into their teaching. However, we find a significant difference ($p = .000$) in which more women (54%) than men (35%) consider their own knowledge of the games an obstacle, especially among young women compared with young men ($p = .000$). We also see a trend in which more men (56%) than women (49%) prioritize other activities in their teaching.

Men and women cite essentially the same reasons for potentially using exergames in their PEH teaching. However, we find a trend among compulsory school teachers in which more women (93%) than men (85%) feel the exergames can help students embrace learning physical activities. Among upper secondary school teachers (Table 1), we find significant differences in the reasons “gender equality” ($p = .039$) and “gender patterns” ($p = .025$), especially among young teachers ($p = .016$ and $p = .036$, respectively), where more women than men feel that the games can provide opportunities for students to form an ethical opinion on equality and gender issues.

Table 1.

Upper secondary school teachers’ responses (given in percent), broken down by gender, to what potential they see based on different reasons for using exergames in their teaching.

| N = 94 (%) | Men | | | Women | | |
|--|-----------|--------------|-------|-----------|--------------|-------|
| | Potential | No potential | Total | Potential | No potential | Total |
| Encourage physical activity | 88 | 12 | 100 | 91 | 9 | 100 |
| Perform physical activities | 88 | 12 | 100 | 83 | 17 | 100 |
| Improve physical condition and health | 85 | 15 | 100 | 85 | 15 | 100 |
| Perform physical activities safely | 51 | 49 | 100 | 57 | 43 | 100 |
| Form an ethical opinion on, e.g., gender equality* | 49 | 51 | 100 | 70 | 30 | 100 |
| Form an ethical opinion on, e.g., gender patterns* | 54 | 46 | 100 | 76 | 24 | 100 |
| Ergonomically adapt movements | 68 | 32 | 100 | 80 | 20 | 100 |

Note: Chi-square test: * $p < .05$ ** $p < .01$ *** $p < .001$

Familiar with the games. Those familiar with the games feel to a greater extent than those who are not that lack of space ($p = .005$) and financial concerns ($p = .000$) are significant obstacles to introducing exergames into their teaching. Those unfamiliar with the games instead believe to a greater extent than those who are familiar that their own knowledge ($p = .000$) and own attitude toward using the games ($p = .000$) are obstacles. Most teachers in both groups (about 70%) do not consider lack of time ($p = .0021$) an obstacle and more than half of both groups consider the prioritization of other activities in their teaching ($p = .008$) an obstacle (Table 2).

Table 2.

What the teachers (given in %) consider obstacles in relation to whether or not they are familiar with the games.

| N = 485 (%) | Familiar with the games | | | | Unfamiliar with the games | | | |
|---|-------------------------|-----------------|------------|-------|---------------------------|-----------------|------------|-------|
| | Obstacle | Not an obstacle | Don't know | Total | Obstacle | Not an obstacle | Don't know | Total |
| Lack of space** | 25 | 69 | 6 | 100 | 19 | 65 | 16 | 100 |
| Financial concerns*** | 59 | 35 | 6 | 100 | 38 | 47 | 15 | 100 |
| Lack of time* | 17 | 77 | 6 | 100 | 17 | 68 | 15 | 100 |
| My own knowledge of the games*** | 42 | 53 | 5 | 100 | 64 | 23 | 13 | 100 |
| My attitude toward using the games*** | 21 | 73 | 6 | 100 | 33 | 52 | 15 | 100 |
| I prioritize other activities when teaching** | 51 | 43 | 6 | 100 | 53 | 33 | 14 | 100 |

Chi-square test: * $p < .05$ ** $p < .01$ *** $p < .001$

We note that teachers cite essentially the same potential with respect to the different reasons, regardless of familiarity with the games. However, we find a significant difference among compulsory school teachers regarding whether the games encourage students to engage in physical activities ($p = .032$; FET), where those familiar with the games (96%) consider this a reason to a greater extent than those who are not (79%). Among upper secondary school teachers' responses, we note a trend regarding whether the students can form an ethical opinion on gender patterns when playing the games, where those familiar with the games (69%) view this as potentially possible to a greater degree than those who are not (44%).

