Health Promotion in Physical Education

Development and Evaluation of the Eight Week PE Programme “HealthyPEP”
for Sixth Grade Students in Germany

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Yolanda Demetriou

Preface

Parts of this research project have already been published previously in two journal articles. The first article was published in Psychology of Sport and Exercise (Demetriou & Höner, 2012) and presents the systematic review of this research project (see chapter 3). This systematic review has been adapted and expanded in this dissertation thesis in order to provide a full review of the internationally carried out physical activity interventions in the school setting while emphasizing particularly on the studies with high methodological quality.

Additionally, in this dissertation thesis, studies carried out in Germany that did not fulfill the exact inclusion criteria of the systematic review already published, were also described in detail. In a second publication in European Journal of Sport Science (Höner & Demetriou, 2012a), first results of HealthyPEP on the health and fitness level (motor performance, BMI, and health-related quality of life) were published. These results (in addition to other results of the study that were not previously published) are described and analysed in more detail in the following work.

The publishing houses of both journals (Elsevier, Taylor and Francis) give the right to the authors to publish the content of already published articles in dissertations and they also provide the right to expand the content of the article into a book publication.

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1 Introduction

One of the biggest health-political challenges of the 19th century was to add years to life. The mean living age of women at that time was 41 years and of men 39 years. In the year 2000, it increased to 81 and 75 years for women and men respectively. Since then the target of the World Health Organization (WHO) has been to increase people's quality of life and in this course, the slogan "add life to years" has been widely introduced (Kurth et al., 2002).

The success story of the health situation in the 19th century is characterised by successful prevention. Many infectious diseases that threatened people's lives were pushed back by advances in medicine and better hygienic circumstances. In 2010, infectious diseases were the cause of death of only 1.8% of the people in Germany (Statistisches Bundesamt, 2011). Nonetheless, the potential of prevention is not exhausted. Nowadays, chronic diseases such as cardiovascular diseases (CVD), obesity, diabetes type II, hypertension, colon and breast cancers, osteoporosis, depression, and backaches represent one of the most substantial problems in modern society. CVD are a leading cause of death and disability and they account for 41% of the deaths in Germany (Statistisches Bundesamt, 2011). In the United States, every 45 seconds someone will have a stroke and every 3.1 minutes one stroke victim will die. Every minute two people will suffer a coronary event and one will die (Matson-Koffman, Brownstein, Neiner, & Greaney, 2005). These chronic diseases are a constant burden and a major cost factor for the health system (Cecchini et al., 2010).

In contrast to previous centuries, where people were often helpless to fight against infectious diseases, nowadays many civilization illnesses can be prevented when leading a healthy lifestyle (Kurth et al., 2002). Unfortunately, modern society has evolved into environments that appear to support unhealthy patterns such as smoking, unhealthy eating, and insufficient physical activity during all stages of life. Even though it is widely known that a physically active lifestyle can contribute to the prevention of chronic diseases (Junge & Nagel, 1999; Schneider & Becker, 2005), a high percentage of people in the industrialised countries lead a sedentary lifestyle (Bize, Johnson, & Plotnikoff, 2007). The WHO Regional Office for Europe named the seven leading risk factors that account for almost 60% of all ill health in Europe: These were high blood pressure, tobacco, alcohol, high cholesterol, overweight, low fruit and vegetable intake, and physical inactivity (WHO, 2006a). These unhealthy behaviours have developed over the last decades and their massive negative effects on people's health are being revealed clearly (Cecchini et al., 2010; Matson-Koffman et al., 2005). As a result, people are suffering from the consequences of these behaviours and society pays with money and lost productivity (Fogel, 2009; Payne & Morrow, 2009).

Consequently, actions need to be taken against these negative developments. Therefore, it is first necessary to gain knowledge about the time in people's lives, in which these developments take place and the factors that contribute to their development. Although the

lifestyle people lead is not static but much more a constant process where people continuously adapt to internal changes and the environment, it is known that a specific health or risk behaviour (e.g., physical activity patterns, diet, and smoking) is difficult to be changed once established. In health terms, childhood and adolescence are particularly important times of life. During this age, lifestyles are formed and can only be changed with difficulty during later years. Certain behaviours are initiated during the adolescent years, while some patterns of behaviour, such as eating and physical activity, can become established in earlier childhood. Given this, research into young people's health and health behaviour – and the factors that influence them – is essential for the development of evidence-based policy and practice (Holland, 2000; Parry-Langdon & Roberts, 2004).

When focusing on young people's low physical activity levels, concerns arise about possible long-term negative health effects that might evolve from this behaviour and the necessity to create measures against these negative developments becomes evident (Parry-Langdon & Roberts, 2004). The current health status of young people shows that the engagement of a wide range of sectors and stronger health systems for better prevention and control is necessary in order to achieve a positive influence on their quality of life. Encouraging physical activity in young people should be a priority aim. Children and adolescents have a right to be brought up in an environment that is health-promotion and that enables them to make informed choices about their lifestyle (WHO, 2006a). In this course, circumstances need to be created that guarantee that the healthy choice will be the easiest one. The need to promote an active lifestyle at a young age is shown in the attempts of government agencies, communities, and scientists to implement suitable physical activity programmes (Cale & Harris, 2005c). For example, in February 2010, the first lady of the United States Michelle Obama launched the ambitious programme "Let's Move" with the aim to raise a healthier generation of kids. The programme aimed to engage every sector impacting the health of children and provide schools, families and communities with simple tools to help kids be more active, eat better, and get healthy (The White House, 2010). The efforts of the White House are a sign for the importance and necessity of the health promotion of young people. In this course, also the importance and the opportunities of the school setting to promote students' health becomes clear. Schools are an ideal place to reach almost all young people and carry out attempts to influence their health behaviour positively (Cale & Harris, 2005b). Therefore, the school resources need to be used and systematically analysed in order to gain knowledge on how to positively influence young people in this setting.

Health-promotion among young people is a field of great importance. In recent years, much research has been carried out to understand the negative effects of inactive lifestyles and to subsequently develop effective strategies to counteract these (Booth et al., 2001). Nevertheless, many questions remain unanswered and further research is needed concerning two aspects: 1) The evidence gained up to now from the interventional research needs to be systematically analysed in order to draw first conclusions on the effectiveness of physical

activity school-based interventions on a broad range of outcome variables of student populations and 2) Data are lacking on ways to tailor interventions to the needs and interests of young people in order to prevent the decline in physical activity and physical fitness that occurs during late childhood and adolescence (Bös et al., 2009). Therefore, investment in research is necessary to determine the effectiveness of different school-based approaches for the promotion of young people's physical activity. Trudeau and Shephard (2005) emphasise that it is essential to evaluate these strategies used in the school setting in order to make optimal use of the existing resources. Especially in Germany, few evaluated health-promotion physical activity interventions that examine the health effects of physical education (PE) exist. It is therefore important to design and evaluate intervention programmes on a high evidence level that examine whether PE can fulfil the aims that are anchored in the PE curriculum (e.g., the competence to be regularly physically active or the knowledge of the health effects of regular physical activity) (Hohmann, 2007; Hohmann, Lames, & Letzelter, 2007; Kurz, 2008a). Furthermore, Hohmann et al. (2007) emphasise that science must examine whether long-term targets of PE such as improvement of physical competence, health enhancing behaviour or a motivation to exercise beyond the PE lessons can be positively influenced by PE. These findings will enable health systems to review their impacts and develop suitable programmes to promote young people's health (Currie et al., 2008).

Objectives and structure of the research project

The purpose of this research project was to make a contribution towards filling the international and especially in Germany existing research gap concerning health promotion in PE. Therefore, before designing the intervention study, in a first step theoretical considerations were made concerning health parameters of young people from the perspective of sports science (*chapter 2*). The current state of young people's health and fitness status as well as their physical activity levels are presented and recent theoretical assumptions and empirical findings on the various effects of regular physical activity and physical fitness on young people's health are discussed. Additionally, based on already existing findings, sports scientific considerations in the field of health promotion through physical activity in a young age are made from the perspective of sport pedagogy, sport psychology, and training science. Each of these disciplines highlight a different facet of this topic and needs to be taken into account in order to gain a broad perspective concerning relevant aspects of school-based health promotion.

Interventions need to be designed based on the most recent theoretical and empirical findings. A systematic review that summarises the effects of research studies carried out in the school setting and thus provides information on the possibilities of health promotion through physical activity is still missing. The results of such a review are crucial for the further planning of intervention programmes in the school that aim to promote students' health through physical activity. Therefore, before designing the intervention study to promote

students' health in the school setting, it is important to systematically analyse the findings of already existing intervention studies in this field. Thus, a systematic review on the effects of physical activity intervention studies in the school setting on young people's health is conducted (*chapter 3*). This systematic research provides insights into which areas in this field have already been sufficiently examined and for which aspects further research is needed. Furthermore, it helps to establish but also to expand already known theoretical concepts. In a further step, in order to complete the picture of the results of current intervention programmes, a more detailed literature search was carried out to retrieve further studies carried out in German language countries, which were not detected with the strict inclusion criteria of the main systematic review.

In the third part of this research project, the intervention programme conducted is presented in detail (*chapter 4*). First, the development of the health-promotion PE programme (HealthyPEP) for sixth grade high school students in Germany is described. This includes the description of the theoretical considerations from the fields of sport pedagogy, sport psychology, and training science on which HealthyPEP is based and the description of each component of HealthyPEP. Second, it was aimed to carry out a comprehensive evaluation of HealthyPEP (Mittag, 2006). Therefore, the study methods including study sample, study design, assessed measures, and the analysis method used are presented in detail. Several process measures to examine the degree of the treatment integrity were used and a number of outcome measures on three target levels (psychological determinants of physical activity, physical activity behaviour itself, and variables on the overriding health and fitness level) were applied to analyse the intervention effects. Furthermore, additional analyses were carried out to examine the revealed significant intervention effects in more detail. Finally, the study results are described and interpreted while taking into account several methodological problems that occurred during the process of the study.

Finally, the work carried out during this research project is summarised and perspectives for future research and practical consequences for PE are discussed (*chapter 5*) The additional material such as supplemental tables and references from the systematic review, the materials given to the teachers and the students in the course of HealthyPEP, the questionnaires used to assess students' data, and finally some tables of the detailed results of HealthyPEP are provided in the appendix (see the second volume) .

2 Theoretical Considerations: Health Parameters of Young People From the Perspective of Sports Science

The aim of the following chapter is to systematically present the recent findings on young people's health and fitness status as well as their levels of physical activity behaviour. Further on, it is aimed to review the connection between these factors. In the second part of this chapter, scientific considerations are made from the perspective of the three sport science disciplines; sport psychology, sport pedagogy, and training science concerning health promotion through PE in the school setting. These scientific considerations build the theoretical basis for the interventional research described in the following chapters.

2.1 Health status, fitness levels and health behaviour among young people

Before describing the health status of young people and analysing factors that contribute to it, it is essential to refer to and discuss the definition of health. The most commonly used definition is the ambitious statement of the World Health Organisation (WHO) given in 1948 (Üstün & Jakob, 2005). Health was determined as "a state of complete physical, mental and social well-being not merely the absence of disease" (WHO, 2006b). This definition shows that already at this point the WHO emphasised the need to consider a persons' well-being and not only the change in the frequency and severity of disease. Although this definition is quoted most commonly, it has also been subject to a lot of criticism. Üstün and Jakob (2005) state that usually critics argue that the WHO definition is utopian, inflexible, and unrealistic. Additionally, they emphasise that especially by including the word "complete" into the definition, it makes it highly unlikely that anyone would be healthy for a reasonable period of time. In line with this criticism, Brodtmann (2008) argues that according to the Ottawa-Charta (Trojan & Stumm, 1992), health is a constant process and not something stable. The aim is therefore to enable people to possess a high degree of self-determination concerning their health and in this way to empower them to actively contribute to their health enhancement. Saracci (1997) describes health as "a condition of well being free of disease or infirmity and a basic and universal human right" and emphasises that this description does not contradict the definition of the WHO. It rather provides an intermediate concept linking the WHO's ideal to a more down to earth state of health and disease that can actually be measured. Jadad and O'Grady (2008) go even further and question the extent to which any definition of health can be successful or even useful. The question rises whether it might be more reasonable to limit the concept of health on the existing possibilities with which it can be measured.

Another important and often discussed theory (e.g., Lindström & Eriksson, 2005) which needs to be mentioned in this course, is the salutogenic theory of sense of coherence coined by Antonovsky (1979). In his theory the idea was originated that it might be more important to focus on people's resources and capacity to improve their health rather than concentrate on

risks, ill health, and disease in order to describe the absence of health. According to this theory, health was placed on a continuum between ill health and total health. Salutogenesis characterises the origin of health which is according to Antonovsky (1987) based on a persons' understanding of the situation, seeing the meaning in it, and having the necessary resources to act in a specific direction in order to promote his health. Thus, the three key concepts of the theory are comprehensibility, meaningfulness, and manageability.

It can be concluded that health is a very broad term that can be defined or described from different points of view. Usually health is determined by different components such as physical performance and functioning, body composition, and psychological health. In this way doctors, psychologists, and pedagogues consider health from different perspectives and evaluate it using different measures (McDowell, 2006). It is not the aim of this work to develop a new and improved definition of health. Much more, in the following research project, health is considered as a broad term that can be characterised by several variables. It would expand the scope of this section to systematically describe the status of all variables associated with young people's health. Nevertheless, it is important to give a picture of the most relevant health indicators. Therefore, in the following section three markers of health are discussed in more detail. These are the objective markers of health in terms of physical fitness and BMI as well as the subjective health in terms of HRQOL of children and adolescents. Based on these variables, it can be measured whether improvements on health took place due to an intervention treatment.

2.1.1 Health and fitness status

When comparing the health status of different age groups, it becomes clear that children and adolescents reach the highest values on health. Nevertheless, in this young age group there are indications of decreasing health in modern society. Even though children and adolescents are the healthiest population, in every fourth family a child is suffering from chronic or psychosomatic disease (Bergmann, Bergmann, & Kamtsiuris, 1998). Poor health in this age group may have particular significance as it can affect the fulfilment of the developmental tasks of adolescence, and there may also be long-term negative effects (Currie et al., 2008). As in adults, the most frequent diseases in this age group are chronic ones such as allergies, obesity, asthma, neurodermatitis and headaches. The causes for these diseases are suspected to lie in the lifestyle and environment of the industrialized countries. Similar findings apply to young people's physical activity and fitness levels, which seem to be decreasing when compared with previous generations (Bös, 2003). These developments need to be carefully observed and measures against them need to be taken.

For the description of the state of health and the fitness status of the young population as well as their health behaviour two large scaled surveys are presented in the following. These are the international Health Behavior in School-aged Children (HBSC) study (Currie et al., 2008)

and the German National Health Interview and Examination Survey among children and adolescents (KiGGS) (Robert Koch-Institut, 2008). The HBSC study aims to measure and track the relevant aspects of young people's health and health-related behaviours. This is achieved by collecting data of 11-, 13-, and 15-year-olds every four years in 41 countries across Europe and North America. The fourth HBSC report was conducted in 2005/2006 on 204,000 young people and provides the latest evidence on the health and the health-related behaviour of young people in industrialized nations (Currie et al., 2008). The KiGGS survey is a nation-wide, representative survey that states the status quo of the health and health behaviour of 17,641 German children and adolescents in the timeframe of 2003 and 2006. Beyond these two surveys, in order to complement the picture of young people's health status and health behaviour, findings from recent systematic reviews and meta-analyses are presented.

Physical fitness has been defined in many ways (Cale & Harris, 2005a) but it is typically viewed as a multi-factorial trait concerning the ability for movement and to be physically active (Pate, 1988; Woll, Kurth, Opper, Worth, & Bös, 2011). Definitions of physical fitness across various research fields such as psychology, sociology, and sports science have shown its strong association to health, performance, or skill (Caspersen, Powell, & Christenson, 1985). Depending on the authors and their health definition, physical fitness is considered to be at least a powerful marker of health a part of health itself (Grupe & Krüger, 1997; Woll et al., 2011). A healthy body and physical fitness are considered as important health resources and they are often used to define or evaluate a child's general health and motor development (Hurrelmann, 2008; Tittlbach et al., 2011). According to Ortega, Ruiz, Castillo, and Sjöström (2008), high physical fitness is associated with positive health among both healthy and diseased young people (see Figure 1). According to the authors, physical fitness is influenced among other factors by physical activity and is in turn a powerful marker of health that has a direct influence on several diseases as for example overweight, CVD or cancer and on skeletal and mental health. Oerter and Montada (2002) also emphasise the importance of physical fitness for a healthy development of children and adolescents. In general, it is unquestioned that when examining health issues in young people, physical fitness is an important aspect and should not be neglected (Lohaus, Jerusalem, & Klein-Heßling, 2006).

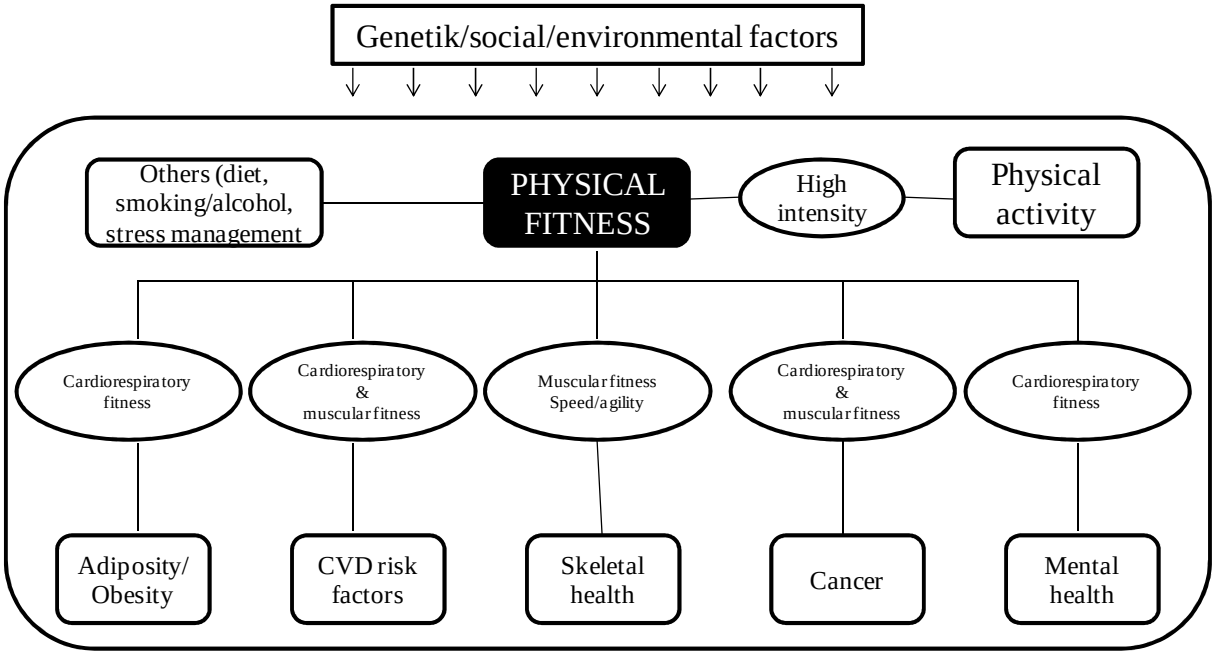

Figure 1 Physical Fitness as a Powerful Marker of Health (Modified After Ortega et al., 2008, p. 8).

Several methods can be used for the measurement of physical fitness. These can be methods used in the laboratory such as maximal oxygen uptake (VO_2 max), isometric dynamometer, number of repetitions with maximal force to reach fatigue or methods used in field investigations such as a battery of simple tests to measure the different aspects of fitness (Cale & Harris, 2005a). Ruiz et al. (2011) present a list of the most popular physical fitness test batteries internationally used and Bös (2003) systematically presents the test batteries usually used in Germany. In school-based interventions, most commonly motor performance tests are used as for example the AAHPERD's Physical Best, the FITNESSGRAM, the Münchner Fitnesstest, the body coordination test (KTK), the Eurofit-Test, and the DMT 6-18. Although these test batteries are more alike to each other than they are different, up until now an internationally recognised and implemented test does not exist. Thus, it is difficult to compare the fitness levels of young people. In Germany, several attempts have been made to establish a standard test to measure motor performance. The Eurofit-Test failed to accomplish this need. A further attempt was made with the German motor performance test, DMT 6-18 (Bös, 2009; Tittlbach et al., 2011), which was developed within the scope of the German Society of Sport Science.

A large number of studies examining young people's physical fitness exist, the first being dated in the early 1950s. The most recent systematic review on the development of children's and adolescents' physical fitness levels in Germany is presented by Bös (2003). He systematically summarises the results of studies analysing the development of young people's physical fitness levels over the last two decades. The recent debate in Germany concerning the status of young people's physical activity levels has resulted into a number of surveys assessing physical fitness data in this young age group. These are for example the WIAD

survey (Klaes, Cosler, Zens, & Rommel, 2003) which assessed physical fitness data of 19,000 German students and the "Motorik Modul" of the KiGGS survey that examined the fitness levels of 4,529 children and adolescents between the ages of 4 to 17 years in Germany. Based on regression analyses on data from 54 studies, Bös (2003) concludes that in recent years a decrease in young people's physical fitness levels of about 10% can be observed even though some of the analysed studies could not confirm this trend.

BMI is the second important marker of health considered in this research project. It is defined as the individual's body mass (kg) divided by the square of his height (in meters). Although less sensitive than skinfold thicknesses (Cole, 2000), it is the measure most commonly used to define weight levels (Demetriou & Höner, 2012). According to the WHO (2000), adults with a *BMI* of below 18.5, between 18.5 and 24.9, between 25.0 and 29.9, and above 30 are classified as being underweight, normal weight, overweight, and obese respectively. In children and adolescents, BMI is substantially related to age and these cut offs cannot be globally set but need to be related to young people's age. In the United States, the cut offs of the 85^{th} and 95^{th} percentiles of BMI are recommended as indicators of overweight and obesity respectively (Cole, 2000). High BMI levels are associated with shorter lives and overweight people are more likely to suffer a number of illnesses, particularly diabetes and ischemic heart disease. Additionally, BMI is directly associated with social and psychological problems and with general HRQOL. Also in children and adolescents obesity and overweight may interfere with normal psychosocial, emotional and physical development (WHO, 2006a) and it needs to be taken into account that overweight children tend to become overweight adults and have a higher risk of premature mortality. This point is of special importance because it shows that actions against overweight need to be taken already at a young age.

The WHO recognizes that childhood overweight and obesity have reached epidemic proportions. In industrialized countries, but also in most parts of the world, the prevalence of overweight is rising dramatically. Ten per cent of the world's school-aged children are estimated to be overweight (Lobstein, Baur, & Uauy, 2004). The data presented on overweight and obesity in the HBSC study show that the proportions of 13 and 15-year-old boys and girls who are overweight range from 4% to 35% across countries and regions. Among these countries, Canada, Greenland, Malta and the United States reach the highest rates. Concerning age, there are no significant differences in overweight or obesity among either boys or girls, but there is a tendency for 11-year-old girls to have higher levels of overweight or obesity than those aged 15. Gender differences were found to reveal that boys were significantly more likely to be overweight or obese than girls in around half of the countries at age 11, and in the majority of countries at ages 13 and 15. Lower family affluence is significantly associated with higher levels of overweight or obesity in around half of the examined countries. Overall, 14% of the 11-year-olds and 13% of the 13 and 15-year-olds are overweight or obese. These data are alarming but still they must be considered with caution since they are derived from self-reported height and weight information used to calculate

body mass index and not from actual measurements (Currie et al., 2008). Specifically for the German population, the KiGGS survey revealed that 15% of the examined children were overweight and 6.3% of those were obese (Kurth & Schaffrath Rosario, 2007).

In recent years, several similar constructs that aimed to measure people's subjective health as emphasised in the WHO definition stated in 1948 evolved and gained a lot of attention (Höner & Demetriou, 2012b; Radoschewski, 2000). These are the *health-related quality of life* (HRQOL), the life satisfaction, and the self-rated health. Kaplan and Bush (1982) introduced the term HRQOL and emphasised that two types of global quality of life could be identified: HRQOL and quality of life that is not restricted to health. HRQOL is limited to those aspects that can clearly be shown to affect mental or physical health and it is generally understood as a multidimensional concept that consists of various components such as functional status and well-being from the subjective perspective of the individual (Cruz, Camey, Fleck, & Polanczyk, 2009; Ravens-Sieberer, Erhart, Wille, & Bullinger, 2008).

HRQOL is found to be a more appropriate measure of adolescent health than traditional morbidity and mortality measures and it is therefore highly relevant in adolescence. In the course of the HBSC survey, adolescents' subjective view of the quality of their lives was assessed as "self-rated health" which was defined as a subjective indicator of general health (Currie et al., 2008). Self-rated health has been associated with symptoms of anxiety, depression, and BMI (Kruger, Bowles, Jones, Ainsworth, & Kohl, 2007) but also with other factors such as academic achievement, bullying, and family communication (Schnohr & Volmer-Larsen Niclasen, 2006; Vaez & Laflamme, 2008). Childrens' self-rated health declines with increasing age. Both physical and emotional symptoms are reported more often in the older age groups. In half of the countries, the examined 15-year-old boys rate their health significantly lower than 11-year-old boys. This is the case also for girls in most countries. There are significant gender Differences in children's self-rated health with fair or poor health being more commonly reported by girls than boys at all ages. These gender differences are significant for 11-year-olds in a minority of countries, but in the majority of countries for 13-year-olds and in almost all countries for 15-year-olds. Low family affluence is significantly associated with higher levels of fair or poor health in the majority of countries for girls and around three quarters of the examined countries for boys. Overall, 12%, 15% and 18% of the 11, 13 and 15 year-olds respectively rate their health as fair or poor (Currie et al., 2008).

The results from the HBSC survey concerning young people in Germany showed that 11% of the 11-year-old girls and boys, 17% and 12% of the 13 year-old girls and boys respectively, and finally 20% and 12% of the 15 year-old girls and boys respectively rate their health as fair or poor. The HBSC data revealed large cross-national differences among all three age groups of young people reaching from 4% to 37% of the young people rating their health as fair or poor (Currie et al., 2008). Ravens-Sieberer, Erhart, et al. (2008) report the results from the

German KiGGS survey on young people's HRQOL. The data from this survey confirmed the decrease of HRQOL with age also among the German population. The total HRQOL score measured by the KINDL-R questionnaire decreased from 79.4 to 75.8 and finally to 74.8 points in the 7-10, 11-13, and 14-17-year-olds respectively. This decrease of HRQOL is more distinct in girls than in boys. The data also reveal that children with a higher socio-economic status had higher overall HRQOL scores compared to children with a middle or low socio-economic status.

2.1.2 Health behaviour: physical activity levels

Living circumstances are changing and the question that simultaneously arises is whether the physical activity levels of children and adolescents are changing too. Younger children are more likely to report a wide variety of positive health behaviours but engagement in these health behaviours declines as children enter adolescence (Currie et al., 2008). The mass media declare with imposing catch lines that children's physical activity levels are sinking (Stern, 2004). A large number of scientific studies support these statements but the results are inconclusive (Bös et al., 2009).

In order to achieve progress in this research field it is essential to first precisely define the concepts of physical activity and exercise. Second, it is important to refer to the methods with which young people's physical activity levels are being assessed and the problems that researchers face while doing this. Third, the recent recommended levels of physical activity young people need to achieve in order to experience positive health effects have to be stated and finally, the prevalence of young people's physical activity status must be described.

Defining physical activity

"Physical activity is a bodily movement that is produced by the contraction of skeletal muscles and that substantially increases energy expenditure above the basal level" (Caspersen et al., 1985, p. 126). The first International Consensus Statement on physical activity, fitness and health suggested that physical activity was an umbrella term that had multiple dimensions. Forms of physical activity such as exercise, sports, and dance are considered sub-categories of physical activity. "Exercise refers to a planned, structured, and repetitive bodily movement done specifically to improve or maintain one or more components of physical fitness" (Caspersen et al., 1985, p. 128). The distinction that has been made between physical activity and exercise notes that exercise is a specific form of physical activity dedicated to improve physical fitness. Physical training is another term that is used as a synonym for exercise (Corbin, Pangarazi, & Franks, 2000). In the following, the term physical activity is used and includes as stated above several forms of activity such as exercise and sports carried out by young people in several domains such as in the sports club or during their free time outside of a sports club.

Assessment of physical activity

The accurate and reliable assessment of physical activity is necessary for any research study where physical activity is an outcome measure. When measuring physical activity, its duration, frequency, type, and intensity which derives from different domains need to be considered (Woll et al., 2007). This makes the assessment of physical activity, especially over long periods, very difficult. Up to now several methods exist to assess physical activity such as accelerometers[1] (e.g., Kriemler et al., 2010; Marcus et al., 2009), pedometers (e.g., Duncan & Staples, 2010; Horne, Hardman, Lowe, & Rowlands, 2009), observations (Schutz, Smoll, Carre, & Mosher, 1985) or standardised questionnaires (P. L. Bush, Laberge, & Laforest, 2010; Clocksin, Wattson, Williams, & Randsell, 2009). Nevertheless, a golden standard for the measurement of young people's physical activity levels does not exist. On the contrary, each method is associated with measurement bias or other restrictions such as high costs or a high amount of time needed to carry out the measurements. Additionally, the validity of physical activity assessment methods seems to decrease with rising usability levels (Muller, Winter, & Rosenbaum, 2010) (see Figure 2).

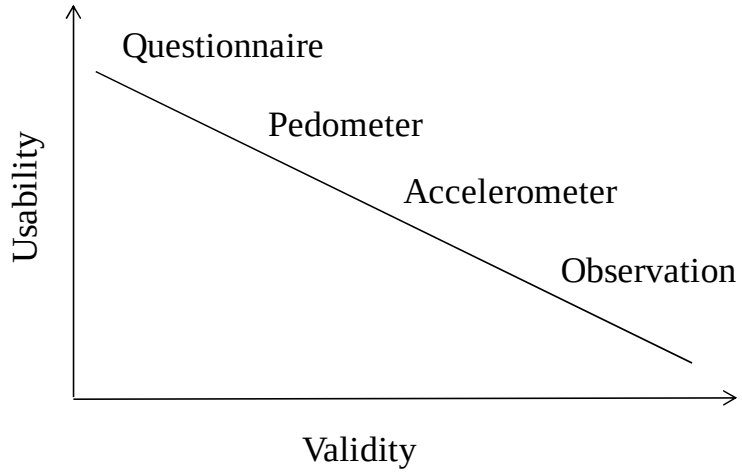

Figure 2 Validity Versus Usability of Physical Activity Assessment Methods (Adapted by Muller et al., 2010).

Several studies emphasise that accelerometers and pedometers easily break or are not being used by the young people as instructed (Hollar, Messiah, et al., 2010). Pedometers are also problematic when aimed at assessing physical activity that is being carried out apart from walking and running. In exercises such as cycling, swimming or strength exercising, the pedometers are not in a position to measure physical activity. Additionally, both devices are costly and therefore difficult to be used in large studies. Direct observation of people's physical activity levels are a valid method but they are associated with a great effort on behalf

[1] Accelerometers are small portable devices that operate by measuring change in velocity over time (acceleration) ($m \cdot s^{-2}$) and, thus, enable the intensity of physical activity to be quantified (Robertson, Stewart-Brown, Wilcock, Oldfield, & Thorogood, 2011).

of the observer and with limitations concerning the extent to which the observer can accompany the observed person (Muller et al., 2010). These restrictions of the more objective measurement methods result in the fact that in large epidemiological studies, but also in interventional studies, self-report via questionnaires is often the chosen tool as it enables the assessment of physical activity on a large scale with relatively little expense (Baumgartner, Jackson, Mahar, & Rowe, 2003; Demetriou & Höner, 2012). For example in the HBSC study, young people were asked to report the number of days over the past week that they were physically active for a total of at least 60 minutes per day. The question was preceded by an explanatory text that defined moderate to vigorous physical activity (MVPA) as "any activity that increases your heart rate and makes you get out of breath some of the time" and gave some examples of such activities (Parry-Langdon & Roberts, 2004). Other questionnaires used in experimental studies, as for example the Flemish Physical Activity Questionnaire (FPAQ) (Haerens et al., 2006), ask for minutes of different types of activity (sports, transport) and within different contexts (leisure time, school). Five indices can be computed: a total physical activity index and its components – namely, active transportation to/from school, school-related sporting activities, leisure-time active transportation, and leisure-time sporting activities.

Nevertheless, self report methods of measuring physical activity tend to recall bias and social desirability, which lower their reliability and validity (Hagger, Cale, Almond, & Kruger, 1997; Muller et al., 2010). Studies have suggested that the physical activity levels of children and adolescents based on subjective reports may be overestimated (Ching & Dietz, 1995; Crocker, Bailey, Faulkner, Kowalski, & McGrath, 1997). In a study comparing the data from the MoMo questionnaire (Bös et al., 2009) with the more objective data gained from an accelerometer, it became clear that the physical activity levels given in the questionnaire were significantly higher. This phenomenon was observed also with other questionnaires such as the SHAPES questionnaire (Wong, Leatherdale, & Manske, 2006). It was also highlighted in the systematic review by Adamo, Prince, Tricco, Connor-Gorber, and Tremblay (2009) and once again confirmed in a recent study by LeBlanc and Janssen (2010). Of the 83 studies reviewed in the systematic review, 72% reported that children and youth significantly over-reported their self-reported MVPA compared to the objective measure of MVPA assessed by an accelerometer. Self-reported measures of MVPA overestimated the measures of accelerometers by an average of 147%. In the study by LeBlanc and Janssen (2010), self-reported MVPA was even over-estimated by an average of 183%. Beets, Beighle, Erwin, and Huberty (2009) examined the convergent validity of pedometer and accelerometer estimates of MVPA in youth and found comparable estimates of MVPA via pedometer compared to MVPA from accelerometers in 10- to 14-year-olds. Concerning the group of the younger children (5-8 years), the pedometer estimates significantly differed from the accelerometer values. This was valid for the more active as well as the obese children.

J. F. Sallis and Saelens (2000) state that the over-reporting of the physical activity levels is the biggest handicap when assessing physical activity by questionnaire in young people. Bös et al. (2009) and Kahlert and Brand (2011) conclude that children especially overestimate their physical activity time when they are asked to document the exact minutes in which they are physically active. Kahlert and Brand (2011) recommend assessing students' physical activity levels using a broad range of items that ask questions about general levels of physical activity instead of using many differentiated questions that span distinct domains of physical activity. Furthermore, one should consider the differences in the ability of children and youth to think abstractly and remember their physical activity behaviour in detail. J. F. Sallis and Saelens (2000) emphasise that children often give the time they participate in a course and not the time they only spent being physically active. For example football training might last for two hours but the time that children are active is restricted to one hour. In addition, children and youth may have an activity pattern that is much more variable and intermittent than that of adults (Baquet, Stratton, Van Praagh, & Berthoin, 2007). Altogether, these factors suggest that physical activity reports made by children are more likely to suffer from recall bias and are less likely to be accurate (Chinapaw, Mokkink, van Poppel, van Mechelen, & Terwee, 2010).

These results show that the assessment of MVPA in youth is still problematic and as Jorgensen et al. (2009) emphasise, no golden standard exists up to now on how to precisely measure physical activity. It is often recommended to use a mixture of methods when assessing young people's physical activity levels in order to gain valid and reliable data. Nevertheless, the high cost and effort associated with such a dada assessment lead to the fact that, as stated before, in large studies the most commonly used method is the subjective data assessment by questionnaire.

Recent physical activity recommendations

A number of positive health effects are assumed to be gained from regular physical activity. In order to achieve these benefits, a minimum amount of physical activity is required that differs according to the person's age (Janssen & LeBlanc, 2010; Strong et al., 2005; Welk, Corbin, & Dale, 2000; WHO, 2010; Yetter, 2009). Additionally, the nature of physical activity needs of children differs from that of adults (Cale & Harris, 2005c). Empirical data have shown that young children's activity is highly transitory and that they spend most of their time in low intensity activities interspersed with short bursts of high intensity activity. It is typical for children that these bouts of activity will include both physical activity and time for rest and recovery.

Until recently, the WHO (2010) suggested a daily accumulation of at least 60 minutes of MVPA for children and youth. Andersen et al. (2006) even suggested that physical activity levels should be higher than the current international guidelines. Recent systematic reviews

support this opinion and recommend higher levels of children's participation in physical activity for health. Consequently the WHO still recommends 60 minutes of MVPA, but also emphasises that these minutes should be additional to everyday physical activities. As everyday physical activities total around 30 minutes of MVPA in the quintile of the least active children, the current recommendations for young people's physical activity levels constitute more activity in total compared with earlier recommendations (Andersen, Riddoch, Kriemler, & Hills, 2011). These minutes of physical activity should be accumulated during the entire day and should mostly be of intermittent intensity. Activities specifically aimed at improving muscular strength, flexibility and bone health should be undertaken two or more days each week. Two hours or more of inactivity are discouraged for children, especially during the daytime hours (Baumgartner et al., 2003; Biddle, Sallis, & Cavill, 1998).

When considering the described nature of young people's physical activity and the current recommendations on the amount they should be active, it becomes clear that children should be active when ever opportunities to be active are available. Optimally, such opportunities would occur before school, after school, during school hours, and on weekends. Since children spend a great amount of their time in school, the school setting is responsible to provide sufficient opportunities for young people to be physically active. According to the WHO (2006a) school curricula should include the opportunity for all children to participate in 30 minutes to one hour of physical activity per day. This means that even beyond PE lessons students need to be physically active during recess and during other academic lessons taught in school.

Prevalence of young people's physical activity levels

According to the HBSC survey, less than half of the young people surveyed satisfied these recommendations. Specifically, children living in Canada, England, Ireland, Lithuania, and the United States report relatively high levels of physical activity, whereas children in Belgium, Estonia, France, Italy, Norway, and Portugal report relatively low levels of physical activity. There is a tendency for higher daily MVPA among younger children. In the majority of countries, there are significantly higher levels among 11-year-olds than 15-year-olds for both boys and girls. Overall, 26%, 20%, and 16% of the 11-, 13-, and 15-year-olds respectively report at least one hour of MVPA daily. Boys report higher daily MVPA than girls at all ages and in all countries and these gender differences are significant in the majority of countries at all ages. A significant association between low family affluence and lower prevalence of daily MVPA is found in under half of the countries across all geographic regions for girls and boys (Currie et al., 2008). Across countries and age groups, boys (40%) appear more active than girls (27%), and physical activity levels decrease with age. On average, 26% of the 11-year-olds report meeting the guidelines compared to only 16% of the 15-year-olds (Currie et al., 2004).

Specifically in Germany, sports are one of the most important free time activities especially among boys. For girls the importance is not as high and comes in a fourth position after meeting with friends, socializing, and listening to music (Gogoll, Kurz, & Menze-Sonneck, 2003). According to the HBSC data, 20% of girls and 25% of boys in the 11-year-olds, 13% of girls and 19% of boys in the 13-year-olds, and 10% of girls and 16% of boys of the 15-year-olds report at least one hour of MVPA daily. Bös et al. (2009) present the results from the KiGGS study on the physical activity levels of German young people. Here, only 15.3% of the children and adolescents between the age of 4 and 17 years reach the current recommendations of a minimum of 60 minutes of daily physical activity. When looking at the results separately for gender it becomes clear that boys are more active (17.4%) than girls (13.1%). Additionally, the results confirm previous findings that physical activity decreases with age. After primary school only 10% of the young people fulfill the current physical activity recommendations.

2.1.3 The effects of physical activity and physical fitness on health

Grupe and Krüger (1997) summarise several models that try to determine the way physical activity has a positive impact on health. For example the risk-factor model expresses that several risk factors such as high blood pressure, overweight, lack of physical activity, and alcohol consumption can have a negative influence on health. Regular physical activity on the other side can reduce these negative effects to a certain degree. A second model is the health resource model, which indicates that specific factors contribute to the enhancement of health. These factors are physical fitness but also specific cognitive, emotional, and social factors. As a consequence, in the following section it is first important to discuss the relationship between physical activity and fitness and to rise the question whether both factors can predict health to the same degree. Second, the empirical findings on the effects of physical activity and physical fitness on health are reviewed.

Association between physical activity and physical fitness in respect to health

Blair, Cheng, and Holder (2001) examined whether physical activity or physical fitness is more important in predicting health benefits. They carried out their analysis by examining the results of nine studies that simultaneously examined the physical activity and fitness levels of adult men and women. The data suggest that fitness is more important to predict health issues than physical activity levels. The authors though presume that this result is not valid. They state that physical activity is the principal determinant of cardiorespiratory fitness even though it is also determined by genetic factors. The authors believe that the results are due to the fact that physical fitness is measured objectively and physical activity is a subjective self-report that often leads to misclassification. Unfortunately, on the basis of the reviewed studies, it was not possible to answer this question about the relative predictive strength of physical activity and physical fitness. Nevertheless, many experts assume that an increasingly

sedentary lifestyle is a major reason for the higher prevalence of diseases in young people today (Cavill, Biddle, & Sallis, 2001).

Additionally, there seems to be a high correlation between physical activity levels and fitness levels in youth. Tittlbach et al. (2011) examined the association between physical activity and health resources in terms of physical fitness. The analysis revealed that adolescents with higher levels of physical activity had better health resources than adolescents who were inactive or only somewhat active. The effect sizes were strong for the association between physical activity and self-perceived physical performance and medium for the association between physical activity, endurance, and strength. Post-hoc tests revealed that a slightly higher activity level (e.g., somewhat active to medium active) was associated with significantly better values in endurance, strength, coordination, and self-perceived physical performance. However, the results indicated that only considerably higher activity levels (e.g., somewhat active to highly active) revealed significantly better values in flexibility.

Health effects of fitness and physical activity

Several studies have examined the health effects of physical fitness. Ortega et al. (2008) found in their review that high cardiorespiratory fitness and muscular strength were associated with lower cardiovascular disease risk factors in healthy young people, a better quality of life, and positive health in both healthy and diseased young people. In a further review Ruiz et al. (2009) examined the predictive validity of health-related fitness batteries and concluded that higher levels of cardiorespiratory fitness in childhood and adolescence were associated with a healthier cardiovascular profile later in life. Additionally, muscular strength improvements from childhood to adolescence were negatively associated with changes in overall adiposity and a healthier body composition in young age was associated with a healthier cardiovascular profile later in life and with a lower risk of death.

When examining the relationship between physical activity levels and health, it becomes clear that numerous studies have shown the health benefits of regular physical activity in school-aged children, adolescents, adults, and the elderly (Aldana et al., 2005; Buman et al., 2010; Cavill, Kahlmeier, & Racioppi, 2007; Janssen & LeBlanc, 2010). Nevertheless, the link between physical activity and health in children and adolescents has yet not sufficiently been investigated and thus more studies are needed in this age group (Rowland, 2007). Hallal, Victora, Azevedo, and Wells (2006) have designed a model that shows the twofold association between young people's physical activity and health. On the one side there are direct positive effects on the physical activity levels in adulthood and morbidity in young people and adults. On the other side there are indirect effects resulting from adults' physical activity levels to lower levels of morbidity and mortality in adults (see Figure 3). What adolescents do in their teenage years may set the pattern for long periods of adulthood, as people establish many of their lifestyle choices as they proceed through adolescence.

Although the ill effects of heart disease, osteoporosis and other chronic diseases manifest themselves in adulthood, it is increasingly understood that their development starts in childhood and adolescence (Parsons, Power, Logan, & Summerbell, 1999). Thus, the establishment of healthy patterns of physical activity during childhood and adolescence is important also due to the reason that studies have confirmed that physical activity tracks from adolescence to adulthood (Burke et al., 1998; Reed, Warburton, Macdonald, Naylor, & McKay, 2008). Promoting physical activity must therefore start early in life (Hallal et al., 2006).

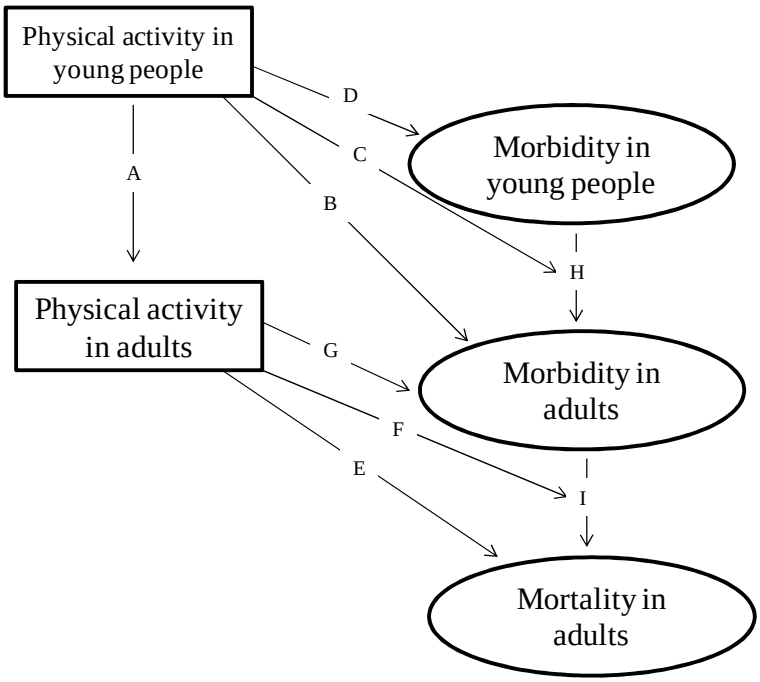

Figure 3 The Association Between Young People's Physical Activity and Health. The Proposed Mechanisms Include Four Direct Effects (Pathways A-D) and Three Indirect Effects (Pathways E-G) (Hallal et al., 2006, p. 1020).

The assertion concerning the positive link between physical activity levels and health is supported by systematic reviews and studies that have shown that physically active children and adolescents have a better health status. Andersen et al. (2011) carried out a review of reviews examining the association between physical activity levels and cardiovascular risk factors in children. They included all relevant systematic reviews conducted in the timeframe between 2005 and 2011. Concerning blood pressure, they concluded that MVPA of at least 30 minutes three times per week can reduce blood pressure among children with hypertension. The data from the analysed reviews propose that a minimum of 40 minutes of moderate activity per day, five times per week for at least four months is necessary to yield improvement on blood lipids. Additionally, studies were reviewed that examined the relationship between cardiovascular risk factors (waist circumference, BMI, triglycerides, blood pressure, fasting glucose, reduced HDL-C level, and fitness) and physical activity levels. The authors showed that studies relating self-reported physical activity to CVD risk

factors were inconclusive whereas the findings from studies measuring physical activity with accelerometers were more consistent. These revealed a negative association between physical activity levels and CVD risk factors. Biddle, Gorely, and Stensel (2004) reviewed the evidence concerning ways in which physical activity is linked to cardiovascular disease, obesity and being overweight, psychosocial outcomes, type II diabetes, and skeletal health in children and adolescents. The authors conclude that it is desirable to promote physical activity in youth. Janssen and LeBlanc (2010) also provided strong and consistent evidence concerning the health benefits of physical activity and fitness in children and youth. In their review, about 50% of the aerobic exercise interventions resulted in changes in the BMI and levels of total fat and/or abdominal fat, with small to medium ($d < 0.50$) but significant effects. Notable effect sizes were also achieved through aerobic exercise interventions in terms of decreasing triglycerides ($d = 3.03$), systolic blood pressure ($d = 1.39$), and fasting insulin values ($d = 0.60$), as well as increasing HDL-cholesterol levels ($d = 0.26$). The review suggests that youngsters who are at risk with regard to these health variables may especially benefit from exercise interventions. Dencker and Andersen (2008) reviewed studies examining the effects of accelerometer based physical activity levels on body fat. The authors concluded that a uniform picture characterises the relationship between these factors resulting in higher physical activity levels being associated with lower body fat values.

Original research studies, for example the studies by Andersen et al. (2006) and Tittlbach et al. (2011), have examined the relationship between physical activity and health. Andersen et al. (2006) examined the association between accelerometer measured physical activity levels and cardiovascular risk factors (BMI, sum of skinfold, blood pressure, glucose, insulin, cholesterol, triglyceride, and insulin resistance) in a cross-sectional study of 1732 randomly selected 9- and 15-year-old children from Denmark, Estonia, and Portugal. The findings of the study were that a graded negative relationship existed between the cardiovascular risk factors and children's physical activity levels. The risk factors were higher in the first to third quintile of physical activity compared with the most active quintile. Tittlbach et al. (2011) used the data from the KiGGS survey and confirmed that even though results showed small effects, the adolescents with higher levels of physical activity had a lower body mass index, less body fat, fewer emotional and peer problems than adolescents who were inactive or only somewhat physically active. In addition, the association with musculoskeletal pain was significant, but not in the assumed direction of health promotion since active individuals perceived more pain than inactive or less active individuals. Finally, there is no significant association between physical activity and flexibility, HDL cholesterol, body mass index, and hyperactivity. The amount of variance explained by physical activity was between 12.6% and 0%. In most analyses, the explained variance was very low (<3%).

In recent years, the effects of physical activity on young people's mental health has also been examined. A meta-analysis by Fedewa and Ahn (2011) revealed that physical activity levels were associated with improved mental health outcomes such as depression, anxiety, self-

esteem, emotional distress, life satisfaction, and problems in social functioning. Sund, Larsson, and Wichstrom (2011) aimed to examine the cross-sectional and one-year longitudinal relationship between physical activity levels and depressive symptoms and the moderating effects of vigorous exercise between stressful life events and depressive symptoms in 2,464 adolescent girls and boys in average 13.7-year-olds in Norway. Low levels of physical activity were associated with higher depressive symptom levels in the cross-sectional analysis and also predicted higher depressive symptoms one year later. Fedewa and Ahn (2011) conducted a meta-analysis to examine the effects of physical activity and physical fitness on children's achievement and cognitive outcomes. They included 59 published and unpublished studies in their analysis and concluded that physical activity and fitness have a significant positive small to medium effect on children's cognitive outcomes and academic achievement. Concluding it can be said that physical activity can lead to improvements in both long- and short-term physical and mental health and there is increasing evidence that it is also associated with academic and cognitive performance (Biddle & Asare, 2011; Biddle et al., 2004; U.S. Department of Health and Human Services, 1996).

Current research shows a promising picture on the positive health effects of fitness and physical activity on several health aspects in young people. To complete the picture it needs to be considered that participation in vigorous exercise and competitive sports can lead to the negative health consequences of musculoskeletal injuries. Incomplete recovery can cause long term health problems such as joint degeneration which consequently limit the possibilities to participate in health-enhancing physical activity through life (Maffulli, Longo, Gougoulias, Loppini, & Denaro, 2010).

2.2 Health promotion in PE under the perspective of sports science

In the previous sections, the health status of children and adolescents has been described and the effects of physical fitness and physical activity levels on young people's health have been discussed. In conclusion, it was stated that physical activity and physical fitness are determining contributors for a balanced and healthy lifestyle and therefore need to be promoted from an early age.

It is widely accepted that the school is a highly suitable setting to achieve this target. In this course, the analysis of recent theories and empirical findings on health promotion in PE is of crucial importance for the design and evaluation of efficient and high evidence based intervention programmes. Only by taking into account the opportunities and the obligation of the school setting to enhance students' health and by considering the recent findings of the methods and mechanisms that need to be used in order to achieve this, positive changes can be achieved in the future. Therefore, in the following section, first the didactical discussion on the significant relevance of the school and especially of the PE lessons to enhance students' physical activity and fitness levels as well as to provide them with the knowledge and skills to

be independently physically active is reflected in the sport pedagogical discussion (see section 2.2.1). Second, the theories and methods that need to be used in order to achieve the optimal effects on young students' fitness levels during the restricted time of PE are the objectives of the scientific discussion in the sports science discipline of training science (see section 2.2.2). Third, the theories which need to be taken into account in order to implement effective methods that will influence young people's health behaviour beyond PE are subject in the sport psychological discussion (see section 2.2.3).

2.2.1 Pedagogical considerations: Why health promotion in the school setting?

In most of the industrialized countries, every child is obliged to attend a school for at least seven years. During the period that young people attend school, they should be educated and gain the knowledge, skills, and competence to continue a self-based, independent education and thus be able to live a fulfilled life (Kolb, 2011; Kurz, 2008a).

Health promotion is one of the targets that the school aims to achieve and includes a number of aspects such as dental health, nutrition, AIDs prevention, and physical activity promotion. As stated by the Roman poet Juvenal, it is to be prayed that the mind will be sound in a sound body. This proverb needs to be taken seriously and the school needs to follow its obligation to encourage a physically active lifestyle in young people. Especially due to the changed circumstances in which young people grow up nowadays, the school has the obligation to provide students with sufficient physical activity opportunities and skills to independently lead an active lifestyle and to be conscious of its importance. When physical activity is restricted during school hours, children do not regain the lost physical activity after school, resulting in children who are sedentary throughout the majority of the day (Dale, Corbin, & Dale, 2000). Although the school makes students sit still for long hours, it is still one of the most suitable settings for students' health promotion due to a number of reasons (Frey & Hildenbrandt, 1995; Hardman, 2007; Hardman & Marshall, 2009; Speroni, Earley, & Atherton, 2007).

One important reason for health promotion in the school setting is the students' *young age*. The risk for chronic disease begins in childhood and thus health promotion and the establishment of healthy habits can never begin too soon. Lifestyle behaviours are formed and established in childhood and it is important to teach young people a healthy lifestyle before risk behaviours have been established. In an older age established habits are difficult to be changed (WHO, 2006a). School-aged children have the cognitive abilities and a high receptiveness which allows them to incorporate health information and behaviours into their daily lives (Jerusalem, 2006). Schools also offer the opportunity to reach an almost *population wide* sample as approximately 98% of the children between the age 6 and 16 attend school (J. W. Davis & Bauman, 2008). Additionally, it offers the possibility to reach the *full socio-economic spectrum* that is represented in society. This is, in contrast to the media, where

attention is likely to be limited, voluntary, spontaneous, and selective (Fox & Harris, 2003). Evidence has shown that those who are socio-economically disadvantaged are much more likely to engage in clusters of unhealthy behaviours (Department of Health, 1997). Also it is well known that these "health needy" are the most difficult to reach as they are neither easily attracted to health-promotion services nor influenced by health-promotion campaigns (Fox & Harris, 2003). A further reason for the suitability of the school to promote a healthy lifestyle is the fact that it occupies a good deal of *youngsters' time* as they spend approximately 40-45 percent of their waking time at school. Students attend school regularly over the entire year with only some weeks of holidays. Furthermore, students attend school for many years in which their personality and lifestyle is being built (Jerusalem, 1999). Schools offer continuity, so that successful interventions may be sustained after the initial intervention and may be disseminated throughout school systems (Donnelly et al., 2009). Teachers are *highly educated experts* regarding the education of young people but can also be continuously trained to deliver health promotion interventions. Finally, the school offers the necessary *infrastructure* needed to carry out measures to promote students' physical activity levels and education towards a healthy lifestyle.

In Germany, in the course of the sport pedagogical discussions, it is emphasised that PE has to accomplish a double assignment in order to fulfil the reasons for its legitimacy (Prohl & Krick, 2006). First, PE has to educate the students towards sport, which means that PE should provide students the opportunity to participate in the sport culture. Here, physical fitness and basic sport skills need to be promoted during PE hours. In this way, a number of experiences with movement and sports need to be lived, among them experiences with regular training, exhaustion, and sweating (Bös et al., 2009). Second, PE receives its legitimacy by educating students through sport. This means that PE should foster students' personality development through the experiences in sports and physical activity. For example, PE should positively influence young people's essential values such as respect for one's opponents, for rules, but also that regular training is needed to succeed, and that defeat can be overcome. Moreover, it provides opportunities to experience that people can become integrated and that they must be able to rely on each other.

Both assignments contribute to the awareness of the students towards a physically active lifestyle (Brodtmann, 2003). Students' interest and motivation during PE need to be awakened and furthermore they need to be encouraged to participate in physical activity outside the school setting during the afternoon hours (Balz, 2007). It is often emphasised that PE should orient students towards a health-related fitness whereby knowledge, attitude, and enjoyment of the movement are emphasised (Cale & Harris, 2005b; Fox & Harris, 2003). As Fuchs (2003) states, the priority aim of PE is to make itself redundant. But in order to get that far regular PE is an indispensable necessity.

These reasons stated above show the suitability of the school setting for students' health promotion which is consequently also manifested in the *physical education* (PE) curriculum as one of the central targets of PE (Kurz, 2008b). Within the school setting, the PE lessons provide the ideal frame for the promotion of physical fitness and a physically active lifestyle. The importance of regular physical activity on students' health is undeniable and therefore a main issue in the didactic discussion underlying the PE curricula (Ministerium für Kultus Jugend und Sport Baden-Württemberg, 2004).

Health promotion is one of the central targets of PE, but not the only one. Most German PE curricula are based on a didactic concept by Kurz (2008b), who emphasises that PE should focus on six pedagogical perspectives that represent what people seek to experience through physical activity and embody important pedagogical aims for personality development (Kurz, 2008b, 2009): 1) PE should provide opportunities for students to experience *achievement and performance*. Students should improve their motor abilities and learn to estimate these correctly. They should experience that effort and performance are worthwhile aims. Thus, during PE, opportunities should be provided in which the students can experience their own competence and performance and consequently gain confidence. 2) In PE *social behaviour* should be taught and opportunities to *experience community* should be created. During this course, students should be able to cooperate with and compete against each other. Thereby, they should be able to be fair and be willing to overcome conflicts. Last, students should be able to face social exclusion and act against it. 3) Students should learn to *act creatively* and *express themselves with their bodies*. 4) During PE students should be provided with the opportunities to feel *strong sensations and happiness* through physical movement. 5) Students should learn to estimate *risks* and be *willing to dare* while arranging safety measures. 6) PE should promote students' *health* by enhancing enjoyment during physical activity and exercise. Additionally, PE should increase the knowledge and the experience of students on the association between physical activity, fitness, and health.

After discussing in detail the reasons why health promotion should be carried out in the school setting and especially in PE, it needs to be emphasised once more that health promotion is only one of the central targets of PE. The importance of the other five perspectives that PE should address are not questioned (Grupe & Krüger, 1997; Kurz, 2008a; Steinmann, 2004). Nevertheless, it is not possible to pursue these perspectives simultaneously and therefore the German PE curricula recommend conducting programmes that especially emphasise one perspective for a limited amount of time. In this way, all perspectives should be addressed for example during the 5th and 6th grade (Kurz, 2008b).

2.2.2 Training science considerations: How can PE contribute to children's health?

As stated in the previous section, health promotion is one of the central targets of PE and in this course, physical fitness, which is considered as one of the central aspects of health, needs

to be addressed in PE (Thienes, 2008). Physical fitness improvements can be achieved directly through PE or by promoting students' competence to build a physically active lifestyle and thus be individually active beyond the PE lessons (Balz & Neumann, 2007; Neumann, 2004). Nevertheless, the extent to which health effects can be achieved in PE remains unanswered. First, it is of great importance to review the existing training theories and methods for the promotion of physical fitness in young people and second, it is required to adapt these for the implementation in PE that is bound to specific circumstances.

The field of health promotion through PE is a relatively new field for the sports discipline of training science. In the 70s, training was carried out with the aim to achieve the best performance in sports competitions. In recent years, this narrow conjunction has changed with the increasing importance of reaching a minimum fitness level in order to achieve health effects through physical activity. As previously stated, one of the main legitimisation arguments of the existence of PE is students' health promotion, and when considering the more broad definition of training, which does not only take into account bodily improvements in order to reach the maximum performance during a sports completion, it needs to be accepted that PE can only contribute to students' health when training is a part of it. Nevertheless, an intense discussion between sports pedagogues and training sciences representatives exists on the question whether training should be implemented in PE (Baschta & Thienes, 2010, 2011; Frey & Hildenbrandt, 1995). This conflict contributed to the fact that training science is not highly developed in the field of PE (Frey & Hildenbrandt, 1995). Frey and Hildenbrandt (1995) argue that one of the main tasks of PE is to develop a broad, unspecific fitness and that it is unreasonable to believe that this can be done without specific training procedures. A few years later, Frey (2002) still criticises that empirical data on the effectiveness of PE to enhance students' health lack. Furthermore, he emphasises that research is needed in order to answer the question whether effects on students' fitness can be achieved through PE or whether the overall aim of PE needs to be revised and restricted to teaching students how to train on their own and not to expect fitness improvements directly from training in PE.

A recent study by Fröhlich, Gernet, Susgin, and Schmidt (2008) determined for the first time the energy expenditure due to activity during PE in male students and showed that on days with PE at school, all children and youths fulfilled the recommendations for minimum physical activity and on days without PE many did not. The study showed that on days with PE, days without PE, as well as during PE, large intra- and inter-differences in the energy expenditure of students were found. This shows that PE does not always lead to higher energy expenditure. Overall there was a significant difference between the days with and without PE on the energy expenditure of students. These interindividual differences were due to the content, the motivation, and the fitness level of the students. Additionally, results of the recent research (see chapter 3) show that school-based intervention studies were able to improve

students' fitness levels. It needs to be taken into account though that these intervention programmes don't always represent the normal PE lessons' frequency and duration.

As noted by Frey (2002) a lack of knowledge and evidence on the effectiveness of PE to influence students' health exists. In order to fill this research gap, training research should be carried out to investigate in which way established training theories can be adapted in the PE setting in order to achieve performance improvements in students (Frey & Hildenbrandt, 1995; Steinmann, 2004). Fitness training in young age cannot be a pure reflection of training in adulthood by only reducing the amount and intensity of exercise. It much more needs to be adapted in order to meet the age specific needs of children and adolescents. Training is possible in PE but at the same time it needs to be emphasised that there are natural limits. Answers on questions concerning broad training science principles such as biological development, versatility and variation, the appropriate stimulus, the optimal relation between load and relaxation, progressive load, and differentiation can be given based on already existing empirical findings. For example, it is well known that training should be performed several times per week and that warm-up should be specific and not global, that coordination should be carried out before endurance and strength exercises, and that preferably endurance components should be carried out last. Much more, questions remain unanswered concerning specific PE training science topics that can only be investigated in the school setting. Answers to these questions cannot be given by examining these training principles in other settings with a similar population and similar conditions. This means that the specific characteristics and circumstances in PE need to be taken into account in order to design the optimal training programme during PE and consequently have a positive influence on students' health. Thus, the fact that only limited school hours are dedicated to PE and the fact that vacations during the school year interrupt the training flow need to be especially taken into account.

It is well known that a *minimum of time* is needed to achieve improvements on motor performance. This is a serious restriction concerning the training effects PE can achieve, as depending on class level, PE takes place only once or twice per week. Often two PE hours are carried out consecutively and sometimes one additional hour is given during the week (Deutscher Sportbund, 2006). Consequently, the question arises whether enough time is provided through PE to achieve training effects (Thienes, 2008). Several studies have shown that motor performance improvements can be achieved when a training session is systematically planned and carried out once a week in order to improve endurance, strength and coordination (Letzelter, 1983; Reuter, 2003; Steinmann, 1980, 1992), but it must be emphasised that studies exist which could not confirm these results (Faigenbaum et al., 1996). An optimal training in a young age group has to take about 20 to 40 minutes into account. This time can be integrated into the PE lesson when planning the lesson accordingly. A strict schedule, a minimum of equipment, and independent training by the students can lead to an effective training also during a small given period of time (Günther, 2004a). Previous studies have shown that student's physical fitness can be improved during short 15 minute

programmes especially among the unfit students (Frey & Hildenbrandt, 1995). It is though assumed that the frequency of the training is more important than the duration. This is a big disadvantage of PE as it is usually carried out only twice a week. Furthermore, recent studies stated that the time effectively used during PE lies between five to ten minutes and reaches a maximum of about 17 minutes of the overall 45 minutes of a PE lesson (Frey & Hildenbrandt, 1995). Hohmann et al. (2007) emphasised that this is most likely to be due to organizational mistakes, the fact that teachers are not aware of this time problem, and their lack of methodological competence to optimally organize the PE lesson.

A related question that arises addresses the required *intensity* with which training in PE must be carried out in order to achieve motor performance effects. Kindermann, Keul, Simon, and Reindell (1978) recommend a minimum heart rate of 160 to 170 in the age group of 11- to 14-year-old students in order to achieve positive results. Furthermore, they conclude that teachers can aim the training to achieve a heart rate of 160 and be sure not to make any mistakes. Over- or under-training cannot result from such intensity. In general, the risk of under-load in PE is much higher than overtraining. Healthy students are not at risk of an overtraining because the skeletal muscles fatigue much faster than the heart muscle (Frey & Hildenbrandt, 1995). Fairclough and Stratton (2005) showed in their study that children were not able to fulfil the current recommendations (United States Department of Health and Human Services, 2000), which demand that students should at least 50% of the PE time have a heart rate reserve over 50% or a VO^2max over 50%. Additionally, the authors argue that the fact that the intensity of the exercise is more important compared to the time in which it is carried out show that a training effect can be possible also during PE.

Based on these aspects, a precise preparation and planning of an adequate training in PE concerning *content, equipment and material, methods, and structure* of the lessons taking training science and pedagogical principles into account has to be done (Frey & Hildenbrandt, 1995; Steinmann, 2004).

Endurance, strength, flexibility, coordination, and speed are the five elements of physical fitness. Among these, strength and endurance are the fundamental elements of fitness that need to be addressed in the lessons' *content* when PE aims to enhance students' fitness (Steinmann, 2004). Strength and endurance can be addressed in three different ways: a) during separate lessons, b) in the same lesson with exercises that simultaneously promote both, and c) in the same lesson with different exercises promoting each element separately. All three options are possible, especially in PE where the fitness level of students is relatively low. Furthermore, it needs to be emphasised that except for anaerobic endurance and speed training, training of the general strength, endurance, and flexibility does not systematically differ from each other in its basic forms. This fact opens opportunities for fitness training during PE (Frey & Hildenbrandt, 1995). Nevertheless, it is still important to name the key targets of a PE lesson and to specifically plan the content in order to reach the set target.

Several strength kinds exist including maximum-strength, speed-strength, and endurance-strength. The first two strength kinds require high intensity levels for their increase. These high intensity levels can only be carried out with a certain development level, which is only reached after puberty. In contrast, endurance-strength demands lower intensity levels but a longer duration and therefore it is more suitable for students of a younger age. Consequently, exercises with light resistance weight and a high amount of repetitions should be carried out (König, 2011). During PE, a basic endurance that is dynamic, aerobic, general, and sports comprehensive needs to be addressed. This can be achieved by 10 to 15 minutes of training per lesson using three strategies: the continuous method, the extensive interval method, and the fartlek method. König (2011) emphasises that overall an increase in the frequency of the training should be preferred compared to an increase of intensity. Unfortunately, often this cannot be achieved in respect to the PE conditions and the question remains unanswered on the exact intensity concerning endurance training that can be used in PE in order to reach positive training effects.

In order to achieve an effective training for the improvement of students' motor performance in PE with restricted time and frequency, available *equipment and material* that are used must be chosen carefully. Some materials are needed to improve the effectiveness of a lesson and to make it more interesting but on the other hand they should be used carefully not to waste time for the setup of the equipment. Suitable material can be benches, medicine balls, ropes, and one's own or the partners' body (Frey & Hildenbrandt, 1995).

Studies that analyse different *methods* concerning the efficient implementation of PE lessons in order to achieve fitness effects are rare (Thienes, 2008). One attempt to develop specific methods for strength training in PE was made by Deddens and Duwenbeck (2006) and Duwenbeck and Deddens (2003). They developed two methods for strength training during PE that were originally designed in the field of fitness and health physical activities and in the bodybuilding field. These were soft strength training and one set training. Thienes and Austermann (2006) carried out a study with which they provided the empirical evidence for the effectiveness of these methods in PE. A further method, which has been proven effective in PE, is the circuit training. This can be implemented in a playful way but at the same time it can also create an environment in which the aim is to improve one's own performance (LaFleche, 2012).

Finally, it is important to reflect about the s*tructure* of the lesson. It is necessary to begin the lesson with a warm-up sequence where the children are physically and psychologically prepared for the upcoming lesson and the physical load. Overall, the warm-up part of the lesson improves metabolism, nerve conduction velocity, the sensitivity of the central nervous system, and the psychological attitude towards sport (Weineck, 2004). It should not exceed 10-15 minutes in order to prevent the students from being too tired for the main part of the lesson. Additionally, the warm-up should be specific and related to the main part of the lesson

and it should include simple or already known exercises by the students, or games where all students can take part and are not over-challenged. Furthermore, the warm-up should have a motivating character. For the structure of the main part of the lesson several training science rules need to be taken into account. Generally, the training of coordination should be carried out before the strength and endurance training. Intensive exercises can diminish the effectiveness of speed, and strength training should therefore not be carried out during the same lesson or should address different muscle groups. Endurance training should be placed at the end of the lesson. The intensity of the lesson should increase by time and should be concluded by a cool-down exercise at the end of the lesson to calm the students down (Frey & Hildenbrandt, 1995).

Finally, it must be mentioned that there are limits to the extent of the health effects that can be reached through PE. PE cannot provide the entire physical activity a young person needs in order to accomplish an optimal development. Nevertheless, it can at least partly compensate to the long hours that students spend sitting still during the other lessons in school and during homework. At last, even if it is being questioned that PE can contribute to students' fitness, it can at least influence students to establish positive physical activity habits and contribute to an active lifestyle outside the school setting (Frey & Hildenbrandt, 1995; Grupe & Krüger, 1997). Unfortunately, a lack of research methods and studies in the PE setting exists. In future, there is a lot to be done from the perspective of training science in the PE field. The training effects, which can be achieved during PE, are controversial. It must also be emphasised that empirical findings on a high evidence level in this field are needed to influence political decisions concerning PE in school (Hohmann et al., 2007). Additionally, based on these findings, information and specific teaching materials can be created and given to the teachers to be able to teach an efficient and adequate health and fitness-promoting PE lesson (Hohmann, 2007). Thus, we must try to find the answer whether, and if yes, how PE can contribute to students' fitness and in this way to their health.

2.2.3 Psychological considerations: Which factors promote a physically active lifestyle?

Research has shown that health behaviours are already manifested at early stages of life and that these early behaviour habits are an important factor in determining health-related behaviour at later stages in life (Hayman, Mahon, & Turner, 2002; Lohaus et al., 2006). It is also known that health behaviours become even more difficult to change with growing age as they already become stable in young years. Therefore, it seems essential to influence health behaviours early during development, and to look for parameters associated to them (Klein-Hessling, Lohaus, & Ball, 2005).

In order to develop strategies that promote a physically active lifestyle, it is essential to know the factors determining this behaviour. J. F. Sallis and Owen (1999) emphasise the need to first understand the fundamental processes of human behaviour in order to be able to establish

or change it in a second step. Fishbein et al. (1992) also emphasise that the more one knows about the variables responsible for a specific behaviour, the more likely it is to develop effective intervention programmes (Fuchs, 2003; Höner, 2008; Sudeck, 2006). A growing number of theories and models of human behaviour have added to understanding on how factors contribute to a healthy lifestyle and they are used to guide the development of specific intervention programmes.

These thoughts apply also to the research field of physical activity promotion. It is important to first examine behavioural and social science theories and to gain knowledge underlying the specific behaviour of physical activity change in order to be able to design effective intervention programmes to consequently influence this behaviour (U.S. Department of Health and Human Services, 1996). Physical activity is a behaviour that cannot be directly influenced. Instead, modifying relevant determinants of this behaviour can indirectly influence it. Therefore, the identification and the understanding of relevant factors that influence participation in physical activity in youngsters are important in order to be able to design effective interventions (Deforche, De Bourdeaudhuij, & Tanghe, 2006; Dishman, Sallis, & Orenstein, 1985). Dishman et al. (1985) emphasise that it is especially important to identify modifiable determinants such as self-efficacy or attitudes rather than factors that cannot be altered to influence participation in physical activity, such as age, sex, and ethnicity.

In this section, first, theories and models used in behavioural and social science research that have been also used to examine and explain physical activity behaviour are presented. Second, attitudes, knowledge, motivation, and self-efficacy which were derived of the previously discussed theories and have been shown to be important modifiable determinants of physical activity in young people are discussed in more detail. These theoretical considerations are the basis for the selection of the relevant psychological variables, which will be aimed to be influenced with the intervention study of this research project.

2.2.3.1 Theories and models used in behavioural and social science research

A theory presents a systematic way of understanding events, situations and specifically the behaviour of human beings. With the use of a specific concept that includes propositions on how the illustrated variables interact, a specific behaviour can be predicted. Additionally, the use of theories and hypotheses can contribute to define the targets and strategies of intervention programmes. Theory is a basic platform and a road map which can be used to design and evaluate the success of interventions to change behaviour (Rimer & Glanz, 2005).

In research, two kinds of theories are used: the explanation and the intervention theories (see Figure 4). Explanation theories provide information on the relevant behaviour determinants that have been more or less confirmed with empirical results whereas intervention theories

provide the practical information on how to implement the existing knowledge into practice (Fuchs, 2003).

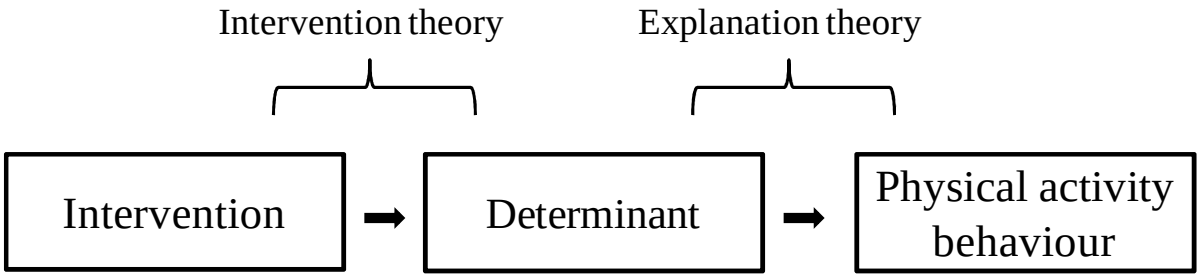

Figure 4 Intervention Theory and Explanation Theory (Fuchs, 2003, p. 111).

Because interventions to encourage physical activity have to be based upon determinants of physical activity in young people, studying these is the first step to be taken. According to Fuchs (2003), explanation theories provide the necessary information a researcher needs concerning personal, social, structural, and cultural conditions in order to design a promising intervention. Examples for such theories are the theory of planned behavior (Ajzen, 1991) and the social-cognitive theory (Bandura, 1986).

Table 1 provides an overview of the theories and models used to explain physical activity behaviour (for a detailed description of these theories see e.g., Biddle & Nigg, 2000; Fuchs, 2003; Niermann, 2011; Rimer & Glanz, 2005). Many of these theories have been developed based on previous theories and therefore often have similar key constructs that can differ in the term that is used to describe them. For example, self-efficacy is the key construct in the social cognitive theory and a very similar construct can be found in the theory of planned behavior named perceived behavioral control. Nevertheless, these theories provide information of which determinants might be especially important to predict behaviour.

The theories and models presented here are divided into the categories of the individual, interpersonal, and environmental level of behaviour change. At the individual level, the theories consider individual characteristics that influence behaviour such as knowledge, attitudes, beliefs, and personality traits. In order to plan effective interventions, researchers need to understand the individual factors that contribute to behaviour change. At the interpersonal level, it is assumed that individuals live and are influenced by a social environment. Therefore, it is hypothesised that the people and groups surrounding him or her influence the individual's behaviour. Finally, environmental models explore how social systems function and change. At this level, regulations, policies, informal structures which may constrain or promote recommended behaviours, social networks and norms which exist among individuals, groups, and organisations, or laws that regulate or support healthy actions are considered (Rimer & Glanz, 2005).

Up until now, most of the theories and models used to explain behaviour are based on social-cognitive factors and neglect other factors such as the environment which might be equally

important for human behaviour. J. F. Sallis and Owen (1997) emphasise the importance of ecological models that incorporate the roles of intrapersonal, social, and physical environmental factors on behaviours such as physical activity. In these terms, they developed an ecological frame model, which is not an explanation theory, but still provides a frame into which theories such as the social-cognitive theory can be integrated.

The most supported theories in the physical activity domain include the transtheoretical model, the social cognitive theory and the theory of planned behavior. Additionally, in recent years, the self-determination theory (Antikainen & Ellis, 2011) and the Rubicon model have gained popularity in exercise psychology (Höner, 2005). Unfortunately, a comprehensive theory specifically designed for the health of children and adolescents does not exist and further research is urgently needed to fill this research gap. It needs to be taken into account that these social cognitive behaviour models are based on cognitive rational aspects and findings gained through theoretical considerations and empirical research on an adult population. They don't represent the psychosocial life of young people and the specific determinants of a healthy lifestyle in this age group (Jerusalem, 2006). Still they do provide first indications on which variables might be relevant to an active lifestyle in young people. Nevertheless, these theories should not be used unaltered for the design of intervention programmes in this young age group. Much more, they need to be adopted to fit the life content and development status of this age group. Unfortunately, research concerning the determinants of physical activity in young people is not as advanced as the research in this field for adults.

Table 1 Summary of Theories and Models Ssed in Physical Activity Research (Modified and Extended After Rimer & Glanz, 2005; U.S. Department of Health and Human Services, 1996)

Level	Theory/model - Reference	Key concept
Intrapersonal	Classic learning theories (Skinner, 1953)	Reinforcement, cues, shaping
	Health belief model (Rosenstock, 1990)	Perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, self-efficacy
	Transtheoretical model (J. O. Prochaska & DiClemente, 1982)	Pre-contemplation, contemplation, preparation, action, maintenance
	Protection motivation theory (Rogers, 1983)	Perceived severity, perceived vulnerability, response effectiveness, self-efficacy
	Rubicon model (Heckhausen & Gollwitzer, 1987)	Pre-decisional, pre-actional, actional, post-actional phase, motivation, volition
	IMIS-Model (Höner, Sudeck, & Willimczik, 2004; Sudeck & Höner, 2011)	Pre-decisional motivation phase - goal setting: desirability & feasibility; pre-actional volition phase - goal pursuit: implementation intentions, coping plans, self-commitment

Level	Theory/model - Reference	Key concept
	MoVo-Model (Göhner & Fuchs, 2007)	Self-efficacy, outcome expectations, goal intention, intention strength, self-concordance, implementation, action initiation, volitional intention shielding, situational cues, outcome experiences
	The Berliner stage model (Fuchs, 2003)	Pre-contemplation, contemplation, disposition, pre-action, implementation, habituation, fluctuation, resumption
	Self-determination theory (Deci & Ryan, 1985)	Amotivation, external, introjected, identified, and integrated forms of regulation, intrinsic regulation
	Theory of planned behaviour & Theory of reasoned action (Ajzen, 1991; Fishbein, 1979)	Attitude toward the behaviour, outcome expectations, value of outcome expectations, subjective norm, beliefs of others, motive to comply with others, perceived behavioural control
Interpersonal	Social cognitive theory (Bandura, 1977)	Reciprocal determinism, behavioural capability, self-efficacy, outcome expectations, observational learning, reinforcement
	HAPA Model (Schwarzer, Lippke, & Ziegelmann, 2008)	Self-efficacy (task, coping, recovery), outcome expectancies, risk perception, planning (action, coping), action (initiative, maintenance, recovery)
Environmental	Ecological perspective (J. F. Sallis & Owen, 1997)	Multiple levels of influence, intrapersonal, interpersonal, institutional, community, public policy

Once there is enough knowledge on the determinants of physical activity in this age group, a second step can be taken: the development of physical activity interventions. *Intervention theories* specify the probability with which actions, methods, and circumstances can lead to specific conditions. Examples of such theories are the cognitive behavior change theory (Kanfer & Gaelick-Buys, 1991) and the theory of persuasive communication (Petty & Cacioppo, 1986). Intervention theories are often formulated very broadly and consequently provide little information or help for the design of specific intervention programmes (Fuchs, 2003). It is necessary to work on the development of sport specific intervention theories based on empirical findings on specific populations and settings. Nevertheless, it is important to consider the existing theories when planning interventions even though they might not be developed for this specific sample study or setting (Sudeck, 2006). Still they might provide relevant information and in a second step, by using the empirical findings gained from intervention studies, they can be further expanded.

In practice both kinds of theories are important. Only when knowing how a specific behaviour develops and by which factors it is being determined, intervention guidelines can be designed

for the implementation of adequate and effective programmes that aim to influence the determinants of physical activity and subsequently in this way promote people's physical activity levels (Fuchs, 2003; Michie & Abraham, 2004; J. F. Sallis & Owen, 1999).

2.2.3.2 Modifiable determinants of physical activity behaviour

Before discussing in more detail four modifiable determinants which have been found to be promising in predicting physical activity among young people, it needs to be mentioned that empirical findings mostly present relationships between variables in order to generate hypotheses for further study and often do not support causal inferences. According to J. F. Sallis and Owen (1999) and Bauman, Sallis, Dzewaltowski, and Owen (2002), the term determinant is wrong as most often it refers to the correlational results of physical activity from observational studies. Thus, determinant is a misnomer because correlational studies cannot lead to conclusions about causation. Nevertheless, this term has been broadly used by many researchers including the above mentioned authors criticising it. Therefore, it is also used in the following research work but it needs to be considered that it only represents correlational results.

Although correlates of physical activity among youth have not been clearly established, a growing literature has suggested that social-cognitive factors such as self-efficacy, perceived behavioural control, attitudes, knowledge, subjective norms, enjoyment of physical activity, family or friend support, and perceived benefits and barriers influence the decision to become physically active among youth (Craggs, Corder, van Sluijs, & Griffin, 2011; Motl et al., 2000; J.F. Sallis, Prochaska, & Taylor, 2000). However, theory based research examining which of those social-cognitive factors have the most important influence on physical activity among youth is limited and further research is needed. Results from the recent empirical and theoretical research revealed a promising association between attitudes, motivation, knowledge, and self-efficacy and a physically active lifestyle (Gorely, 2005; Trotter, 2011). Therefore, these determinants of physical activity were chosen to be further investigated in the empirical research of this work and are discussed in the following in more detail.

2.2.3.2.1 Attitudes

Attitude research began in the late decades of the nineteenth century. Since then, numerous scientists have tried to define the psychological concept of attitudes. Ajzen and Fishbein (1980, p. 54) state that attitude "is simply a person's general feeling of favorableness or unfavorableness for that concept". Eagly and Chaiken (2007, p. 598) recently confirmed this definition by describing attitude "as a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour". In respect to physical activity, attitude expresses a person's positive or negative evaluation to engage in physical activity (Erdmann, 1982).

Several theories as well as empirical research imply that attitudes are important in order to predict behaviour. The theory of reasoned action (Ajzen & Fishbein, 1980) and its extension into the theory of planned behaviour (Ajzen, 1991) emphasise that attitude toward physical activity is an important predictor of engaging in physical activity. According to this theory, intention is an immediate determinant of behaviour and intention in turn is predicted from attitude, subjective norm, and perceived behavioural control. Furthermore, attitude is a function of the belief that participation in physical activity will result in certain outcomes and the positive or negative evaluation of these outcomes. The construct of attitudes also appears in the Health Belief Model (M. H. Becker & Maiman, 1975) in which attitude can be expressed as perceived benefits minus perceived barriers which subsequently influences behaviour (Deforche et al., 2006). Also, according to the theory by Triandis (1977) attitudes play an important role in the development of a behaviour.

In recent years, research has confirmed these theoretical assumptions. Fuchs (1997) presented a number of studies showing that attitudes predict adults' participation in physical activity. Also in children and adolescents, empirical evidence exists on the effect of attitudes on intentions to participate in physical activity and on actual activity levels (e.g., Hagger, Chatzisarantis, & Biddle, 2001). Hagger et al. (1997) suggested in their review analysing children's physical activity levels and attitudes towards physical activity, that children who have positive attitudes towards experiences through physical activity such as the excitement of the task itself or for the appreciation of the movement within the task may be more active than those who do not. In a study examining a sample of 1152 school pupils aged 13 years, Hagger et al. (2001) confirmed the strong effects of attitudes on young people's physical activity levels which were previously found in several other studies (Atsalikis & Sleap, 1996; Hausenblas, Carron, & Mack, 1997).

It is recognised that the period of middle childhood is the time when attitudes are formed and thus, also the fostering of positive attitudes towards physical activity should begin in young age (Ausubel, Sullivan, & Ives, 1980; Medinnus & Johnson, 1976). Since the 1980s, teachers, parents, and physical educators rate the development of positive attitudes towards exercise as one of the most important objectives of PE and it should be given serious consideration by which educational activities physical educators can achieve this (Digelidis, Papaioannou, Laparidis, & Christodoulidis, 2003; Hagger et al., 1997; Schutz et al., 1985). Fox and Biddle (1988) emphasise that attitude toward physical activity consists of a number of different aspects such as parental influences, peer influences, personality traits and past behaviour and experiences with activity which cannot all be influenced through PE. Physical educators must therefore focus on their ability to provide children with the experiences of a variety of activities and present these in a positive, meaningful and challenging way. If this is achieved, then children may be more encouraged to adopt an active lifestyle and participate in physical activities while young, which may in turn lead to continued participation in adulthood (Hagger et al., 1997).

2.2.3.2.2 Knowledge

It is commonly believed that the information and the knowledge people possess in a certain domain is of central importance for their following decisions. Lack of health-related knowledge is believed to be one of the factors causing insufficient physical activity and consequently other illnesses resulting from this such as the obesity epidemic or cardiovascular disease. Bandura (1997) argues that because people lack knowledge of how some lifestyle habits affect their health it is unlikely that they will put themselves through the drudgery of changing bad health habits they enjoy. Therefore, it is assumed that an increased health-related fitness (HRF) knowledge could lead to an increase of physical activity behaviours (Keating et al., 2009).

Overall, only few attempts have been made to empirically examine the relationship between knowledge and physical activity and the results reported do not always confirm the aforementioned hypotheses. For instance, DiLorenzo, Stucky-Ropp, Vander Wal, and Gotham (1998) found that HRF knowledge of fifth and sixth grade students was a determinant of children's exercise behaviour, but Ferguson, Yesalis, Pomrehn, and Kirkpatrick (1989) found that no significant correlation existed between these variables in middle school students. When examining college students, Brynteson and Adams (1993) found that students with more HRF knowledge were more physically active. Keating et al. (2009) emphasise that because of the inconsistency of the data reported by studies in this field, it is difficult to conduct a systematic review or a meta-analysis.

The current empirical results have led many investigators to conclude that knowledge is necessary but not sufficient to change behaviours while other researchers even stress that knowledge has been consistently shown to be non-influential in predicting behaviour (Ajzen, Joyce, Sheikh, & Cote, 2011; Fisher & Fisher, 1992; Jerusalem, 2006). It is often argued that additional self-influences are needed to overcome the impediments towards adopting new lifestyle habits (Bandura, 1997). For example, it is believed that in addition to having the required knowledge, it is necessary to be motivated to perform the behaviour in question. It has been well documented that knowledge appears to help the initiation and adherence to its corresponding behaviour. It is more often stated that knowledge creates the precondition for change but does not necessarily lead to healthy lifestyles. It is widely believed that volitional behaviours are influenced by corresponding knowledge. For example, it is also known that attitudes can change following increased understanding (Ajzen, 1988). Even then, the adoption of health-enhancing behaviour is often limited by physical, social, economic and cultural factors.

Methodological problems concerning the questionnaires used to assess knowledge also need to be faced. First, often questionnaires consisting of one or a few questions to test knowledge are used. Second, knowledge tests rarely deal with the particular behaviour of interest, and third, knowledge tests may reflect a person's attitudes rather than assess accurate information.

The items used in many questionnaires are often factual in nature with no clear implications on the type of the desired behaviour. Based on such items it is unlikely that the results on knowledge will correspond to the actual behaviour of a person. This insufficient measurement of HRF knowledge in general might have an impact on the results of the relationship between the two variables.

Although students' HRF knowledge is believed to be important and has been included in PE programmes for more than three decades, little is known as to how much HRF knowledge students possess at different grades. It is also unclear what the effective teaching strategies are that could be used to increase student HRF knowledge. The relationship between HRF knowledge and fitness behaviours for students at different ages remains unclear and requires more examination (Keating et al., 2009).

2.2.3.2.3 Motivation

Motivation is defined as an active orientation of the current behaviour based on a positive rated aim (Rheinberg, 2008). A person who feels no impetus or inspiration to act is thus characterized as unmotivated, whereas someone who is energized or activated toward an end is considered motivated (Ryan & Deci, 2000). People have not only different amounts but also different kinds of motivation. That is, they vary not only in level of motivation (i.e., how much motivation), but also in the orientation of that motivation (i.e., what type of motivation). Orientation of motivation concerns the underlying attitudes and goals that give rise to action (Ryan & Deci, 2000).

People are often moved by external factors such as rewards, grades, evaluations, or the opinions they fear others might have of them. Just as frequently, people can be motivated from within as for example by interests, curiosity or care. Deci and Ryan (1985) developed the self-determination theory in which five types of motivation are located. These are external, introjected, identified, integrated, and intrinsic forms of regulation. However, the integrated form of regulation is mostly relevant to an adult population and not to young people and is not further considered here (Wang & Biddle, 2007). Figure 5 shows the self-determination continuum and the different kinds of motivation associated with it. On the left side, amotivation is characterised by the absence of motivation. When moving from left to the right side, the self-determination of a person increases and the four extrinsic forms of motivation become more and more internally regulated until reaching the intrinsic motivation where a person is intrinsically regulated.

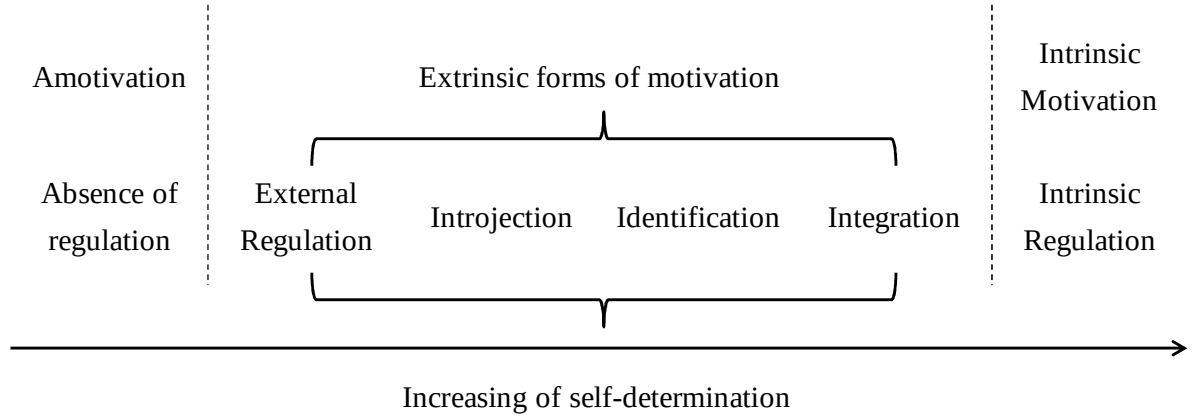

Figure 5 Representation of the Self-Determination Continuum (Levesque, Copeland, Pattie, & Deci, 2010).

According to the self-determination theory, conditions supporting the individual's experience of the three psychological needs autonomy, competence, and relatedness foster the most volitional and high quality forms of motivation. During activities that promote these needs people are highly engaged, strive for enhanced performance, show stronger persistence and creativity levels. In general, conditions that allow satisfaction of the three psychological needs enhance intrinsic motivation, whereas conditions that frustrate these needs undermine intrinsic motivation. Also persistence in sport behaviour has been associated with the degree of self-determination with low levels leading to reduced persistence (Wang & Biddle, 2007).

Intrinsic motivation refers to engaging in an activity because it is interesting or enjoyable. When a person is intrinsically motivated he will perform the behaviour voluntarily and not because of material rewards or external constraints. Intrinsically motivated behaviours are the prototype of self-determined behaviour because they are only performed out of pure interest and they simultaneously satisfy the innate psychological needs for competence and autonomy. In this state, individuals experience choice-fullness in their behaviour, thereby fulfilling their need for autonomy. They are also at a level of optimal challenge which fulfils their competence need. Furthermore, intrinsic motivation is associated with feelings of satisfaction, enjoyment, competence, and the desire to persist in the activity (Ryan & Deci, 2000). Kimiecik and Harris (1996) define enjoyment as the optimal psychological state of intrinsic motivation that leads to performing an activity for its own sake and it is associated with desirable affective states such as happiness, vigour, pleasure, and relaxation. Intrinsic motivation is a critical element in cognitive, social, and physical development because it is through acting on one's inherent interests that one grows in knowledge and skills. Nevertheless, although intrinsic motivation is clearly an important type of motivation, most of the activities people do are not, strictly speaking, intrinsically motivated. In schools, for example, it appears that intrinsic motivation becomes weaker with each advancing grade (Ryan & Deci, 2000). Therefore, it is important to also analyse the state in which people are not mainly motivated towards something solely by intrinsic factors.

When one fails to experience optimal challenge and autonomy, a state of extrinsic control is necessary if participation is to occur. Extrinsic motivation refers to doing something because it leads to a separable outcome (Deci & Ryan, 1985; Ryan & Deci, 2000). Extrinsically motivated behaviours can vary in the extent to which they represent self-determination. In the classic literature, extrinsic motivation has typically been characterized as a pale and impoverished although powerful form of motivation (De Charms, 1968). External motivation represents the least autonomous form of extrinsic motivation. Such behaviours are controlled by external sources and are carried out to satisfy others or gain material rewards. A second type of extrinsic motivation is the introjected motivation. People perform in a similar way as with the extrinsic form of motivation in which actions are based on the expectations by others. In the introjected form of motivation though, these expectations have been internalised in such a way that people act with the feeling of pressure in order to avoid guilt or anxiety or to attain ego-enhancements or pride. A more autonomous and self-determined form of extrinsic motivation is the regulation through identification. Here, the person has come to positively value the behaviour and has identified with its importance. The activity is still performed for extrinsic reasons but it is performed out of one's own choice. Finally, the most autonomous form of extrinsic motivation is the integrated form of motivation. In this form of regulation a person fully identifies with the activity and internalises the reasons for action. Integrated forms of motivation share many qualities with intrinsic motivation but they are still performed for a reason that is separate from the behaviour (Ryan & Deci, 2000).

Based on the learning theories (Skinner, 1953), most behaviour, including physical activity, is learned and maintained while providing reinforcement and anticipating future rewards. These can be physical consequences (e.g., looking better), extrinsic rewards (e.g., receiving praise and encouragement from others), and intrinsic rewards (e.g., experiencing a feeling of accomplishment). It is important to note that extrinsic rewards may help people adopt positive lifestyle behaviours but may not be reliable in sustaining long-term change (Rimer & Glanz, 2005). Students can perform extrinsically motivated actions with resentment, resistance, and disinterest or, alternatively, with an attitude of willingness that reflects an inner acceptance of the value or utility of a task. Internalization and integration are the processes through which extrinsically motivated behaviours become more self-determined (Ryan & Deci, 2000). Understanding these different types of extrinsic motivation and what fosters each of them, is an important issue for educators who cannot always rely on intrinsic motivation to foster learning (Ryan & Deci, 2000).

More than three decades of research have shown that the quality of experience and performance can be very different when one is behaving for intrinsic versus extrinsic reasons (Ryan & Deci, 2000). Thus, assessing intrinsic and extrinsic motivation in sport settings is important because different types of motivation have been associated with different experimental outcomes. For example, high intrinsic motivation has been associated with increased enjoyment of an activity, a desire to pursue challenges, and increased adherence to

sport (Dishman et al., 2008; Zhang, 2009). Individuals experiencing this type of motivation may enter a state of absorption in an activity for which time becomes irrelevant. This state, similar to flow, could easily explain the relationship between intrinsic participation motives and increased levels of adherence. Sport and exercise for many individuals provide domains in which intrinsic motivation is frequently present. Experiencing "flow", or being in "the zone", is widely discussed in athletic experience (Csikszentmihalyi, 1990, 1975) and is understood in self-determination theory as representing the heightened awareness and feelings of well-being associated with an intrinsic motivation (Deci & Ryan, 2004). In contrast, high extrinsic motivation has been associated with increased state of anxiety in young athletes, a tendency to attribute participation in sport to rewards gained instead of the sport itself, and increased dropout from sport (Martens & Webber, 2002). Studies show, for example, that more autonomous extrinsic motivation is associated with greater engagement, better performance, less dropping out, higher quality learning, and greater psychological well-being among other outcomes (Ryan & Deci, 2000).

Research within the sport and exercise domain has found age-related differences in motivation. A crucial point is that activities need to be enjoyable for their own sake, especially in younger children who, unlike adults, are unable to delay gratification (Klein-Hessling et al., 2005). Enjoyment has been identified as a potential correlate of youth' physical activity in cross-sectional and descriptive studies exhibiting a strong positive relationship across a number of studies. DiLorenzo et al. (1998) examined a number of psychological and environmental variables in relationship to physical activity in fifth and sixth grade children and discovered that enjoyment of physical activity was the only consistent predictor of physical activity levels for boys and girls. In a sample of 1504 children in grades 4-12, J. F. Sallis et al. (1999) found that enjoyment of PE consistently predicted participation in physical activity among boys in grades 4-12 and girls in grades 7-12. Enjoyment has also been found to be associated with a variety of physical activity correlates, such as self-efficacy, goal setting (Rovniak, Anderson, Winett, & Stephens, 2002) and self-determination (Ntoumanis, 2002). Recently, enjoyment of physical activity was shown to mediate the effect of a comprehensive school-based intervention designed to promote physical activity on self-reported physical activity in adolescent girls (Dishman et al., 2005).

2.2.3.2.4 Self-efficacy

Self-efficacy theory was originally developed by Bandura (1986) and builds a framework for understanding human behaviour based on a socio-cognitive approach. Within the self-efficacy theory, self-efficacy is defined as a person's belief in his or her ability and capacity to enact and master goal-directed behaviours (Bandura, 1997). Self-efficacy does not characterise the skills a person possesses but much more what he or she believes to be able to do under a variety of circumstances. Self-efficacy is very important because skills can be easily overruled by self-doubts, which can lead to the fact that highly talented people don't exhaust or even

undermine their capabilities. According to the self-efficacy theory, effective functioning requires both skills and the efficacy beliefs to use them well. Therefore, people who have strong beliefs in their capabilities approach difficult tasks as challenges to be mastered rather than as threats to be avoided. These people are characterised by choosing challenging goals and maintaining a strong commitment to them. Also, they invest a high level of effort, remain task-focused, and attribute failure to insufficient effort. Finally, they quickly recover their self-efficacy after failures (Feltz, Short, & Sullivan, 2008).

By now, self-efficacy has gained a lot of importance and it is a key construct within several theories in health psychology (Ashford, Edmunds, & French, 2010). These are for example the social cognitive theory (Bandura, 1997), the protection motivation theory (Rogers, 1983), and the transtheoretical model (J. O. Prochaska & DiClemente, 1982). Also, the concept of perceived behavioural control is closely related to self-efficacy and retains a central position within the theory of planned behavior by Ajzen and Fishbein (1980).

Self-efficacy over opportunities, resources, and skills necessary to perform a behaviour is believed to be a critical aspect of behaviour change processes (U.S. Department of Health and Human Services, 1996). The reason why self-efficacy beliefs have gained a pivotal role in the theories of social behaviour lies in the fact that it is assumed that these believes do not only influence the health behaviour directly but they also seem to act upon other classes of determinants that contribute to motivation and self-regulativeness which consequently leads to health behaviour. Self-efficacy has been demonstrated to be an important predictor of a number of different health behaviours as for example reducing alcohol consumption (Oei & Burrow, 2000) and smoking cessation (Baldwin et al., 2006). Self-efficacy has been repeatedly shown to predict physical activity behaviour in healthy adults (Kaewthummanukul & Brown, 2006) and in both girls and boys (Klein-Hessling et al., 2005). Additionally, it has shown to predict both the adoption and the maintenance of physical activity (Strachan, Woodgate, Brawley, & Tse, 2005). There is also experimental evidence that changes in self-efficacy can mediate intervention effects concerning objectively measured physical activity levels (Darker, French, Eves, & Sniehotta, 2010).

The prediction of positive health-related behaviour shows quite consistently the influences of self-efficacy. It is assumed that this variable represents an important influence that improves health behaviour even in young children. These children have a positive view of their competencies and they may use this to promote their health and so avoid health problems. In line with their positive view about themselves and their competencies, these children will more likely engage in positive rather than in negative health behaviours (Klein-Hessling et al., 2005). In sport, high efficacy expectations are theorized to motivate greater initial engagement in an activity, as well as promote repeated experiences with that activity (Deci & Ryan, 2004). Nevertheless, only few empirical studies have been conducted to investigate this association. Hagger et al. (2001) showed in their study that students' self-efficacy had a

strong influence on their physical activity intentions. Additionally, self-efficacy reduced the influence of attitudes and perceived behavioural control on intentions. A correlational study by Fawcett, Garton, and Dandy (2009) analysing the data of 1230 12- to 17-year-olds confirmed the strong association between the believed abilities of adolescents and their participation in structured physical or creative activities.

The self-efficacy theory accentuates that people develop higher efficacy expectations via a number of sources as for example enactive mastery experience, vicarious experience, verbal persuasion, and physiological or affective states (Bandura, 1997). Enactive mastery experiences refer to the successful performance of a specific behaviour which leads to enhanced efficacy. Vicarious performance refers to seeing someone else with whom one identifies perform the target behaviour successfully and consequently appraising one's own behaviour. Verbal persuasion by which others express their beliefs over one's own competence is believed to have short lasting effects on self-efficacy beliefs. Finally, by reducing negative emotional states one can enhance self-efficacy.

Ashford et al. (2010) have conducted a systematic review with meta-analysis examining the effectiveness of intervention techniques to increase healthy adults' self-efficacy beliefs. They found a significant but small effect between the interventions and changes in self-efficacy d=0.16). Additionally, moderator analyses were carried out which revealed that specific intervention techniques were more effective in promoting self-efficacy than others. Vicarious experiences (d=0.32) and providing feedback by comparing a participant's performance with the performance of others produced the largest effect sizes (d=0.44). On the other side, interventions including graded mastery experience (d=0.03), persuasion (d=0.16), and barriers (d=0.10) led to smaller increases in self-efficacy. The authors discuss that seeing other similar people perform a specific action (vicarious experience) might raise the individual's belief that they too possess the capabilities to master the same activity. Also, by being made aware of one's success leads to increased self-efficacy. Graded mastery, where the activity became increasingly difficult, was associated with a lower self-efficacy. This finding is surprising and contradicts previous findings. It is possible that this technique might lead to low self-efficacy initially but might be helpful for maintaining self-efficacy in the long run. The effect of verbal persuasion also seems to be limited in enhancing self-efficacy and the identification of barriers led to smaller increases in self-efficacy than initially expected. It is possible that barriers might be unhelpful in the motivational phase of behaviour change but might be helpful in later stages. Ashford et al. (2010) further discuss that these findings which run counter to what would be expected from previous literature might be due to statistical fluke due to multiple comparisons or it might be possible that the presented strategies were not implemented correctly during the interventions.

Regarding the measurement of self-efficacy beliefs it needs to be taken into account that it is widely acknowledged that a high sense of efficacy in one activity domain is not necessarily

accompanied by high self-efficacy in other activities. Therefore, to achieve explanatory and predictive power, measures of personal efficacy must be tailored to domains of functioning and must represent gradations of task demands within those domains. This requires clear definition of the activity domain of interest and a good conceptual analysis of its different facets, the types of capabilities it calls upon, and the range of situations in which these capabilities might be applied (Rosenberg, Schooler, Schoenbach, & Rosenberg, 1995).

2.3 Chapter summary

This chapter is dealing with the theoretical considerations and the empirical findings that build the basis for the design of the empirical study during this research project (see chapter 4). In a first part of this chapter, the recent findings on young people's health and fitness status as well as their levels of physical activity behaviour were presented. In summary, it can be stated that German young people's physical fitness levels have decreased by about 10% in the last years (Bös, 2003) and that 15% of the examined children were overweight and 6.3% of those were obese (Kurth & Schaffrath Rosario, 2007). Additionally, 11% to 20% of the 11- to 15-year-olds respectively rated their health as fair or poor. These figures lead to the conclusion that a considerable number of young people have reduced levels of health already at this young age. Furthermore, the connection between these factors was presented. It can be concluded that the results from these systematic reviews and meta-analyses are promising and confirm to a high degree the positive effects of physical fitness and physical activity on health (e.g., Janssen & LeBlanc, 2010; Ortega et al., 2008). In most of the studies and systematic reviews, positive small to medium effects were confirmed on young people's cardiovascular risk factors such as waist circumference, BMI, triglycerides, blood pressure, fasting glucose, and reduced HDL-C level (e.g., Andersen et al., 2011). Additionally, positive effects were observed on mental health outcomes and academic achievement (e.g., Fedewa & Ahn, 2011). Finally, one negative effect of higher levels of physical activity was revealed regarding musculoskeletal pain (e.g., Maffulli et al., 2010).

In the second part of this chapter, the necessity for health promotion in the school setting was discussed from the perspective of sport pedagogy (see section 2.2.1). It was concluded that the school is a highly suitable setting for students' health promotion due to a number of reasons such as the students' young age, the fact that a population wide sample can be reached through the school, and the large amount of time young people spend in school. Therefore, health promotion is one of the central objectives of PE that is also part of the PE curriculum. Theories as well as empirical findings on how to address students' health in PE are of crucial importance for the design and evaluation of efficient and high evidence based intervention programmes. Therefore, from the perspective of training science (see section 2.2.2), the theories and methods that need to be applied in order to achieve the optimal effects on young students' fitness levels during the restricted time of PE were discussed. It was concluded that

strength and endurance are the fundamental elements of fitness that need to be addressed in the lessons' content when PE aims to enhance students' fitness (Frey & Hildenbrandt, 1995; Steinmann, 2004). Several theories exist on how to promote these competencies among young people (e.g., soft strength training and one set training were by Deddens and Duwenbeck (2006) and Duwenbeck and Deddens (2003)), but unfortunately, the empirical findings on their promotion within PE are limited. Additionally, it is recommended to use a limited number of equipment and to structure the lesson in order to increase the time students are active but also to provide some theoretical elements to increase students' competence to independently train in the afternoon hours (Balz & Neumann, 2007; Neumann, 2004). Finally, the theories which need to be taken into account in order to implement effective methods that will influence young people's health behaviour beyond PE were subject in the sport psychological discussion (see section 2.2.3). In this course, the psychological determinants of physical activity attitudes, knowledge, motivation, and self-efficacy that were derived from the previously discussed theories and that have been shown to be important modifiable determinants of physical activity in young people were discussed in more detail. These theoretical considerations built the basis for the selection of the relevant psychological variables, which the intervention study of this research project will target to influence.

3 Current Research: School-Based Physical Activity Interventions

In the previous chapter, the undeniable importance of the adoption of an active lifestyle from an early age and the contribution of the school setting in order to do so were discussed in detail. In order to conduct effective interventions it is inevitable to gain an overview over the current state of the empirical research findings in this field. It is important to know what kind of intervention programmes were carried out in the past years and it is also substantial to know which interventions were effective and which were not. Therefore, also for this research project it is essential to systematically view the empirical studies which have been carried out in the past before designing a further empirical study. Consequently, in the following chapter, in a first step, the international literature is systematically reviewed and analysed. This work resulted into a wide ranging systematic review presenting the current status on physical activity school-based intervention programmes carried out internationally and has been in large parts already published in the journal "Psychology of Sport and Exercise" (Demetriou & Höner, 2012). In a second step, a more detailed review on the interventions carried out in Germany that were not included into the systematic review are discussed. These interventions did not fulfil the inclusion criteria for the systematic review but are equally important in order to receive a complete picture of the current status of the empirical research in this field.

3.1 Existing reviews and meta-analyses on health promotion in the school setting

In recent years, the school setting has received special attention in the field of health promotion, and numerous interventions have been carried out as a result (Naylor & McKay, 2009). The rising number of school-based interventions may be explained by several reasons (see section 2.2.1) such as the easy accessibility to children and adolescents and the large amount of time students spend at school (Ribeiro et al., 2010; Yetter, 2009). Consequently, health-promotion is one of the central targets of the PE curriculum (Kurz, 2008a; National Curriculum, 2007). School-based health promoting interventions vary, ranging from programmes that prevent smoking (e.g., Nabors, Lobst, & McGrady, 2007), alcohol consumption (e.g., Lemstra et al., 2010), and excessive weight (e.g., K. C. Harris, Kuramoto, Schulzer, & Retallack, 2009) to programmes that promote physical activity as opposed to inactive lifestyles (e.g., Cale & Harris, 2006). Different kinds of programmes that promote physical activity can be observed. Some programmes consist of only a physical activity component (e.g., an intensified or increased PE; e.g., P. L. Bush et al., 2010; T. L. McKenzie et al., 2004; J. F. Sallis et al., 2003; Slawta & DeNeui, 2010), whereas other programmes consist of only a cognitive component (e.g., transfer of knowledge; e.g., P. J. Bush et al., 1989; Ezendam, Oenema, Van de Looij-Jansen, & Brug, 2007; Frenn et al., 2005). Finally, there are programmes that incorporate both components (e.g., Hollar, Lombardo, et al., 2010;

Macdonald et al., 2007; Naylor et al., 2006; Slootmaker, Chinapaw, Seidell, van Mechelen, & Schuit, 2010).

It is necessary and urgent to systematically review the outcomes of these interventions and to make evidence-based recommendations for practitioners. There have been several meta-analyses and systematic reviews on selected outcome variables or specific populations. For example, K. C. Harris et al. (2009) carried out a systematic review of studies up to 2008 and examined the effects of school-based physical activity interventions on children's BMI. Standiford Brown (2009) reviewed the effects of physical activity interventions published between 1993 and 2008 that were designed specifically for adolescents. De Meester, van Lenthe, Spittaels, Lien, and De Bourdeaudhuij (2009) analysed studies performed between 1995 and 2008 that promoted physical activity among European teenagers. Teufel-Shone, Fitzgerald, Teufel-Shone, and Gamber (2009) reviewed physical activity interventions in studies carried out between 1986 to 2006, that were implemented with American Indian and Alaska native populations in the United States and Canada. The full list of existing systematic reviews and meta-analyses on this topic is presented in table 2. Therefore, in the following part of this research project, a systematic review that evaluates the effects of all school-based interventions with a physical activity component on a broad range of outcome variables on student populations is presented (Demetriou & Höner, 2012).

Table 2 Reviews and Meta-Analyses Concerning Health Promotion in the School Setting (Demetriou & Höner, 2012)

Author	Year	Aim of the Review	K[a]	Type of Review	Setting[b]
Almond & Harris	1998	Interventions to promote health-related PE	27	NR	1
Bailey	2006	Physical education and sport in schools: A review of benefits and outcomes	-	LR	1
T. Brown & Summerbell	2009	School-based interventions that focus on changing dietary intake and physical activity levels to prevent childhood obesity	-	SR	1
Cale & Harris	2006	School-based interventions to promote young people's physical activity	5	RR	1
De Meester et al.	2009	Interventions for promoting physical activity among European teenagers	-	SR	2
Doak, Visscher, Renders, Seidell, & Visscher	2006	Prevention of overweight and obesity	25	R	2
Dobbins, De Corby, Robeson, Husson, & Tirilis	2009	School-based physical activity programmes for promoting physical activity and fitness in children and adolescents aged 6-18	-	SR	1
Flodmark, Marcus, & Britton	2006	Prevention of obesity	24	SR	2
	2000	Prevention of weight gain	11	SR	2

Author	Year	Aim of the Review	K[a]	Type of Review	Setting[b]
J. Harris & Cale	1997	A review of the effectiveness of health-related PE programmes in schools	-	CR	1
K. C. Harris et al.	2009	Effect of school-based physical activity interventions on BMI in children	-	MA	1
Hoehner et al.	2008	Physical activity interventions in Latin America	10	SR	2
Kahn et al.	2002	The effectiveness of interventions to increase physical activity. A systematic review	-	SR	2
Lubans, Morgan, Callister, & Collins	2009	Effectiveness of pedometers in promoting physical activity among youth.	-	SR	2
Matson-Koffman et al.	2005	Policy and environmental interventions that promote physical activity and nutrition for cardiovascular health	-	LR	2
Salmon, Booth, Phongsavan, Murphy, & Timperio	2007	Promoting physical activity participation among children and adolescents	-	NR	2
Sharma	2006	School-based interventions for childhood and adolescent obesity			
Shaya, Flores, Gbarayor, & Wang	2008	School-based obesity interventions	51	LR	1
Standiford Brown	2009	Promoting physical activity amongst adolescent girls	-	R	2
Stone, McKenzie, Welk, & Booth	1998	Effects of physical activity interventions in youth	-	SR	2
Teufel-Shone et al.	2009	Physical activity interventions implemented with American Indian and Alaska native populations in the United States and Canada		SR	2
Timperio, Salmon, & Ball	2004	Evidence-based strategies to promote physical activity among children, adolescents and young adults	-	SR	2
Trudeau & Shephard	2005	Contribution of school programmes to physical activity levels and attitudes in children and adults	-	LR	1
van Sluijs, McMinn, & Griffin	2007	Promote physical activity	57	SR	2
Yetter	2009	Exercise-based school obesity prevention programmes: an overview	-	NR	2

Note. NR=Narrative Review, LR= Literature Review, RR= Review of Reviews, R= Review, SR= Systematic Review, CR= Comprehensive Review, MA= Meta-Analysis.
[a]Number of studies included into the systematic review. [b]Setting of the intervention: 1: school-based; 2: considered also other settings

3.2 A systematic review of international studies

For effective evidence-based interventions to be developed in the future, we need to further understand the differences and effect sizes between an intervention group (IG) and control group (CG) in terms of post-intervention outcome variables. Moreover, we need to examine the underlying mechanisms in the causal pathway between exposure to the intervention and programme effects. Only through such investigations can we answer the three key questions proposed by Michie and Abraham (2004) on behaviour change interventions (i.e., Do they work? How well do they work? How do they work?). In particular, existing reviews on physical activity interventions have not sufficiently addressed the third very challenging question, which relates to the mediating effects of psychological variables, such as self-efficacy or attitudes towards physical activity (Bauman et al., 2002). Examining these variables will offer insight into the underlying mechanisms of the interventions. Furthermore, the effectiveness of interventions needs to be considered in relation to the specific groups targeted (e.g., age and gender) and the study designs chosen (e.g., duration or methodological quality of the intervention). Understanding the influence of these factors will enable the development of behavioural theories and, subsequently, create effective physical activity programmes for health promotion (Bauman et al., 2002).

In the following sections, a systematic review that fills the existing research gap in the field of health-promotion through physical activity in the school setting is presented. The analysis was based on all school-based interventions that were carried out prior to December 2010 and that contained a physical activity component. The aims, designs, and methodological quality of the intervention studies are presented and discussed critically. The effects of the interventions were examined on three target levels: levels of physical activity, potential psychological determinants of physical activity (e.g., attitudes towards physical activity and self-concept), and health and fitness outcome variables (e.g., motor performance and BMI). Further, the effects of specific factors (e.g., age and duration of the intervention) on intervention outcomes were evaluated. Finally, the extent to which the selected intervention studies took into account mediator effects of psychological variables on the students' physical activity levels were examined. This systematic review is conducted to provide the basis for the design and the evaluation of the empirical study of this research project (see chapter 4).

3.2.1 Method

The analytical strategy used was organized based on a modified model proposed by Kahn et al. Kahn et al. (2002) and consisted of three target levels that physical activity interventions aim to change (see Figure 6): the students' levels of physical activity (*behaviour level*), the health and fitness of the students (*health and fitness level*), and the psychological determinants of physical activity (*psychological determinants level*). This model suggests that a systematic manipulation of variables on the *psychological determinants level* may lead to a

positive change on the *behaviour level*, which, in turn, leads to improvements on the *health and fitness level*.

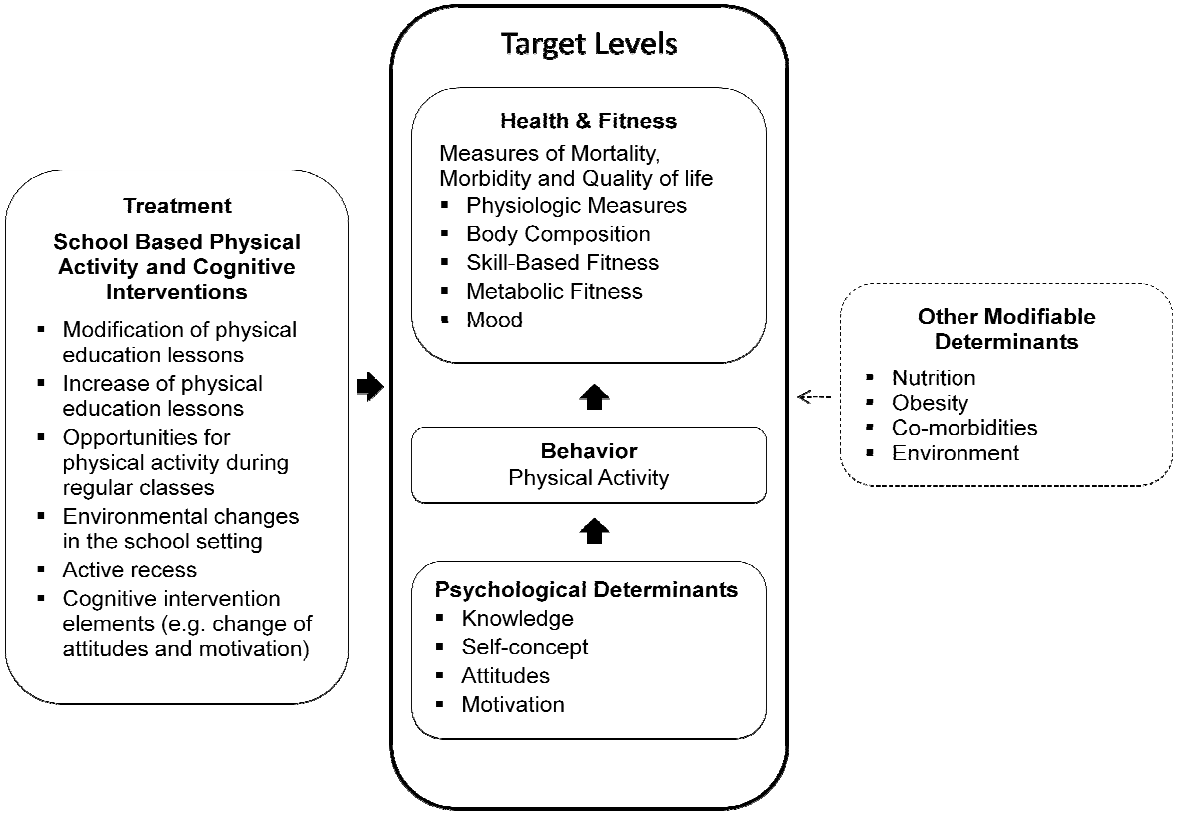

Figure 6 Conceptual Model of the Systematic Review (Adapted by Kahn et al., 2002, in Demetriou & Höner, 2012, p. 187).

3.2.1.1 Selection of studies

A literature search was carried out between July 2008 and December 2010 in the following databases: ISI Web of Knowledge, PsycInfo, MedLine, PsyndexPlus, Academic Search Premier, ERIC and SportDiscus. The search was set on four levels using different keyword (see Table 3). These keywords were combined into formulas with which the search was carried out in the databases (see Table 4).

Table 3 Categories and Keywords for the Literature Search (Demetriou & Höner, 2012, p. 188)

Category	Keywords
Population	children; youth; adolescents; students; pupils; boys; girls
Setting	school; physical education
Treatment method	intervention; training; experiment; program; education; treatment; evaluation
Treatment objective	fitness; exercise; sport; physical activity; exertion

Table 4 Databases and Search Formulas Used to Identify the Studies Chosen for the Systematic Review (Demetriou & Höner, 2012)

Database	Search Area	Search Formula	Hits
MedLine	Abstract & Title	• (Intervention* or training* or experiment* or program* or education* or treatment*) and school* and sport* • (Intervention* or training* or experiment* or program* or education* or treatment*) and school* and physical activit* • (Intervention* or training* or experiment* or program* or education* or treatment*) and school* and fitness* • (Intervention* or training* or experiment* or program* or education* or treatment*) and school* and exertion* • (intervention* or training* or experiment* or program* or education* or treatment*) and school* and exercise*	4357
ERIC	Abstract & Title	• (experiment* or treatment* or evaluation*) and (school* or education*) and (student* or pupil*) and (sport* or exertion* or exercise*) • (intervention* or training* or Program*) and (school* or education*) and (child* or youth* or adolescent*) and (sport* or fitness* or activit*)	806
Academic Search Premier, PsychInfo, SportDiscus, Psyndexplus	Abstract & Title	(Intervention* or training* or experiment* or program* or education* or treatment* or evaluation*) and (school*) and (child* or youth* or adolescent* or student* or pupil* or boy* or girl*) and (fitness* or exercise* or sport* or activit* or exertion*)	12910
ISI Web of Know-ledge	Title, Abstract, Keyw.	(Intervention* or training* or experiment* or program* or education* or treatment* or evaluation*) and (school*) and (child* or youth* or adolescent* or student* or pupil* or boy* or girl*) and (fitness* or exercise* or sport* or activit* or exertion*)	6352

There were two main criteria for study selection: (a) the intervention had to take place in the school setting and (b) the intervention had to consist of a physical activity component implemented during PE lessons or regular school hours. To focus the scope of our review, after-school interventions were not considered because they have already been discussed in detail by Pate and O'Neill (2009). Studies that met these additional criteria were selected for the review: (c) involved *controlled trials* with a comparison between IG and CG, (d) *sampled* students between the ages of 6 and 19, and (e) were journal articles in terms of *publication type*. Note, however, that we excluded books, unpublished studies, and studies that examined specific populations, such as overweight individuals, persons with physical or mental disabilities or students suffering from asthma or diabetes.

The database search retrieved 20428 articles (24425 including duplicates). First, the list of titles was scanned, and 19829 irrelevant articles were excluded. The reference search of relevant reviews and meta-analyses retrieved an additional 86 relevant articles. Next, the abstracts of 685 articles were evaluated, and the full texts of 482 selected studies were retrieved. Finally, studies were analysed to produce a final selection. Altogether, 129 studies fulfilled the inclusion criteria and were included in the systematic review (see Figure 7) (the complete reference list of the 129 selected studies is available in the Appendix).

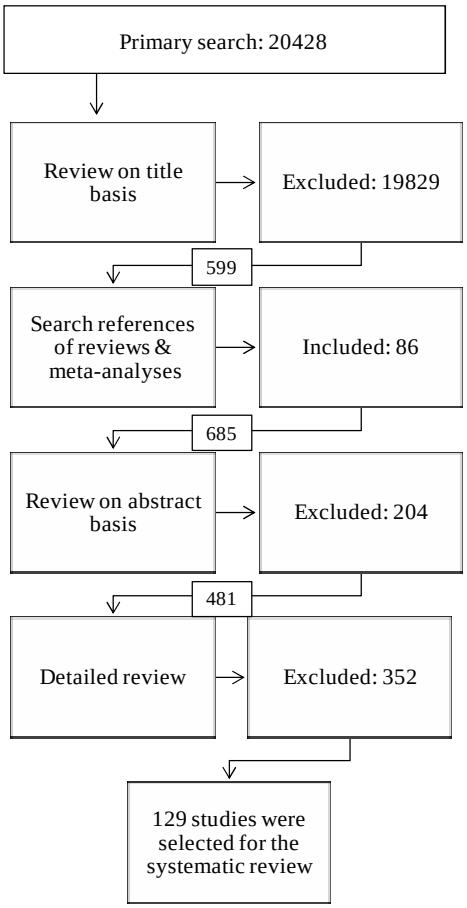

Figure 7 Identification of the Studies Included Into the Systematic Review (Demetriou & Höner, 2012, p. 188).

3.2.1.2 Data extraction

Standardised forms were developed to extract relevant data from the selected studies. The extracted data included the following: author, year of publication, aim of the study, sample description (number of participants, sex, age, and school grade), task of the CG (what kind of programme did they complete?), intervention country, intervention type (physical activity component or a combination of physical activity and cognitive elements), intervention name, description, duration and frequency of the intervention, examined variables and measuring instruments, data analysis (statistical tests), theoretical framework, and study results (differences between IG and CG).

3.2.1.3 Criteria of methodological quality

To maintain a high methodological quality, only controlled studies were included in the review. On the basis of the Cochrane Collaboration and van Sluijs et al. (2007), seven additional criteria were used to create a score that represents the methodological quality of each study (see Table 5). One point was given to a study when a criterion was met, whereas no points were given when a criterion was not fulfilled or when it was not sufficiently described. Studies scoring zero or one points characterize studies with low methodological quality, studies with two to four points were of moderate quality, and studies scoring five or above were of high methodological quality.

Table 5 Methodological Quality Criteria for the Categorisation of the Chosen Studies (Demetriou & Höner, 2012, p. 189)

Item	Description
(A) Pre-Test Analysis	Were the participants' characteristics and central outcome variables analysed before the beginning of the intervention? Were differences between the IG and the CG in these variables statistically controlled in the further analysis?
(B) Randomisation	Were the participants randomised into the IG and CG? Did the randomised sample consist of more than 50 participants or, on the school and class level, of more than 15 schools or classes?
(C) Student dropout rate	Was the student dropout rate in studies with a follow-up up to 6 months less than 20% and in the studies with a follow-up of more than 6 months less than 30%?
(D) Timing of measurements	Did data collection of the IG and CG take place in comparable timeframes?
(E) Blinding outcome assessment	Were the persons collecting the data not informed about the group membership of the participants?
(F) Follow-Up	Was a follow-up measurement realised at a minimum of 3 months after completion of the intervention?
(H) Systematic dropout	Did the dropouts differ from the subjects that completed the intervention?

3.2.1.4 Analysis of selected studies

Due to the heterogeneity of the interventions and outcome measures, a meta-analysis of the selected studies was deemed inappropriate. Critically, the different effect sizes (or the absence of effect sizes) reported in the studies supported the decision to conduct a systematic review. Most frequently the Adjusted Difference (change estimates and 95% CIs for the differences between IG and CG adjusted for stratified variables), Mean Difference (Δ), and Net Effect (IG post - IG pre) – (CG post - CG pre) and Effect size (*ES* or η^2) were used.

The effectiveness of the intervention was examined by considering significant differences between IG and CG in the most frequently examined variables on the three target levels (psychological determinants, behaviour and health and fitness), either immediately after the intervention (t2) or during follow-up periods of a few weeks or months after the intervention (t3). When the physical activity levels of students in the IG remained unchanged and the physical activity levels of students in the CG declined, the effects of the intervention were still considered to be positive. On the *health and fitness level*, BMI and different aspects of motor performance (e.g., endurance, strength, and coordination) were most often examined. On the *behaviour level*, physical activity was the dominant variable. On the *psychological determinants level*, attitudes, knowledge of health, and the effects of physical activity and different aspects of self-concept (self-esteem, emotional self-control, self-efficacy, self-perception, and self-competency) were most commonly assessed. Other variables were measured less frequently and were of minor relevance for this systematic review. To be included in the review, studies had to measure outcome variables on at least one of the three target levels.

Direct comparison of the outcome variables was problematic due to the variety of and inconsistency in the methods used for data assessment across the studies. Different test batteries were used to measure motor performance, and these test batteries varied in the number of components measured and the way in which each component was measured. For example, in some studies, only the participants' endurance was assessed using different tests (e.g., 6-min run and shuttle-run test), whereas a wide spectrum of motor abilities (endurance, strength, coordination, flexibility, and speed) was considered in other studies. Thus, in the analysis, it was focused on the overall change across all measured motor performance components, and the change was considered significant when significant differences were found in more than 50% of these subcomponents. A separate analysis of each motor ability subcomponent was not conducted.

The students' physical activity was defined differently across studies. In most cases, the authors assessed the total amount of MVPA, which consisted of school-related physical activity, time spent on leisure sports, and time spent on active transportation (Christodoulos, Douda, Polykratis, & Tokmakidis, 2006; Haerens, De Bourdeaudhuij, Maes, Cardon, & Deforche, 2007). However, other studies measured only physical activity outside of school

(Baláš & Bunc, 2007) or only physical activity during PE classes (Coleman et al., 2005). Measurement instruments used to assess physical activity varied based on the underlying definition of physical activity chosen by the authors. Given the interventions aimed to increase the level of physical activity in students, it was looked at significant changes in physical activity independent of its definition or measurement instrument (e.g., standardised questionnaire, accelerometer or pedometer). The same procedure was used for variables on the psychological determinants level (e.g., self-concept), which were treated as a coherent construct independent of the questionnaire used.

To analyse the effectiveness of interventions, all 129 studies were first treated as one category. Next, in order to identify the influencing factors and some initial indication of whether these factors can act as moderators on interventions, the following subcategories were examined: age of participants (children ≤12 years/adolescents >13 years), methodological quality (low/moderate/high), type of intervention (physical activity component or a combination of a physical activity component and cognitive elements), duration of the intervention (short term: less than three months; moderate term: four to 12 months; long term: 13 or more months), frequency of the intervention (once per week or less frequent/2-3 times per week/4 times per week or daily). Furthermore, the mediator effects of psychological determinants on the physical activity level and/or outcomes on the health and fitness target level were examined. Examples of intervention studies and their corresponding effect sizes are presented and interpreted based on Cohen's criteria, i.e., small (d = 0.2), medium (d = 0.5), and large effect sizes (d = 0.8) (Cohen, 1992).

3.2.2 Results

Recent years have seen an increase in the number of school-based interventions that used physical activity to promote student health (see Figure 8). In the 1980s and 1990s, 11 and 23 studies were carried out, respectively. In the first decade of the 21st century, the number of studies conducted increased to 94, the majority of which were conducted in North America (55 studies) and Europe (54 studies). Categorising these studies by country showed that most of the studies were carried out in the USA (49 studies) and Great Britain (14 studies).

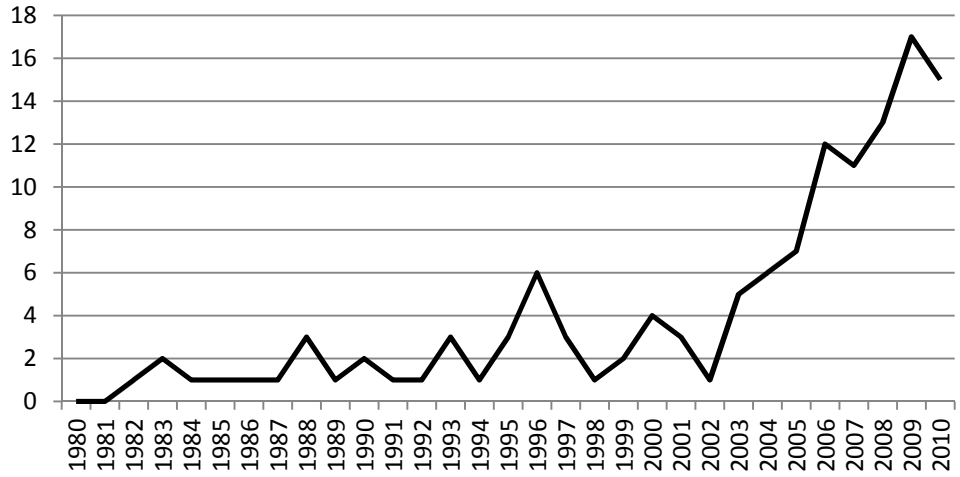

Figure 8 Number of Selected Studies in Each Year (One Publication from the Year 1975 was Omitted) (Demetriou & Höner, 2012, p. 190).

3.2.2.1 Aims and design of the interventions

The interventions focused on different targets in the field of health promotion. On the *health and fitness target level*, interventions pursued the enhancement of cardiovascular health, the prevention of chronic diseases, the enhancement of fitness, the prevention of obesity and improvements of body composition, the prevention of back pain, positive influences on blood lipids and other medical parameters, and an increase in bone density and bone minerals. On the *behaviour target level*, interventions aimed at increasing physical activity levels. Finally, on the *psychological determinants target level*, interventions aimed to improve emotional satisfaction, attitudes towards physical activity and fitness, motivational climate in PE and during physical activity, and goal orientation and enjoyment during physical activity and PE.

In most cases (91 studies, 70.5%), the study *sample* consisted of children aged 6 to 12 years, and only 35 (27.1%) studies investigated adolescents aged 13 to 19. Three (2.3%) studies involved both children and adolescents. Seventy-three (56.6%) studies examined samples larger than 250 participants and 56 (43.4%) studies analysed samples smaller than 250. Finally, 116 (89.9%) studies examined both sexes, 9 (7%) studies examined only girls, and 4 (3.1%) studies examined only boys.

Concerning the type of the *intervention*, 57 (44.2%) of the selected studies consisted of only a physical activity component, whereas 72 (55.8%) studies combined a physical activity and a cognitive component. The physical activity components spanned diverse strategies, such as providing modified PE lessons or additional PE (e.g., Bayne-Smith et al., 2004; Boyle-Holmes et al., 2010; Kain et al., 2004), enriching the material in PE (e.g., Vizcaino et al., 2008), or creating environments conducive to physical activity in the school setting (e.g., Ridgers, Fairclough, & Stratton, 2010).

In terms of aspects related to time, there were 30 (23.3%) short-term studies and 34 (26.4%) long-term studies, with the majority of studies (65 studies; 50.4%) of intermediate duration. Across interventions, the physical activity components were also administered at different frequencies. Most of the studies (42 Studies; 32.6%) administered the physical activity component daily, four (3.1%) studies did so four times per week, 21 (16.3%) studies did so three times per week, 23 (17.8%) studies did so twice per week, and 15 (11.6%) studies did so once per week. Twenty-four (18.6%) studies did not provide precise information on the frequency of the physical activity component.

The studies examined a wide variety of *outcome variables* (see Table 6). On the health and fitness level, BMI (75 studies) and motor performance (66 studies) were examined most often. On the behavioural level, 74 studies analysed the participants' physical activity, whereas 49 studies examined variables on the level of psychological determinants, such as attitudes, self-concept, knowledge, and motivation.

Table 6 Examined Variables in the 129 Selected Studies for the Systematic Review (Number of Studies Examining each Variable) (Demetriou & Höner, 2012, p. 191)

Health and fitness level	Behaviour level	Psychological determinants level
BMI (75) Motor performance (67) Skin fold (31) Blood pressure (23) Body fat (23) Pulse rate (10) Cholesterol (9) VO2 max (8) Hip circumference (11) Fat free mass (7) Self-objectification (1) Social physique anxiety (1) Mineral free lean mass (1) C-reactive protein (1) Fibrinogen (1) Length of tibia (1) FCG (1) Limb circumference (1) Several flexions (1) Carotid intima-media thickness (1) Cardiac structure (1) Diastolic function (1) Glucose (1) Insulin (1) Bone mass (1) Serum thiocyanate (1) Ponderosity index (1)	PA (74)	**Attitudes towards**: PA (11) Health (2) School and homework (1) general affective attitudes (1) **Self-concept**: Self-efficacy (10) Self-perception (4) Self-competence (3) Self-concept (1) Self-esteem (1) **Knowledge**: Health (12) Exercise (5) **Motivation**: Intrinsic (Effort and Enjoyment) (10) Motivation towards PA (3) Perception of the motivational Climate of the lessons (2) Task- and ego-orientation (3) Goal orientation (3) **Other behaviour determinants**: Intentions to be physically active (6) Social support (4) Advantages of PA (2) Barriers towards PA (3) Satisfaction about PA (2) Self-regulation (2) Feelings towards PA (1) Self-control (1)

The outcome variables were measured in different ways across studies. On the health and fitness level, the students' motor performance was often assessed by either a 6-minute run, a 1-mile run or a shuttle-run test, while other studies examined the whole spectrum of motor abilities (endurance, strength, coordination, flexibility, and speed) using various motor tests.

As previously mentioned, physical activity was not defined or measured consistently among the studies. Kriemler et al. (2010) and Marcus et al. (2009) are among the 14 studies that involved the use of an accelerometer to assess MVPA. Nine studies (e.g., Duncan & Staples, 2010; Horne et al., 2009) involved the use of a pedometer. Eight studies involved an observation using the SOFIT instrument (Schutz et al., 1985), and 45 studies involved the use of a standardised questionnaire. For example, the Physical Activity Questionnaire (PAQ) is an 8-item questionnaire used to assess weekly physical activity patterns prior to, during and after school. The PAQ has been found to have acceptable test-retest reliability r = .75 in boys and r = .82 in girls (Clocksin et al., 2009). Colin-Ramirez et al. (2010) used the Student Physical Activity and Nutrition Questionnaire (SPAN) to assess physical and sedentary activities. The questionnaire asks children to indicate the number of days on which they participate in sports activities for at least 20 minutes and the number of days on which they participate in activities that do not require them to breathe hard. P. L. Bush et al. (2010) used the Leisure-Time Physical Activity questionnaire (LTPA) — a seven day physical activity recall questionnaire, whereas Slootmaker et al. (2010) used the Activity Questionnaire for Adolescents and Adults (AQuAA) to measure the students' light, moderate, and vigorous intensity physical activities and time spent being sedentary in the past week. Another example is the Previous Day Physical Activity Recall (PDPAR), which is a self-report instrument widely used in physical activity research and has been shown to be significantly associated with objective accelerometer and heart rate measures of physical activity during after-school activities (Weston, Petosa, & Pate, 1997). The outcome variable for the PDPAR is the percentage of 30-min blocks in which a child spends in MVPA or vigorous physical activity (VPA) after school each day (Dzewaltowski et al., 2009).

Finally, all psychological variables were assessed with standardised questionnaires. Gorely, Nevill, Morris, Stensel, and Nevill (2009) used a subscale from the Physical Self Perception Profile (PSPP-C) to assess the students' perceived physical self-competence and a subscale of the Intrinsic Motivation Inventory (IMI) to measure enjoyment of physical activity. Boyle-Holmes et al. Boyle-Holmes et al. (2010) used a scale specifically developed for their study to measure self-efficacy specific to motor skills (Cronbach´s α =.72) and the 6-item Perceived Physical Activity Competence Scale (α = .69) (adapted from Harter, 1982). Christodoulidis, Papaioannou, and Digelidis (2001) also used two subscales of the Intrinsic Motivation Inventory to measure the students' effort and enjoyment in the PE class, their attitudes toward exercise and sports participation (α = .57), and their intention to exercise and participate in sports (α = .83). Harrabi et al. (2010) used a pre-tested self-administered questionnaire to

assess the pupils' knowledge, behaviour, and intentions related to physical activity, but they did not provide any information about the reliability or validity of the scale.

Only 27 (20.9%) of the 129 studies provided a *theoretical background*. However, some of these studies used more than one theory to guide their empirical analyses. The social-cognitive theory was used the most frequently (18 times), the social-ecological model based on social-cognitive theory was used five times, and the theory of planned behaviour was referenced three times. Some theories (i.e., the transtheoretical model, theory of reasoned action, operant learning theory, goal perspectives theory, adult learning approach, and achievement goal theory) were each used by a single study.

3.2.2.2 Methodological quality

Most of the studies (70.5%) were of moderate methodological quality, 28 studies (20.2%) were of low quality, and only 10 studies (7.8%) (Donnelly et al., 2009; Graf et al., 2008; Gunter et al., 2008; Haerens et al., 2007; Hatzis, Papandreou, & Kafatos, 2010; Hoelscher et al., 2004; Horne et al., 2009; Kriemler et al., 2010; MacKelvie et al., 2003; Pate et al., 2007) were of a high methodological quality. More differentiated insight into the intervention studies was gained (see Table 7) by examining each methodological criterion on its own. Most of the studies adequately applied the criteria *pre-test analyses* (65.9%) and *timing of measurements* (66.7%). In contrast, the *randomisation* criterion was not met by 62% of the studies, and 81.4% did not include a *follow-up* measurement. Some studies did not provide sufficient detail about the students' *dropout rate* (42.6%), the *blinding outcome assessment* (62%), and the *systematic dropout* rate (52.7%). Finally, it is striking that most interventions did not exceed the timeframe of 12 months. Detailed information regarding the methodological quality of each study can be found in the appendix (see Supplemental Table 1).

Table 7 Methodological Quality of the 129 Selected Studies (Number of Studies and Percentages) (Demetriou & Höner, 2012, p. 191)

Item	Criterion fulfilled (1)		Criterion not fulfilled (0)		Not sufficient information given (0)	
(A) Pre-Test Analysis	85	(65.9%)	20	(15.5%)	24	(18.6%)
(B) Randomisation	42	(32.6%)	80	(62%)	7	(5.4%)
(C) Dropout	56	(43.4%)	18	(14%)	55	(42.6%)
(D) Timing of measurements	86	(66.7%)	6	(4.7%)	37	(28.7%)
(E) Blinding outcome assessment	9	(7%)	40	(31%)	80	(62%)
(F) Follow-Up	21	(16.3%)	105	(81.4%)	3	(2.3%)
(G) Systematic drop out	32	(24.8%)	29	(22.5%)	68	(52.7%)

Studies with high methodological quality

In the following section, the ten studies characterised by a high methodological quality are described in more detail in order to present examples of studies that have results of high evidence. Thus, the study sample, design, fulfilled methodological criteria, intervention programme, and results of these intervention studies are presented.

Donnelly et al. (2009) carried out a cluster randomised, controlled trial with the primary aim to promote physical activity and to reduce gains in BMI in elementary school children. A large study sample consisting out of 26 elementary schools including 1527 participating students were randomly assigned to IG or CG. This study fulfilled the methodological criteria concerning pre-test analysis (A), randomisation (B), student dropout rate (C), the timing of measurements (D), and blinding outcome assessment (E) (see Table 7). The IG carried out the programme named "Physical Activity Across the Curriculum" (PAAC) which promoted 90 minutes per week of moderate to vigorous physically active academic lessons, delivered intermittently throughout the school day. PAAC had a duration of three years. The primary outcome measured was BMI and secondary outcomes measured only in a sub-sample were daily physical activity and academic achievement. The results showed no significant difference for change in BMI from baseline to year three between PAAC schools and control schools. Concerning the physical activity levels measured by an accelerometer, it was shown that PAAC students had higher levels in physical activity compared to the CG students during the school day and on weekends. Additionally, significant intervention effects were observed in academic achievement for the composite, reading, math, and spelling scores.

Graf et al. (2008) developed and evaluated the Children's Health Interventional Trial (CHILT) which aimed to promote a healthy lifestyle in primary schoolchildren. Specifically, the aims of the programme were to increase the total energy expenditure from physical activity during school lessons and breaks, to optimize PE lessons, to enhance pupil's health knowledge, and to influence the prevalence of overweight and obesity. Twelve intervention schools and five control schools agreed to participate in the CHILT project. The schools were randomly selected from the same region in Germany. The examinations started at the children's first school year (children's mean age at baseline was 6.8 years) and lasted nearly four years. This project fulfilled the following the methodological criteria: pre-test analysis (A), randomisation (B), student dropout rate (C), the timing of measurements (D), and the follow-up (F) (see Table 7). Examined parameters were children's BMI and motor tests such as lateral jumping, one-legged obstacle jumping, sideways movements, and balancing backwards to assess temporal coordination and a 6-min run to assess the endurance performance of the children. During this intervention, the teachers were asked to give one additional standardised health education lesson per week for about 20 to 30 minutes. Main topics of this lesson were biological background, nutrition, and self-management. Schoolteachers received standardized texts and instructional material for these lessons. In

addition, physical activity breaks of five minutes each, were allowed during lessons every morning, students were provided physical activity opportunities during school breaks, and PE lessons were optimised by training the teachers. At the outset of the intervention, all teachers received a basic training and during the first year, the researchers visited the schools to secure that all aspects were being applied as designed. The results showed no Differences in BMI between intervention schools and control schools. All children improved their coordination and endurance at the follow-up but the increase was higher in the intervention schools. Significant differences in favour of the intervention schools were only found in balancing backwards and lateral jumping.

Gunter et al. (2008) aimed to examine the long term effects of a high-intensity seven-month school-based jumping programme on the growing skeleton. Two participating schools were randomly assigned as an intervention or control school that consisted of 101 and 104 pre- and early-pubertal students respectively. In this study the following methodological criteria were fulfilled: pre-test analysis (A), the timing of measurements (D), blinding outcome assessment (E), follow-up (F), and systematic dropout (H) (see Table 7). Anthropometric measures (standing height, sitting height, leg length, and BMI), biological maturity (measured using peak height velocity), physical activity and nutritional behaviour as well as bone mineral content were assessed at baseline, at seven-month post intervention, and annually thereafter for three consecutive years. Both schools participating in the study followed a similar structure of PE lessons. The lessons consisted of four 30-minute parts with the following components: 1) warm up, 2) fitness development, 3) lesson focus, and 4) closing activity. PE was delivered by a PE specialist three times per week except during holidays. The only difference between the two programmes was the inclusion of the jumping into the fitness part of the PE lesson. Here, the students were progressively trained to reach the maximum of 100 jumps per PE lesson during the first two months of the intervention programme. During the remaining seven months of the school year, children jumped in average 90 to 100 jumps per lesson. A significant intervention effect was found at all bone measurements immediately after the intervention and three years later.

Haerens et al. (2007) and Haerens et al. (2008) carried out a study to evaluate the effects on students' physical activity levels of a middle school-based physical activity intervention that combined environmental and computer components and additionally analysed whether further intervention effects were achieved through parental involvement. Altogether 15 schools including 2840 students in seventh and eighth grades participated in the study and were randomly assigned to the intervention or control conditions: a) Intervention with parental support, b) intervention alone, and c) control condition. The intervention programme lasted one school year and measures were performed at baseline and at the end of the intervention. This study fulfilled the methodological criteria concerning pre-test analysis (A), randomisation (B), student dropout rate (C), the timing of measurements (D), follow-up (F), and systematic dropout (H) (see Table 7). Data of students' physical activity levels were

determined using the Flemish Physical Activity Questionnaire and accelerometers in a sub-sample of 258 students. Further, weight and height were assessed and BMI and BMI-z-scores were calculated. Additionally, psychological determinants of physical activity behaviour (intentions, attitudes, self-efficacy, social support, knowledge, benefits and barriers related to physical activity) were also examined. The intervention focused on increasing levels of MVPA to at least 60 minutes per day. Thus, the intervention schools changed their physical environment by creating more opportunities to be physically active during breaks, at noon or after school hours. The content of the physical activities varied and non-competitive activities were included to reach less skilled students. Additionally, extra sports materials were made available. In five of the ten intervention schools, additional efforts aimed at creating a supportive social environment for healthy behaviours outside school through parental involvement. During classes all children had to cycle for ten minutes on a computerized cycle ergometer. Three times a year, information on healthy food and physical activity was published in the school paper and newsletters for the parents. Furthermore, parents were invited to attain an interactive meeting on the relationship of physical activity and health. Finally, information was provided by supplying all parents with a free CD.

School-related physical activity increased significantly more in the IG with parental support and the IG without parental support, when compared to the CG, where it remained stable. For "self-reported leisure time active transportation", a significant gender-by-condition interaction effect was found. In boys, there were no significant differences. Among girls, leisure time active transportation remained stable in the IG without parental support, while it significantly decreased in average four minutes daily in the CG. Physical activity of light intensity significantly decreased on average 21 minutes daily in the IG with parental support while in the CG it decreased on average 57 minutes daily. MVPA increased four minutes daily, on average, in the IG with parental support, while it decreased almost seven minutes daily in the CG. In girls, after one year of intervention, there was a trend for a significant lower increase in BMI in the IG with parental support when compared with the CG. After two years of intervention, there was a significantly lower increase in BMI and BMI z-score and a trend for a significantly lower increase in BMI in the IG with parental support when compared with the IG without parental support. Additionally, the IG without parental support when compared to the CG appeared to have significant negative effects on changes in attitudes, self-efficacy for physical activity at home, perceived health benefits, and perceived environmental and motivational barriers. On the other hand, significant positive intervention effects were observed on changes in self-efficacy for physical activity at school in the IG with parental support compared to the CG. Furthermore, it was examined whether the psychological variables measured had mediating effects on physical activity change. In the IG without parental support there were no mediating effects but suppression effects on attitudes, self-efficacy, perceived benefits, and perceived barriers on changes in total physical activity and leisure-time physical activity were found. Attitudes, perceived benefits, and perceived barriers

also suppressed the intervention effects of the IG without parental support. In contrast, in this group, self-efficacy for physical activity at school partly mediated the intervention effect on total and school related physical activity.

Hatzis et al. (2010) examined the long-term effects of a school-based health education programme in Crete. During the school year 1992-1993, a six-year health and nutrition education programme was launched with the aim to educate students on nutrition, physical activity, and avoidance of toxic substances. The programme was evaluated three (Manios, Moschandreas, Hatzis, & Kafatos, 1999) and six years (Manios et al., 2002) after its initiation. Ten years after the intervention, an evaluation of the long-term effects of the programme was carried out. At the beginning of the intervention programme in 1992, the total population of first grade students from three counties of Crete took part at the study, which resulted in 63 schools. The two counties including 4171 first grade students participated at the programme and the 1510 pupils in the third county served as controls. In this study the following methodological criteria were fulfilled: pre-test analysis (A), randomisation (B), student dropout rate (C), the timing of measurements (D), follow-up (F), and systematic dropout (H) (see Table 7). The intervention programme was based on the "Know your Body" intervention and was adjusted to the needs of the Mediterranean nutrition and culture. Workbooks were developed and given to each student that included the topics healthy diet, physical activity and fitness, dental health hygiene, smoking, and accident prevention. The teachers were provided with support for the teaching methods to be used in the content of the programmes. The physical fitness components of the intervention programme included theoretical elements taught in four to six hours per year and practical lessons of two 45-minute PE sessions per week. Parents were invited to attend educational meetings covering nutritional, physical activity, and health issues. During the academic year 2001-2002, examinations were carried out to analyse the long-term effects of the programme by assessing students' data on anthropometric measures, arterial blood pressure, biochemical examinations, physical fitness indices, dietary and health knowledge scores. Additionally, behavioural factors of smoking, alcohol, and coffee consumption as well as diet and physical activity were assessed by a questionnaire. The study results revealed a positive picture of the long-term effects of the programme. The decrease in total cholesterol levels was significantly more in the IG compares to the CG. There were no significant differences in blood pressure between the two groups. BMI increased significantly more in the CG compared to the IG while the changes in waist circumference and the number of shuttle-run stages did not significantly differ between the groups. Furthermore, the IG showed a higher consumption of carbohydrate, monounsaturated fatty acids, folic acid, vitamin C, and vitamin B2 compared to the CG. On the other hand, the CG students had a lower total energy and trans fatty acids intake.

T. L. McKenzie et al. (1996) carried out the largest intervention study ever sponsored by the National Heart, Lung, and Blood Institute of the U.S. in this field with the aim to examine the effects of a two and a half years programme on students cardiovascular health. The Child and

Adolescent Trial for Cardiovascular Health (CATCH) was a multi-component, multicenter trial aiming to positively influence diet, physical activity, and non-smoking among third through fifth grade students in the USA. CATCH PE was designed to improve existing PE classes, primarily by providing ample opportunities for all students to be more physically active. Additional physical activity was created by providing recommendations for lessons, activities, and equipment and by assisting teachers to improve instructional and management techniques. The goals were to promote children's enjoyment of and participation in moderate-to-vigorous physical activity (MVPA) during PE classes and to provide skills to be used out of school and throughout life. Therefore, all schools participating in the intervention agreed to provide at least 90 minutes of PE spread over a minimum of three sessions per week. Altogether, 96 public elementary schools participated at the study. After baseline, 24 schools at each centre (San Diego, New Orleans, Minneapolis, Austin) were randomized into control and intervention schools. Further on, intervention schools were randomized into two conditions: school-based intervention and school-based plus family intervention. Control schools continued their usual PE programmes. Also in this study most of the methodological criteria were fulfilled: pre-test analysis (A), randomisation (B), student dropout rate (C), the timing of measurements (D), follow-up (F), and systematic dropout (H) (see Table 7). Risk factor measures such as serum lipid, lipoprotein, and apolipoprotein-B, BMI, subscapular skinfolds, and blood pressure were measured (Webber et al., 1996). Additionally, a nine minute distance run, self-administered physical activity checklist (SAPAC) and systematic PE lesson observations were carried out. The study results on the risk factor measures showed a significant ethnicity by IG interaction on BMI. For Caucasian and Hispanic children the change in BMI was similar in both groups. IG African-American students had a higher increase in BMI compared to the CG. There were no significant differences in both triceps and subscapular skinfold. Finally, there were no significant Differences in serum lipids, lipoproteins, and apolipoproteins between the two groups. A total of 2096 PE lessons were systematically observed using the SOFIT instrument. The programme significantly increased the time students spent in walking, very active physical activity and MVPA. Compared to controls, children in intervention schools had a higher estimated energy expenditure and a higher energy expenditure rate per lesson. There was no statistically significant difference in the number of yards completed during the nine minute run between the two groups. Based on the self- administered physical activity checklist (SAPAC) children in intervention schools reported engaging in significantly more vigorous physical activity minutes and MET-weighted vigorous minutes per day than controls.

Horne et al. (2009) designed and evaluated an intervention study including peer modelling, rewards and pedometer-feedback with the aim to increase students' physical activity. Participants were 47 students from the intervention school and 53 students from a matched control school aged nine to eleven years. In this study the methodological criteria concerning pre-test analysis (A), student dropout rate (C), blinding outcome assessment (E), follow-up

(F), and systematic dropout (H) were fulfilled (see Table 7). The intervention programme lasted eight days in which the IG children heard a song by the "Fit n' Fun Dudes" which were presented as cool and physically active students. Additionally, the children received a letter from these Dudes telling them to be more physically active in terms of increasing their daily step counts by 1500 counts compared to their baseline values. If they achieved this target they would receive a reward as for example a ball or a frisbee. After this first part of the programme, a maintenance phase lasting eleven weeks was included with the aim to gradually reduce the extent of students' extrinsic motivation towards physical activity. Here, the students were encouraged to maintain their increased activity levels and to keep track of their step counts in a Fit n' Fun diary. Additionally to the measurement of children's physical activity levels via pedometers, students' BMI levels were assessed. IG girls significantly increased their step counts during the intervention and at the follow-up. In boys, there was a significant difference in favour of the IG during the intervention time but there was no significant difference during the follow-up. Unfortunately, no information was provided on changes in BMI.

Kriemler et al. (2010) examined the effects of a one year school-based physical activity programme (KISS) on fitness, adiposity, and quality of life in primary schoolchildren. Altogether 28 classes in Switzerland were randomly assigned to an intervention (n=16) and a control (n=12) group. This resulted into a sample group of 502 children participating in the study. In this study all of the methodological criteria were fulfilled (except of a follow-up measurement (F)): pre-test analysis (A), randomisation (B), student dropout rate (C), the timing of measurements (D), blinding outcome assessment (E), and systematic dropout (H) (see Table 7). Children in the IG received two additional PE classes per week that were prepared and structured by a team of PE experts and all IG classes received the same curriculum. Daily three to five short activity breaks comprising motor skill tasks such as jumping or balancing on one leg, power games, and coordinative activities were carried out. Additionally, physical activity homework was assigned to the students. The intervention programme lasted nine months. Data on children's body fat (sum of skinfolds, BMI), aerobic fitness (shuttle-run test), physical activity (accelerometer), quality of life, and a cardiovascular risk score were collected. The study results revealed that IG students showed a smaller increase in their skinfold thickness by 0.12 z-score units corresponding to about 2-mm. IG children also increased their physical fitness values in the shuttle-run test of about 5% of their mean baseline values. Also the changes in the amount of physical activity increased significantly greater in the IG from baseline to follow-up in an average of eleven additional minutes per day. Quality of life did not change in the two groups.

MacKelvie et al. (2003) and Mackelvie, McKay, Khan, and Crocker (2001) carried out a study to investigate the changes in bone mineral content (BMC) and areal density (aBMD) in prepubertal boys. Thus, they evaluated the effects of a seven month randomised school-based jumping intervention. The study sample consisted of 14 schools including 383 children form

grades four, five, and six between the age of 8.8 to 11.7 years. This study fulfilled the following five methodological criteria: pre-test analysis (A), randomisation (B), student dropout rate (C), the timing of measurements (D), and systematic dropout (H) (see Table 7). The intervention programme consisted of a high-impact, weight-bearing exercise session in form of a circuit made up of five activities from a total of nine exercises provided to the teachers. All exercises consisted of jumping elements such as jumping jacks, lunge jumps, hopping, or jumping over various obstacles. The programme was carried out twice a week during regular PE and one more time on one other occasion during school hours. The control schools carried out a 10-minute stretching warm-up at the beginning of PE and a stretching break once during the week. Numerous parameters were assessed to determine bone mineral. BMC (g) for the total body (TB), and BMC and aBMD (g/cm2) for the lumbar spine (LS) and proximal femur (PF) and its femoral neck (FN), and greater trochanter (TR). Furthermore, height and weight were measured and students' calcium intake and physical activity levels were assessed by a questionnaire. In boys, there were no significant differences between the two groups in height, weight, lean mass, fat mass, physical activity, or calcium. There was a significant difference in the TB BMC in favour of the IG. In girls, there was no significant difference in bone parameters between the IG and the CG. In the subgroup of the early pubertal girls a significant intervention effect could be observed.

Finally, the research group by Pate et al. (2007) evaluated an intervention to promote physical activity levels among high-school girls. The study sample consisted of 24 high schools (2744 girls) that were randomised into the IG and the CC. Also this study fulfilled most of the methodological criteria: pre-test analysis (A), randomisation (B), student dropout rate (C), the timing of measurements (D), follow-up (F), and systematic dropout (H) (see Table 7). A comprehensive physical activity intervention (Lifestyle Education for Activity Program - LEAP) was designed to change the instructional programme and the school environment to increase support for physical activity among girls. It consisted of 6 components: PE, health education, school environment, school health services, faculty/ staff health promotion and family/ community involvement. The LEAP PE was designed to enhance physical activity self-efficacy and enjoyment, to teach the physical and behavioural skills needed to adopt and maintain an active lifestyle and to involve girls in moderate-to-vigorous physical activity during 50% or more of PE class time. The LEAP health education lessons taught girls the skills necessary for adopting and maintaining a physically active lifestyle. The environmental channel was designed to create a school environment that supported physical activity among girls. Additionally, the school environment was changed to support physical activity among girls through role modelling by the staff and increase communication on physical activity. Girls' physical activity levels were assessed using the 3-Day Physical Activity Recall questionnaire. The students were asked to report the predominant activity they performed during 34 30-minute intervals such as sleeping, eating, hobbies, and physical activity. Translating this information into METs the duration of moderate-to-vigorous physical activity

could be determined. Height and weight were measured to calculated girls BMI levels. At follow-up the ANCOVA showed that the prevalence of regular vigorous physical activity was greater in the LEAP intervention schools than in the control schools. BMI levels did not differ between the two groups.

3.2.2.3 Effectiveness of the interventions

First, the effectiveness of the interventions included in this systematic review was evaluated in terms of variables at three target levels. These variables included BMI, motor performance, physical activity, knowledge, self-concept, and attitudes. Most of the interventions achieved significant effects on motor performance (69.7%), physical activity (56.8%), and knowledge (87.5%). Table 8 shows the number of studies examining each variable and the percentage of positive, negative, and non-significant differences between IG and CG.

At the *health and fitness level*, 21 (28%) of the 75 studies examining student BMIs observed a positive difference between the IG and the CG. For example, Chavarro, Peterson, Sobol, Wiecha, and Gortmaker (2005) showed that after two school years, the BMI of girls attending intervention schools increased less than that of CG girls (adjusted difference (AD) -0.30 kg/m^2; 95% CI -0.5; -0.1). Similarly, Barbeau et al. (2007) observed an AD of -0.45 kg/m^2 (95% CI 0.79; -0.12). Taylor et al. Lemstra et al. (2010) observed that the children's BMI z-score was significantly lower in the IG than in the CG by a mean of 0.09 (95% CI 0.01; 0.18) after one year and 0.26 (95% CI 0.21; 0.32) after two years. Only two studies reported a negative effect on BMI in the IG. Specifically, Katz et al. Katz et al. (2010) found an increase of 0.3 in the IG, whereas the CG showed an BMI increase of only 0.1. The difference between the two groups was statistically significant in favour of the CG. Regarding motor performance, 69.7% of the studies achieved positive differences in favour of the IG, with no negative effects resulting from the interventions. Boyle-Holmes et al. Boyle-Holmes et al. (2010) reported small effect sizes ranging from $d = 0.11$ to $d = 0.40$ concerning the improvement on motor skills in the IG compared to that in the CG. Barbeau et al. (2007) showed significant improvement on cardiovascular fitness (mL/kg per min) in favour of the IG (adjusted change 1.57; 95% CI 0.22; 2.92), and J. F. Sallis et al. (1997) reported a small effect size of $d = 0.3$ in terms of time taken for a one-mile run and the number of sit-ups accomplished per minute in the girls group.

On the *behavioural level*, 74 studies examined student physical activity. Forty-two studies (56.8%) reported positive results in favour of the IG, whereas five studies (6.8%) reported a negative effect. Christodoulos et al. (2006) observed moderate differences in favour of the IG in OMVPA ($\eta^2 = 0.07$), whereas Lubans and Sylva (2006) found a significant effect on MVPA (min/week) in favour of the IG with a small effect size of $d = 0.12$. In a study by Donnelly et al. Donnelly et al. (1996), the CG showed an approximate 20% increase

(compared to the previous semester) in physical activity outside of the classroom, whereas the physical activity of the IG fell by 16%.

On the *psychological determinants level*, 87.5% of the 16 studies examining student knowledge found positive results. Hopper, Munoz, Gruber, and Nguyen Hopper, Munoz, Gruber, and Nguyen (2005) reported strong effect sizes (η^2 = 0.66) in favour of the programme schools in terms of the students' knowledge. In the study by Arbeit et al. (1992), students attending intervention schools showed an 22% increase in knowledge compared to a 13% increase for students attending control schools. Students' attitudes about physical activity and health were measured in 16 studies. Seven studies showed positive effects of the IG compared to the CG, whereas two studies reported negative effects. Stock et al. Stock et al. (2007) showed that health attitude scores increased significantly for the IG but not for the CG (mean: 4.7; 95% CI 2.7; 6.6). In terms of self-concept, six studies examining relevant variables reported positive results. Bonhauser et al. (2005) reported a 7.17 point difference in the self-esteem scale (95% CI 4.43; 9.91), reflecting a 2.3% increase for the IG and 0.1% decrease for the CG. Finally, only 4 of 14 studies that measured enjoyment or motivation towards physical activity reported significant results in favour of the IG (Gorely et al., 2009; Kouli, Rokka, Mavridis, & Derri, 2009; