

Research on Self-determination in Physical Education: Key Findings and Proposals for Future Research

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Background: During the last 30 years several theories of motivation have generated insights into the motives underlying learners' behavior in physical education. Self-Determination Theory (SDT), a general theory on social development and motivation, has enjoyed increasing popularity in physical education research during the past decade. SDT states that for students to be optimally motivated for physical education, it is critical to support the satisfaction of their innate, psychological needs for autonomy, competence, and relatedness by being autonomy supportive, by structuring the environment and by creating a warm and solid relationship with the students.

Purpose: Our goal was to provide a critical review of 74 SDT-grounded peer-reviewed studies in the field of physical education, to identify research gaps, and to provide suggestions for moving this line of research forward by discussing how insights from a pedagogical view can contribute to the development of SDT-based research.

Findings: The included studies confirmed the motivational sequence as proposed by SDT. It was revealed that future research can be of extra value if a) combinations of the three

dimensions of need supportive practices are addressed, b) more intervention and experimental studies are conducted, c) more insight is gained into antecedents of teachers' behaviors, d) a broader set of learning outcomes is investigated, and e) relevant physical education related contextual factors are taken into account.

Conclusions: Given the increasing number of SDT-studies in the context of physical education, this review recommends a better integration of pedagogical and psychological knowledge in future SDT-grounded work in the context of physical education. A better integration is needed because it can lead to ecologically valid and practical recommendations on how to enhance students' motivation taking into account the pedagogical context of physical education.

Keywords: pedagogy; psychology; self-determination theory; motivation

Summary for practitioners

An extensive review of published research on motivation in physical education was carried out. Findings revealed that if students are more optimally motivated for physical education, they will concentrate better and will require only 'light-touch' supervision, which leads to positive learning outcomes. According to Self-Determination Theory optimal motivation occurs in an environment that is characterized by autonomy support, competence-facilitation, and emotionally warm interactions. These recommendations have practical implications for teachers and teaching. For example, teachers can be autonomy supportive by asking students about their interests in different kinds of dance styles. Further, when teachers for example tell students exactly what is expected from them and how expectations can be met, they provide the necessary basis for students to develop their competence. Emotionally warm interactions refer to the quality of the relationship between teachers and students, which can be created by showing students sincere concern. Overall, these characteristics yield advantages, ranging from more enjoyment and autonomous motivation to an increase in physical activity levels.

Introduction

The largest and probably most significant contribution social psychology has made to research on physical education over the past 30 years has been in relation to motivation (Lirgg 2006). This research, as well as studies in other fields such as the sport domain and the workplace, has revealed that motivation is a complex concept. Lirgg (2006) identified up to eight theories of motivation that have been used in research on physical education, namely Need Achievement Theory, Attribution Theory, Social Cognitive Theory, Self-Efficacy Theory, Competence Motivation Theory, Expectancy Value Theory, Achievement Goal Theory, and Self-Determination Theory. Each of these theories has generated insights into the motivational forces underlying learners' behavior in physical education, including factors as needs, expectations, and interests. During the last decade, studies of motivation in physical education have been increasingly framed within the context of physical activity levels (Parish and Treasure 2003) and health (Pihu *et al.* 2008). Physical education has been identified as a contributor to help children achieve the recommended amount of physical activity (Fairclough and Stratton 2005) and to the prevention of sedentary lifestyles and associated diseases (Lobstein and Frelut 2003), with motivation considered as a key factor in this process.

One motivation theory that has enjoyed increasing popularity within the field of physical education is Self-Determination Theory (SDT, Deci and Ryan 2000). Sun and Chen (2010) discussed SDT-grounded studies on motivational dynamics in physical education with the purpose of developing an in depth pedagogical understanding of the value of SDT for the practice of education. The present study builds on this work by suggesting what type of research is needed to enhance the value of SDT-based research for the practice of physical education. This is done by (a) providing a systematic overview of studies investigating motivation in physical education starting from the SDT viewpoint, (b) identifying research gaps, and (c) providing suggestions for future research on how insights from a pedagogical view can contribute to the development of SDT-based research. We begin by providing an overview of the basic tenets from SDT from a historical perspective (Vansteenkiste, Niemiec, and Soenens 2010)

Self-determination theory

SDT provides an understanding of why people initiate and persist in behaviors. It is a macro-theory of human motivation, emotion, and personality processes in social contexts. The theory holds that individuals' behaviors need to be self-determined or volitional for them to be optimally motivated. In 1975, Deci proposed, consistent with other motivation researchers at the time, that people inherently possess intrinsic motivation. Intrinsically motivated behaviors are performed out of interest and curiosity, that is, for their own sake. As a result, people volitionally engage in these behaviors. Physical education is one of the domains where intrinsically motivated behavior is present in a large number of students as many teenagers seem to find exercising enjoyable

Intrinsic motivation was contrasted with extrinsic motivation, which refers to the engagement in a behavior in order to reach an outcome situated outside of the activity. For instance, there are also teenagers only putting effort into their physical education class for other, extrinsic reasons, such as to avoid their teacher being disappointed or yelling at them. These teenagers are said to be extrinsically motivated. Intrinsic and extrinsic motivation are dynamically related to each other as various studies found that externally controlling factors, like rewards, threats, or punishments can erode intrinsic motivation (Deci, Koestner, and Ryan 1999; Vansteenkiste & Deci, 2003; Koka & Hein, 2003). This empirical work suggested that rather than being additive in nature, intrinsic and extrinsic motivation can negatively affect each other over time.

In the 1980s, the distinction between intrinsic and extrinsic motivation was extended and refined. Extrinsic motivation and intrinsic motivation were no longer considered as antagonistic constructs, as previously assumed by deCharms (1968), and four types of extrinsic motivation were distinguished. These types varied depending on whether the reason for engaging in the behavior has been more or less internalized (Ryan and Connell 1989). Specifically, when the activity holds personal meaning for an individual (identified regulation) and when this activity has been brought into alignment with personally held values and ideals (integrated regulation), the regulation for enacting the activity is said to be internalized. To illustrate, when a youngster believes that putting effort into physical education may provide energy to stay concentrated during the rest of the day, he is said to have personally endorsed (i.e., internalized) the reason for engaging in physical education. The concept of integrated regulation is generally not investigated in children and adolescents. It is unlikely

that an integrated regulation is present in during childhood or adolescence (Vallerand 2007), since it requires high levels of self-awareness and introspection. In research studies, these two types of internalized extrinsic motivation (identified and/or integrated regulation) is often combined with intrinsic motivation into a composite score of autonomous motivation (e.g., Haerens *et al.* 2010) as individuals willingly engage in the activity when their behavior is based on either personal values or interests.

The logic behind internalization and autonomous motivation is attractive for the practice of physical education. As Hagger *et al.* (2003) and many others have proposed, if young people in physical education classes are more autonomously motivated, they are more likely to be ‘better pupils’ in the sense that they will concentrate and will require only ‘light-touch’ supervision by the teacher, which leads to positive learning outcomes. Further, it is proposed that in contexts beyond the school, such as leisure time, more autonomously motivated young people are more likely to be physically active since they find physical activity meaningful.

Autonomous motivation is contrasted with controlled motivation and amotivation. When controlled individuals engage in an activity they want to meet an internally or externally imposed demand. Internal demands involve the avoidance of feeling ashamed or guilty, or the internal pressure to bolster one’s self-worth (introjected regulation). External demands can take the form of the avoidance of threatening punishments, the meeting of external expectations, or the pursuit of controlling rewards (external regulation). For instance, when children listen to their physical education teacher because he threatens with bad grades if they do not obey during instructions, the children are acting out of external regulation. Amotivation refers to a lack of intention to act or engage in an activity, or doing an activity with no sense of intending to do it (Deci and Ryan 2002). As mentioned before, several studies within SDT have linked pupils’ motivation for physical education to different outcomes, including affective (e.g., well-being), cognitive (e.g., concentration) and behavioral outcomes (e.g., activity levels). Those studies have consistently found that more autonomous types of motivation are associated with higher well-being, more effort-expenditure and concentration, and greater activity levels compared to more controlled types of motivation.

To facilitate the internalization of externally regulated behavior so that children become autonomously motivated, SDT maintains that it is critical to support the satisfaction of individuals' innate, psychological needs for autonomy, competence, and relatedness. These three needs are said to represent psychological nutrients underlying individuals' growth, well-being, and optimal motivation (Deci and Ryan 2000). Autonomy refers to the experience of a sense of volition and psychological freedom when carrying out activities (deCharms 1968). Competence concerns feeling effective when mastering tasks (White 1959), and relatedness refers to the experience of connectedness and intimacy with others (Baumeister and Leary 1995). A teenager who feels that the physical education class is organized consistent with his or her values, who feels capable of effectively doing the exercises, and who experiences a sense of connection with peers and the teacher would score high on need satisfaction. Ryan and Deci (2007) argue that the satisfaction of all three needs is needed in order to change from controlled to more autonomous regulations and for experiencing the most optimal kind of motivation. Whereas the satisfaction of the needs for competence and relatedness might be enough for individuals to pursue activities for either various controlled reasons, the experience of a sense of choice and, hence, the satisfaction of the need for autonomy is a prerequisite for the development of an identified or integrated regulation.

Largely parallel to the three needs, SDT specifies three characteristics of need-supportive environments: such environments are autonomy supportive instead of controlling, well-structured and competence-facilitating instead of chaotic and critical, and emotionally involved instead of withdrawn (Skinner and Belmont 1993). Teachers' autonomy support includes offering choice, minimization of controlling language, and provision of a meaningful rationale for taking part and being active (Deci *et al.* 1994; Reeve and Jang 2006). Researchers working with SDT propose that teachers structure the learning environment through the provision of optimal challenging tasks, positive feedback, and adequate help as well as the communication of clear guidelines and expectations (Sierens *et al.* 2009). Finally, teacher involvement is defined as the quality of the interpersonal relationship between teachers and students (Skinner and Belmont 1993). Previous research has studied these three contextual features in isolation (e.g., Chatzisarantis and Hagger 2009) or in conjunction (e.g., Ommundsen and Kvalø 2007), thereby making use of experimental (e.g., Mouratidis *et al.* 2008) or

self-report (e.g., Pihu and Hein 2007) methods. Overall, perceived and manipulated need support has been found to yield advantages, ranging from more enjoyment and autonomous motivation to an increase in physical activity levels in leisure time (e.g., Pihu *et al.* 2008).

Given that past work provided initial support for the creation of a need-supportive environment, more recent studies have begun to examine the antecedents of a need-supportive teaching style. For instance, Pelletier, Seguin-Levesque, and Legault (2002) examined social-contextual conditions that lead teachers to be more autonomy-supportive with their students. They distinguished pressures from above and pressures from below as antecedents of teachers' motivation and behaviors. Pressures from above consist of complying to a curriculum, to colleagues, and with performance standards. Pressures from below consist of the perception of student controlled motivation or amotivation. The more teachers perceive pressure from above and pressure from below, the less they are autonomous and the more they are controlled toward teaching, which, in turn, would be associated with being more controlling with students (see also Soenens *et al.*, 2012).

The present study

Given that the pedagogical value of SDT for the practice of physical education has been illustrated (Sun and Chen 2010), and the number of studies applying SDT in the context of physical education has increased over time, the present review has the aim to formulate suggestions on how to move this line of research forward. To do so, the available research base will be systematically reviewed from four different angles, that is, depending (1) on which portion of the theory that was examined, (2) the design and method used, (3) the type of outcome being studied, (4) the number and type of PE-related contextual factors being included. Whereas the first analysis allowed us to conclude to what extent SDT has received confirmation in the literature, analyses 2 through 4 were especially critical to identify a number of understudied topics in the available SDT literature.

As indicated in Figure 1 (i.e., the motivational sequence that is based on the tenets of SDT), the theory-driven analysis of the published studies is realized by differentiating between studies that focus on different parts of the motivational sequence. A distinction is made between (a) hypothesized antecedents of need supportive teaching in physical education, including teachers' own motivation and need satisfaction and the experienced work climate and (b) studies that focus on hypothesized

consequences of need supportive teaching. These consequences include pupils' basic need satisfaction, their type of motivation for physical education, and a variety of outcomes (i.e., cognitive, affective, behavioral), both within the physical education class and outside the physical education class (i.e., during leisure time).

>>Figure1<<

Second, we differentiate between descriptive and exploratory studies (i.e., research without an external influence or intervention of researchers), experimental studies (i.e., research that controls for or accounts for the effects of extraneous factors) (Portney and Watkins 2000), and intervention studies (i.e., studies trying to change factors in the context of the practice of physical education in a real-life setting). Throughout this review, we will use the term observational studies for the descriptive and exploratory studies. With respect to the observational studies, we will distinguish between cross-sectional studies executed at one point in time and longitudinal studies that cover multiple time points.

Third, the research base was examined from the perspective of the studied outcomes. As mentioned before, studies of motivation in physical education are increasingly investigating children's and adolescents' physical activity levels and health (Pihu *et al.* 2008). However, physical education wants pupils to attain learning goals in a variety of contexts. The existence of different kinds of physical education curriculum models, such as sport education (Siedentop, 1994) or teaching games for understanding (Bunker and Thorpe, 1982), each having their own aspirations, illustrates that physical education contributes to a broad range of knowledge and skills. It is critical that motivation research in physical education covers different types of outcomes as to be truly relevant to practice.

Finally, a detailed reading of each study was conducted to search for the description and inclusion of PE-related contextual factors. Since characteristics of the physical education curriculum, class and student related factors, teacher characteristics, and features of facilities and equipment may have an influence on behavioral and learning outcomes during physical education, these factors need to be taken into account.

Method

Literature Search and Selection

The retrieval of published studies for this review included a structured search in three electronic databases (Web of Science, SPORTDiscus, and ERIC). The terms Self-Determination Theory* and physical* and education* were entered in the search category 'keywords'. On 20 of December 2010, 142 articles were retrieved in Web of Science, 89 articles were retrieved in SPORTDiscus, and 39 articles were retrieved in ERIC. Additionally, the following relevant journals for physical education were searched for publications that might have been left out in the search by the electronic databases: European Physical Education Review, Journal of Teaching in Physical Education, Journal of Sport and Exercise Psychology, and Quest. Twenty-four additional articles were found in the European Physical Education Review, one article was found in Journal of Teaching in Physical Education, in Quest and in Journal of Sport and Exercise Psychology. In total, 297 peer-reviewed articles were retained.

As seen in Figure 2, a total of 154 (out of 297) studies were excluded, because they were conducted outside the specific context of school physical education. Next, 69 articles were excluded because they appeared twice in the databases or because they were reviews, book chapters, dissertations, papers not written in English, and papers reporting on the validation of questionnaires to measure constructs of SDT in the context of physical education. As a result, 74 publications were included into this review.

>>Figure2<<

Data Extraction

To review the characteristics of the included studies, detailed information on purposes, design, participants, methods, results, and conclusions were included into a summary table. To provide an overview of the main characteristics of the studies, four tables were composed. The studies were organized by the five distinguished relationships within the motivational sequence (see Figure 1, relationships A, B, C, D and E). Accordingly, in Table 1, an overview is given of the specific relationships investigated in each of the studies. Next, for the purpose of identifying research gaps, the studies were organized according to a) research designs (Table 2), b) the outcome measures included in the studies (Table 3), and c) the inclusion of contextual factors related to physical education (Table 4). All 72 studies included in the review were numbered (see Appendix A) and in the result section

these numbers were used to refer to the studies that are included in the analysis. The publications are numbered in alphabetical order (first author) and by year of publication.

Results

Descriptive results

All included studies were published between the years 2000 and 2010, with a substantial increase in the number of studies published during the last four years (one in 2000; two in 2001; three in 2002; six in 2003; four in 2004; four in 2005; four in 2006; 11 in 2007; 11 in 2008; 15 in 2009; 13 in 2010, with a correlation of .89 ($p < .01$) between the number of studies and the year published). Nineteen studies were published in psychological journals (includes *Psychology and Health*, *Journal of Sport and Exercise Psychology*, *International Journal of Sport Psychology*, *Psychology of Sport and Exercise*, *Journal of Personality and Social Psychology*), 17 studies in journals specializing in educational psychology (includes *Journal of Educational Psychology*, *European Journal of Psychology of Education*, *British Journal of Educational Psychology*, *Contemporary Educational Psychology*), 18 studies in educational journals (includes *European Physical Education Review*, *Scandinavian Journal of Educational Research*, *Journal of Teaching in Physical Education*, *Teaching and Teacher Education*), and 20 studies in journals focusing on the research areas of sport and exercise or health (includes *Research Quarterly for Exercise and Sport*, *Journal of Sport Sciences*, *Human Movement*, *European Journal of Sport Science*, *Asian Journal of Exercise and Sport Science*, *Journal of Adolescent Health*). For convenience, journals focusing on the subject of physical education were labeled as educational journals, although we acknowledge that these journals could also be part of the category of sport and exercise.

Theory-based overview of studies: Verification of the motivational sequence

Although all studies included in the present review were set up to test various aspects of SDT, the research questions varied across studies. As seen in Table 1, nine studies (12.2%) focused on the antecedents (i.e., pressures from above, below or within) of teacher need support and the explanatory role of teacher need satisfaction and motivation in the association between these antecedents the teacher provided need support (relationships A and B in Figure 1). These studies found that teacher antecedents such as beliefs, work pressures, perceptions of student self-determination are related to

teacher need satisfaction and/or self-determined motivation. Higher levels of teacher self-determined motivation to teach were related positively to adaptive motivational strategies.

Twenty nine papers (39.2%; *one study in category 'A, B, & C'; six studies in category 'C & D'; and 22 studies in category 'C, D & E'*) investigated (among others) relationships between need support provided by teachers and need satisfaction in students (relationship C) and found that perceptions of need support were positively related to need satisfaction among students. Fifty-one studies (68.9%; *one study in category 'D'; ten studies in category 'C & D'; eight studies in category 'D & E'; and 32 studies in category 'C, D & E'*) investigated (among others) relationships between need satisfaction and motivation of students (relationship D) and found that need satisfaction was positively related to self-determined motivation or autonomous forms of motivation. Relationship E was (among other relationships) investigated in 47 studies (63.5%; *seven studies in category 'E'; eight studies in category 'D & E'; and 32 studies in category 'C, D & E'*), providing evidence for the existence of a positive relationship between autonomous motivation and positive outcomes in physical education and/or in leisure time.

>>Table1<<

Identification of Research Gaps

Research design

Table 2 summarizes the study designs of the 74 included studies, showing that three studies (4.1%) were intervention-based, ten studies (13.5%) employed an experimental study design, and 61 studies (82.4%) were observational, from which most were cross-sectional (i.e., 51 studies, 68.9%) and a minority (i.e., ten studies, 13.5%) were longitudinal.

First, all three intervention studies (4, 43, 65) focused on training physical education teachers to learn to teach in a more need supportive way. All three studies reported positive training effects, although the type of training offered and the type of outcome studied varied. Chatzisarantis and Hagger (2009) created an intervention with the aim of training PE teachers to become more autonomy supportive (i.e., providing more rationales, acknowledging difficulties, and enhancing pupils' sense of choice). The intervention enhanced pupils' perceptions of autonomy support and autonomous motivation, and increased the frequency with which young people engaged in physical activity during

leisure time. In the intervention study of Prusak *et al.* (2004), the teachers in the intervention group were taught how to provide choice in walking activities, with pupils in the intervention group displaying less amotivation, less external regulation and more autonomous motivation. Finally, Tessier, Sarrazin, and Ntoumanis (2010) conducted an intervention study to train teachers to build in all three need supportive dimensions (i.e., autonomy support, structure, and interpersonal involvement) in their teaching style. The results showed a significant increase in the satisfaction of the students' need for relatedness, but no changes in autonomy and competence satisfaction. The students reported less controlled motivation and they were more strongly engaged during the physical education class.

In experimental studies, one or more need-supportive components were typically isolated and experimentally manipulated. In seven of the ten experimental studies the focus was on manipulating the provision of autonomy support (27, 30, 73). Autonomy support was manipulated in several ways, through more supportive and flexible teaching in which rewards were avoided (Mandigo *et al.* 2008), through increasing pupils' responsibility in decision making and problem solving (Moreno-Murcia, Lacarcel, and Alvarez 2010), through the provision of choice (Ward *et al.* 2008). In these three studies experimentally induced autonomy support led to positive outcomes such as increased perceived autonomy-support, perceived competence, self-determined motivation and enjoyment. In the other experimental studies (50, 68, 69, 72), the instructions of the teacher were manipulated. Incorporating intrinsic goal framing into the instructions led to positive effects on motivation, orientation towards the task, enjoyment, effort, performance and persistence (Simons, Dewitte, and Lens 2003; Vansteenkiste *et al.* 2004a & 2004b), and performance (Vansteenkiste *et al.* 2007). Two other experimental studies focused on competence support by manipulating positive feedback (29) and ability beliefs (28). Mouratidis *et al.* (2008) found that strong positive feedback had a positive effect on vitality, and positive affect and the study of Moreno-Murcia *et al.* (2010) demonstrated that the improvement of belief in students' own ability was associated with an increase in intrinsic motivation. One study (Radel *et al.* 2010) manipulated the perceived motivational orientation of the teacher by telling students the teachers were either volunteers or paid instructors. It showed that the students' perceptions of the teachers' motivation relates to students' own intrinsic motivation for learning.

In the experimental studies, the authors generally concluded that the more the environment is interesting and need-supportive for the students, the better the obtained learning outcomes are. In general, the results of the cross-sectional, the intervention studies, and the experimental studies confirmed the central ideas of SDT and the proposed relationships in the motivational sequence. However, in 41 studies (55.4%, see Table 5), the authors discussed that the study design used was not appropriate for making solid conclusions, such as causal inferences. In seven studies (among which three longitudinal, three experimental, and one intervention study), it was argued that the timing or duration of their study was not optimal. For example, in one study, where autonomy-supportive strategies were used in one physical education lesson, it was reported that the long-term impact of using specific strategies on students could not be concluded (Mandigo *et al.*, 2008). In another study, classroom behavior of the teacher was assessed during the school year, but the measurement of the teachers' expectations was assessed prior to the measurement of teaching behavior (Trouilloud *et al.*, 2006). So the authors mentioned it is possible that the measurement of the teachers' expectations has influenced the teachers' behaviors during the school year.

>>Table2<<

Outcome variables

Two groups of outcome variables are distinguished in Table 3, namely outcomes directly related to physical education and outcome variables related to leisure time. The majority of papers (i.e., 43 or 58.1%) included outcome measures within physical education, such as motor outcomes, affect (e.g., enjoyment and boredom), and behavioral outcomes (e.g., engagement, effort, and activity levels). Twenty-seven papers (36.5%) included outcome variables related to leisure time, such as physical activity levels, effort and engagement, and intentions for physical activity in leisure time. A limited number of studies (i.e., 9 or 12.2%; 10, 29, 33, 38, 46, 64, 67, 68 and 72) combined outcome measures of both physical education (e.g., positive affect) and leisure time (e.g., activity levels).

>>Table3<<

Physical education related contextual factors

Table 4 lists the contextual factors related to physical education that were studied including factors like characteristics of the physical education program, class and student characteristics, teacher

characteristics, and features of facilities and equipment. As can be noted, these factors were mentioned only in a limited number of the studies. To illustrate, 14 studies (18.9%) reported the purpose of the physical education program and 13 studies (17.6%) mentioned lesson content. With regard to class and student related factors, five studies (6.8%) mentioned type of education, ten studies (13.5%) reported the number of classes enrolled in the study, and seven (9.5%) reported the number of students per class. Additionally, 18 studies (24.3%) reported whether the classes were co-educational, single sex, or both. The studies mainly included students aged between 12 and 16, namely 55.7% of the studies included 12-13.9 year olds and 51.4% included 14-15.9 year olds (from which 22 studies (31.4%) included students in both age categories). Remarkably, 11 studies of the 70 studies (15.7%) that included student measures did not specify the age of the student population. Teachers' characteristics such as age, sex, teaching experience, and degree were not frequently included in the method sections (seven, twelve, nine, and five times, respectively). Moreover, features having to do with facilities and equipment were only mentioned once in the included studies. This descriptive information was only minimally mentioned in several studies and the effects of these factors on SDT-related motivational variables were hardly studied.

>>Table4<<

Mentioned limitations and suggestions for future research

Several authors mentioned limitations and/or suggestions for future research in their work. They are summarized in Table 5. Some limitations that relate to the study design and the duration of the studies have already been mentioned in previous parts of the results. Several authors mentioned methodological shortcomings. For example, in five studies (6.8%), the sample size was said to be fairly low. Specifically, Chatzisarantis and Hagger (2009) conducted an intervention study and the problem was raised that only ten teachers out of ten schools were randomly assigned to a control or treatment condition, resulting in only five teachers assigned to each condition. Also Radel *et al.* (2010) mentioned that there would be greater confidence in the effects of an experiment where the perceived teacher's motivation was manipulated if the study could be replicated with a larger sample size than 72 participants. Another frequently mentioned concern (in 29 studies or 39.2%) was measurement issues, especially with regard to the concepts of content, validity, and reliability of used measures. Eight

studies (10.8%) included the comment that all three dimensions of need satisfaction and/or need support should be included in future research, because in previously conducted studies typically one need was investigated or manipulated. The authors of 20 studies (27.0%, see Table 5) would like to see additional (contextual) variables included into the examined models. For instance, in a study of Koka and Hein (2006), it was mentioned that including other variables like perceived negative teacher feedback, self-esteem and physical self-worth in the model would provide more useful information. In most of the studies, where this kind of factors was included into the design, they were treated as control variables, whereas such factors might be related to students' need satisfaction or motivation, or might function as moderators in the identified relationships. Nine studies (12.2%) mentioned that more advanced data analyses, like multilevel analyses, are required in future research. This type of analyses is deemed critical because students are nested within classes, which are part of schools, such that a distinction needs to be made between the student, class, and schoollevel. In 24 studies (32.4%) the concern was raised that the obtained findings could not be generalized to other populations, such as other age categories or other educational tracks. Finally, the necessity to examine the proposed model in a real life setting was mentioned in eight studies (10.8%).

>>Table5<<

Discussion

The present paper provides an overview of a large and growing number of studies that have used SDT as a lens through which motivational dynamics within school physical education can be understood. The increasing number of studies applying SDT to investigate motivation in school physical education forms a significant development for both the fields of psychology and pedagogy. Sun and Chen (2010) highlighted the pedagogical meaning and value of different motivational orientations in relation to the basic psychological needs as conceived within SDT. The present review further builds on this work by offering a systematic review of studies applying SDT to physical education starting from antecedents of need support, through pupil perceived or teacher reported need support, need satisfaction, and motivation towards outcomes (see Figure 1). The studies are reviewed in light of what type of research is needed to enhance the value of future SDT-based research for the practice of physical education.

Research gaps and Suggestions for Future Research

According to SDT, teachers can foster more optimal forms of motivation when they manage to nurture students' basic psychological needs through the provision of autonomy support, by teaching in a well-structured fashion and by being involved. In the educational SDT literature the concept and correlates of (teacher) autonomy support has been studied extensively (Reeve 2009), but far less attention has been paid to the dimension of (teacher) structure or teacher involvement. This picture is slightly different in physical education research, with half of the experimental studies focusing on the provision of structure or competence support. In these experimental studies found an effect of the provision of structure on competence satisfaction (Mouratidis *et al.* 2008), (autonomous) motivation (Moreno-Murcia *et al.* 2010; Mouratidis *et al.* 2008; Simons, Dewitte, & Lens 2003), and several behavioral and intentional outcomes (Moreno-Murcia *et al.* 2010; Mouratidis *et al.* 2008; Simons, Dewitte, and Lens 2003; Vansteenkiste *et al.* 2007) has been reported. Experimental studies that manipulated autonomy support found that increased autonomy support led to positive outcomes such as more autonomous functioning (Ward *et al.* 2008), more enjoyment (Mandigo *et al.* 2008) and a better task orientation (Murcia, Lacarcel, and Alvarez 2010). Although Sun and Chen (2010) argued that the school environment is fairly controlling thus leaving few opportunities to provide autonomy support, several studies included in this review, among which two experimental studies (Murcia, Lacarcel, and Alvarez 2010; Ward *et al.* 2008) and two intervention studies (Chatzisarantis and Hagger 2009; Prusak *et al.* 2004) revealed that the creation of an autonomy supportive learning environment is possible, with resulting positive effects on learners' motivation for physical education. Indeed, the intervention studies illustrate that teachers are capable of teaching in a more autonomy supportive way by being flexible with their students (Mandigo *et al.* 2008), and by providing opportunities for self-initiative (Murcia, Lacarcel, and Alvarez 2010) or choice (Ward *et al.* 2008).

These experimental studies were characterized by the isolated manipulation of one need supportive practice. However, teacher need support involves a combination of different behaviors and practices. As noted in several of the included studies, it would be of great use to the practice of physical education to examine the effects of combined need supportive practices on student outcomes. For instance, in the intervention study of Tessier, Sarrazin, and Ntoumanis (2010) all three needs were addressed when training teachers to adopt a more need supportive approach. Further, in the discussion,

questions were raised about the nature of the interplay among the three dimensions of teachers' provided need support.

The cross-sectional and longitudinal studies included in this review confirmed the relationships of the motivational sequence among different samples of students in the context of physical education. However, far less evidence from intervention and experimental studies was available, making it difficult to infer causality between the variables in the motivational sequence. The authors of 40 studies also raised concerns about their cross-sectional study design themselves, because they found that because of the nature of the data it was not appropriate to make solid conclusions about causal effects. Only ten experimental studies and three intervention studies have sought to manipulate one or more need-supportive features in the learning milieu, but they were short in duration, ranging from just one physical education lesson to a maximum duration of five weeks. Even though structural equation modeling was often used as a statistical method to study a hypothesized sequence of variables in a cross-sectional study design, experimental and intervention studies would be more conclusive because they could reveal causal relationships. Moreover, longitudinal studies would reveal whether perceived need-support predicts changes in need satisfaction and motivation or whether changes in need satisfaction and motivation may also elicit changes in need support.

The results of the review also revealed that the target population of research was primarily students rather than teachers and that student related contextual factors were more frequently mentioned than teacher related contextual factors. To design effective interventions aimed at changing teachers' behaviors and in order for teachers to keep on relying on need-supportive teaching, it is important to gain insight into the origin of teacher behaviors. For instance, if administrative pressure predicts a more controlling approach of pupils, it is instructive for teachers to know this as to help them cope with such stressors in a more adaptive way. Unfortunately, research on antecedents of teacher behaviors is scarce. In other domains than the physical education context, this line of work started to emerge from the 1980s. Researchers started to explore the conditions under which teachers were more autonomy supportive versus controlling towards their students (Deci *et al.* 1982; Pelletier, Séguin-Lévesque, and Legault 2002; Soenens *et al.* 2012). This research regarding antecedents of teachers' need supportive behaviors in the specific context of physical education is largely focused on

autonomy supportive versus controlled teacher behaviors, while little research has been done on the provision of structure and involvement. Therefore, we suggest that scholars further study the possible antecedents of teacher behavior and relate these to all three dimensions of need supportive behavior.

With governments critically investigating the societal benefits of fiscal investments in education, physical education should be able to justify its place in the curriculum (Bailey *et al.* 2009). This concept of educational accountability (Hay 2006) implies that physical education should provide evidence of the realization of its learning goals as to justify its place in education and the cost to the public purse. As suggested by Sun and Chen (2010), there is an urgent need to demonstrate that there are connections between self-determined motivation and student learning in physical education, not only in relation to activity levels or dispositions to lead an active lifestyle (Hagger *et al.* 2005; Mouratidis *et al.* 2008; Ntoumanis 2005), but also in relation to many other learning goals in physical education. For example, other aspirations for physical education could be sports competition, art, personal development, and motor competencies as proposed by Kirk (2010). Only nine studies included a motor outcome in the measures, such as the number of successful shots in a basketball drill (Simons, Dewitte, and Lens 2003) or the performance time in a shuttle-run task (Mouratidis *et al.* 2008). However, these types of outcome measures, also called product assessments (Hay 2006), reflect a students' performance level, rather than students' learning such as improvement on a motor task. Therefore, to increase its relevance to the field of physical education, it is suggested that future studies reflect the degree to which substantive educational purposes of physical education have been realized.

The results of the review showed that contextual factors such as characteristics of the physical education curriculum (e.g., organization of the lesson content, attainment goals), class and student-related factors (e.g., co-education versus single sex), teacher characteristics (e.g., years of experience) and features of facilities and equipment (e.g., number of students per m²) were rarely described and if described, these were rarely taken into account in the analyses. The authors of 20 studies acknowledged not having considered additional (contextual) variables, such as the perceived environment of the students as mentioned in the study of Wang and Liu (2007). In the study of Shen, McCaughy, and Martin (2008) it was indicated that other social (e.g., physical activity of significant others), psychosocial (e.g., ability beliefs), and biological variables (e.g., weight) need to be

considered and incorporated in future research to explain more of the variance in physical activity. Sun and Chen (2010) suggested that in order to allow for teachers and curriculum developers to use SDT in the practice of physical education, it is required to have a full pedagogical understanding of the theory. Therefore, we would plead to treat physical education related contextual variables in a more meaningful way rather than marginalizing them and treating them as “error”. To illustrate, there is a whole body of literature on differences between co-educational and single-sex classes in physical education showing that girls in single-sex physical education classes have a more pronounced positive attitude towards physical education than those in co-educational classes (Derry and Phillips 2004; Macdonald 1990). The majority of studies included in the review omitted pedagogical issues (e.g., learning goals, teaching styles) or contextual factors (e.g., features of accommodation) typical to physical education that need to be considered when advocating recommendations for the practice of physical education. In future studies, we suggest that researchers describe these contextual factors and more thoroughly investigate their link with SDT-related variables. If researchers manage to give a full representation of the pedagogical context, the ecological validity of conclusions will increase.

Conclusion

To conclude, this review presented an overview of study findings applying SDT in a physical education context to identify gaps in the literature and critically discuss existing research. The studies included in the review confirmed the motivational sequence proposed by SDT, confirming the relevance of translating the theoretical tenets of SDT into the practice of physical education. Future research on self-determination in physical education could be of added value to the pedagogy and policy of physical education if a) more intervention and experimental studies are conducted including a broad spectrum of possible need supportive practices, b) more insight into antecedents of teachers’ behaviors is gained, c) possible influencing contextual factors are taken into account, d) the effects of a need supportive environment and optimal motivation for relevant learning outcomes in physical education are investigated, and e) relevant physical education contextual factors are taken into account. Given the increasing number of studies investigating SDT in the context of physical education, the present review aims at realizing a better integration of pedagogical and psychological knowledge in future SDT-grounded work in the context of physical education. The cross-fertilization

of findings from pedagogy and SDT research will likely contribute to the formulation of evidence-based, ecologically valid, and practical recommendations on how to enhance students' motivation in the context of physical education.

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158 Table 1. Studies sorted by the focus on specific relationships of the motivational sequence.

Relationship ^a	A	A & B	A, B & C	D	E	C & D	D & E	C, D, & E
Number of the study in the reference list	3, 51, 71	4 ^d , 25, 60, 61, 62	66	27	18, 19, 20, 49, 52, 59, 74	6, 14 ^b , 22 ^b , 24, 30, 37, 43 ^b , 44 ^b , 55, 60	5, 7, 28, 29, 45, 47 ^c , 64, 67, 72	2, 4, 5, 8, 9, 10, 11, 12, 13, 15 ^b , 16 ^b , 17 ^b , 21, 26 ^b , 31, 33 ^b , 34 ^b , 36, 38, 39 ^b , 42 ^b , 46 ^c , 48, 50 ^b , 54, 56, 57, 58, 63 ^c , 65, 68, 69 ^b , 73 ^b
% of the studies	4.1%	6.8%	1.4%	1.4%	9.5%	13.5%	12.2%	44.6%
number of studies	3/74	5/74	1/74	1/74	7/74	10/74	9/74	33/74

Notes.

^a Relationships as defined in Figure 1.

^b Studies 14, 15, 16, 17, 22, 26, 33, 34, 39, 42, 43, 44, 50, 69 & 73 did not measure student need satisfaction.

^c Studies 46, 47 & 63 did not measure motivation.

^d Study 4 did not measure teacher antecedents and need satisfaction.

159 Table 2. Studies sorted by research design.

Relationship ^a	Intervention studies	Experimental studies	Descriptive studies	
			Cross-sectional	Longitudinal
Number of the study in the reference list	4, 43, 65	27, 28, 30, 31, 44, 50, 68, 69, 70, 73	2, 3, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, 25, 26, 29, 32, 33, 34, 35, 36, 38, 41, 42, 45, 46, 47, 49, 51, 52, 53, 54, 55, 56, 57, 58, 60, 61, 62, 63, 67, 71, 72, 74	1, 7, 23, 37, 39, 40, 48, 59, 64, 66
% of the studies	4.1%	13.5%	68.9%	13.5%
number of studies	3/74	10/74	51/74	10/74

160 Table 3. Studies sorted by outcome variables.

	Physical education				Leisure time		
	Motor outcomes	Affective outcomes	Behavioural outcomes		Behavioural outcomes		
			Engagement & effort	Activity levels	Engagement & effort	Intentions	Activity levels
Number of the study in the reference list	1, 21, 28, 31, 46, 48, 50, 59, 68, 69, 70	8, 9, 10, 19, 23, 29, 31, 33, 34, 36, 38, 45, 56, 67, 69, 72, 74	1, 9, 11, 12, 13, 33, 34, 36, 49, 52, 57, 63, 64, 65, 67, 68, 69	2, 20, 39, 73	2, 46, 47, 68	2, 10, 18, 26, 31, 33, 41, 54, 64	4, 5, 7, 9, 15, 16, 17, 38, 41, 42, 47, 64, 67, 74
% of the studies	14.9%	23.0%	23.0%	5.4%	5.4%	12.2%	18.9%
number of studies	11/74	17/74	17/74	4/74	4/74	9/74	14/74

161 Table 4. Studies mentioning specific contextual factors of physical education in the method section.

Contextual factor	Number of the study	% studies	# studies
Characteristics PE program			
Purpose/content curriculum	3, 13, 22, 37, 43, 46, 47, 48, 49, 50, 59, 65, 68, 69	18.9%	14/74
Lesson content	1, 27, 31, 34, 40, 47, 48, 49, 50, 65, 68, 69, 73	17.6%	13/74
Compulsory ^a or optional ^b PE	1 ^a , 3 ^a , 6 ^a , 7 ^a , 11 ^a , 12 ^b , 18 ^a , 19 ^a , 22 ^a , 23 ^a , 31 ^a , 37 ^a , 40 ^a , 42 ^a , 49 ^{a,b} , 54 ^a , 65 ^a , 68 ^a , 69 ^a	25.7%	19/74
Class and student characteristics			
Type of education	35, 50, 51, 52, 71	6.8%	5/74
Number of enrolled classes	20, 21, 27, 37, 43, 55, 57, 63, 65, 73	13.5%	10/74
Number of students per class	38, 43, 46, 50, 68, 69, 73	9.5%	7/74
Co-education [*] , single sex ^{**} , both ^{***}	3 [*] , 4 [*] , 11 [*] , 12 [*] , 13 [*] , 15 [*] , 16 [*] , 17 [*] , 26 [*] , 37 [*] , 43 ^{**} , 49 ^{***} , 61 ^{***} , 62 ^{***} , 68 [*] , 69 [*] , 72 ^{**} , 73 ^{**}	24.3%	18/74
Age of the students ^(68 studies included students)			
<12 yrs	3, 6, 19, 23, 32, 43, 47, 56, 57, 60, 64	15.7%	11/70
12-13.9 yrs	3, 5, 7, 8, 9, 13, 14, 15, 19, 21, 23, 24, 26, 28, 31, 32, 35, 37, 39, 41, 42, 46, 47, 48, 49, 52, 53, 54, 55, 56, 57, 58, 60, 63, 64, 66, 67, 72, 74	55.7%	39/70
14-15.9 yrs	3, 4, 7, 11, 12, 13, 14, 15, 18, 19, 20, 22, 23, 24, 26, 28, 29, 31, 33, 34, 36,	51.4%	36/70

	37, 40, 41, 42, 47, 49, 52, 58, 60, 63, 64, 65, 68, 69, 74		
16+	3, 10, 11, 12, 14, 18, 22, 23, 24, 26, 30, 31, 38, 40, 41, 42, 44, 49, 50, 51, 65, 68, 69	31.4%	22/70
Not specified	1, 2, 4, 16, 17, 27, 35, 45, 59, 70, 73	15.7%	11/70
<hr/>			
(Preservice) teacher characteristics			
<hr/>			
Age	3, 4, 60, 61, 62, 65, 71	9.7%	7/74
Sex	4, 25, 40, 43, 48, 57, 60, 61, 62, 65, 66, 71	16.7%	12/74
Seniority/teaching experience	25, 40, 43, 47, 48, 61, 62, 66, 71	12.5%	9/74
Degree	40, 46, 47, 48, 71	6.9%	5/74
<hr/>			
Facilities and equipment	59	1.4%	1/74
<hr/>			

162 Table 5. Studies sorted by the kind of mentioned limitations and/or suggestions for future research.

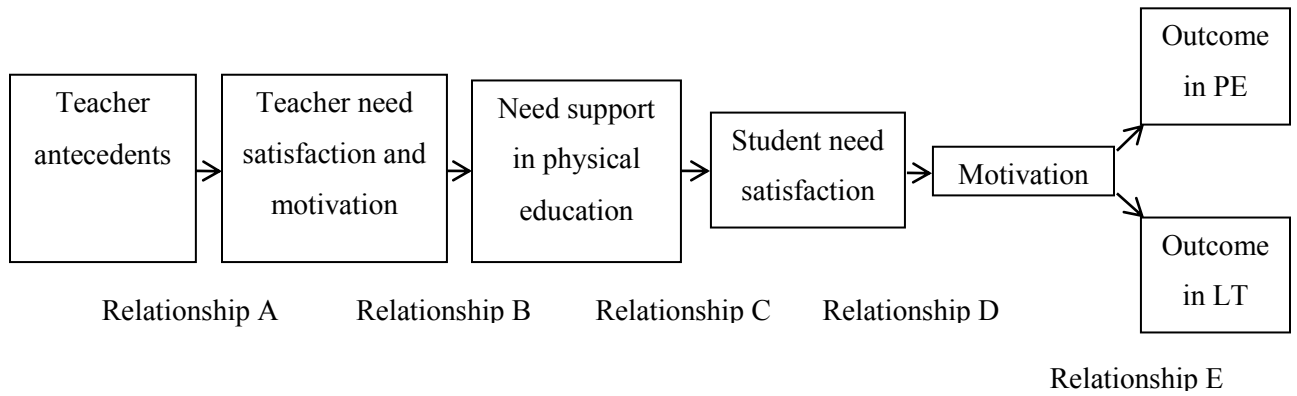
	Number of the study	% studies	# studies
Nature of the design	4, 7, 8, 9, 10, 11, 13, 14, 16, 17, 19, 20, 24, 26,	55.4%	41/74
<i>E.g., "Future research might adopt more complete designs that compare intervention against control groups." (study 4, in which no control group was included)</i>	29, 32, 31, 33, 34, 36, 37, 40, 44, 45, 48, 51, 52, 55, 57, 58, 59, 60, 61, 63, 65, 66, 69, 70, 71, 72,		74
Number of participants or participating schools	4, 35, 44, 61, 67	6.8%	5/74
<i>E.g., "There was a relatively low sample size (N=72)." (study 44); "Results are limited because of the use of one single middle-class school." (study 35)</i>			
Duration or timing of the study	1, 27, 28, 50, 64, 65, 66	9.5%	7/74
<i>E.g., "The length of the cycle (10 weeks) was relatively short." (study 1)</i>			
Measurement issues on content, validity, or reliability	1, 4, 6, 8, 9, 10, 14, 16, 17, 21, 22, 27, 32, 35,	39.2%	29/74
<i>Content: e.g., "The Intrinsic Motivation Inventory measures only one dimension of SDT: intrinsic motivation." (study 14)</i>	37, 38, 44, 46, 47, 51, 52, 54, 60, 61, 64, 65, 67,		72, 73
<i>Validity: e.g., "The validity of some measures was</i>			

<p><i>debatable because they were assessed with single items.”</i></p> <p><i>(study 32)</i></p> <p><i><u>Reliability</u>: e.g., “The measure of perceived positive feedback showed a low level of internal consistency.”</i></p> <p><i>(study 22)</i></p>			
<p>All three dimensions of basic psychological need satisfaction or support are not included</p> <p><i>E.g., “Research may aim at also considering the supporting the needs for competence and relatedness.” (study 57)</i></p>	<p>4, 13, 21, 26, 34, 47, 57, 63</p>	<p>10.8%</p>	<p>8/74</p>
<p>The inclusion of additional (contextual) factors in the model is lacking</p> <p><i>E.g., “There is a possibility that a relevant predictor was omitted from the analyses.” (study 66); “The study did not take into account the perceived environment or situational goal orientations.” (study 70)</i></p>	<p>1, 4, 6, 7, 21, 22, 23, 28, 32, 33, 34, 37, 40, 42, 47, 61, 64, 66, 71, 72</p>	<p>27.0%</p>	<p>20/74</p>
<p>Short falling of data analyses</p> <p><i>E.g., “Multilevel analyses could produce a more global explanation of the interaction between contextual and</i></p>	<p>28, 29, 32, 36, 38, 48, 54, 56, 58</p>	<p>12.2%</p>	<p>9/74</p>

personal variables.” (study 28)

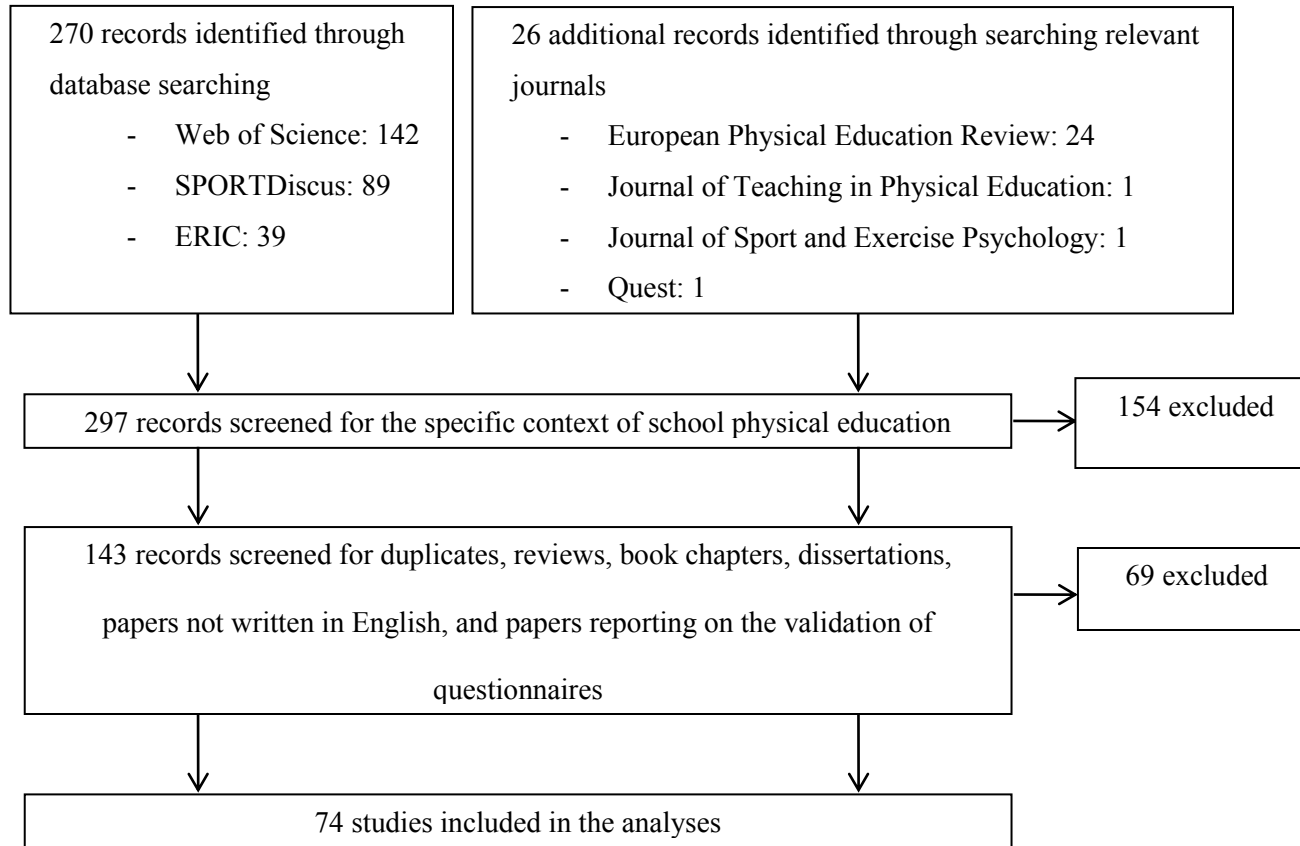
Generalizability of results (age group, educational track...)	3, 11, 12, 14, 16, 17, 19, 20, 24, 34, 37, 40, 42,	32.4%	24/74
<i>E.g., “The study was conducted on only one sample: school children aged 11 – 15 years.” (study 19)</i>	43, 48, 49, 50, 62, 63, 65, 66, 68, 70, 73		
Testing of the results in a real-life setting	6, 8, 9, 18, 26, 31, 67, 71	10.8%	8/74
<i>E.g., “The real world relevance of the profile differences in this study requires further examination.” (study 9)</i>			

164 Figure 1. Sequence of motivational variables in physical education.



165

166 Figure 2. Flowchart of literature search and selection.



Appendix A. Included studies.

These references represent the studies included in the review of literature and the numbers in superscript are used in the tables to refer to the studies. The publications are numbered in alphabetical order (first author) and by year of publication.

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