Play recreationally. Teachers who are recreational exergamers are more likely than those who are not to cite financial concerns ($p = .006$) as an obstacle to introducing the games into their teaching. We also find a statistical correlation where those who are exergamers are more likely to believe that their own attitude toward the games ($p = .001$) is not an obstacle compared with those who are not. Meanwhile, teachers who are not recreational exergamers are more likely than those who are to cite their own knowledge ($p = .000$) and the prioritization of other activities in their teaching ($p = .014$) as obstacles (Table 3).

Table 3.

What the teachers (given in %) consider obstacles in relation to whether or not they are recreational exergamers.

| N = 482 (%) | Play recreationally | | | | Don't play recreationally | | | |
|--|---------------------|-----------------|------------|-------|---------------------------|-----------------|------------|-------|
| | Obstacle | Not an obstacle | Don't know | Total | Obstacle | Not an obstacle | Don't know | Total |
| Lack of space | 28 | 63 | 9 | 100 | 24 | 68 | 8 | 100 |
| Financial concerns** | 71 | 23 | 6 | 100 | 52 | 40 | 8 | 100 |
| Lack of time | 18 | 73 | 9 | 100 | 17 | 75 | 8 | 100 |
| My own knowledge of the games*** | 18 | 73 | 9 | 100 | 52 | 41 | 7 | 100 |
| My attitude toward using the games** | 8 | 83 | 9 | 100 | 27 | 65 | 8 | 100 |
| I prioritize other activities when teaching* | 37 | 54 | 9 | 100 | 55 | 38 | 7 | 100 |

Chi-square test: * $p < .05$ ** $p < .01$ *** $p < .001$

As for using exergames in their teaching, those who are recreational exergamers and those who are not give very similar answers for virtually all the reasons. However, there are two exceptions. One was that more compulsory school teachers who are recreational exergamers (93%), compared with those who are not (78%), responded that the exergames do not make students assess their view on health ($p = .029$). The other exception is a trend that we note among upper secondary school teachers in which those who are recreational exergamers (60%) feel that the games make the students work on performing physical activities safely, compared with those who are not (59%).

Conclusion - Exergames as a teaching tool

The purpose of this study has been to describe Swedish PE teachers' perceptions and use of exergames. We also wanted to explore the possible obstacles and reasons that PE teachers cite with respect to the use of exergames in teaching. The teachers' questionnaire shows that most teachers are familiar with one of the types of exergames, but essentially have never played the games themselves. Of the 493 teachers, 17 have used the games in slightly different ways when teaching PEH.

That the games are too expensive is primarily highlighted by the teachers as the obstacle to using exergames in their teaching, which was also found in previous studies that reached the very same conclusion (Quennerstedt et al., in

review). Other obstacles are that teachers feel they have inadequate knowledge of the games and they prioritize other activities over exergames in their teaching.

The reasons compulsory school teachers cite for using exergames in their teaching are mainly that they believe the games have potential to encourage students to engage in physical activity, the students can perform various movements, and they have fun. The main reason that upper secondary school teachers give for using the games in their teaching is that the games are deemed to have potential to encourage students to engage in physical activity. This finding is in line with previous studies that underscore the advantages of implementing exergames in schools, noting that the games can increase the students' physical activity levels and they may become more motivated to exercise because movement activities are more fun when they play the games (cf. Fogel et al., 2010; Graves et al., 2010; Hansen & Sanders, 2010; Papastergiou, 2009).

Analysis of the results also shows that the majority of the teachers are positive to the games. However, for it to be possible to introduce a new teaching aid into physical education and health, teachers probably need to learn more about exergames. The job of the teacher is to plan, teach, and follow up their lessons. They must therefore choose among different learning situations with the help of various activities and teaching tools and these choices require considerable and extensive didactic reflection (Ennis, 2013; Vander Schee & Boyles, 2010). We believe that research can contribute by problematizing the use of various artefacts, in this case exergames, as teaching tools in order to show whether and if so how the games can be used in a learning situation. The most important factor when introducing any teaching tool into schools and PE is thus a thorough reflection on its educational value, and not, as some research claims, its value primarily for individual energy expenditure (Quinn, 2011; Papastergiou, 2009; Staiano & Calvert, 2011). However, this also requires developing teachers' own knowledge of exergames, where the choice of teaching content and the introduction of new activities and teaching tools involve critically examining the games, which, in turn, entails thorough didactic reflection.

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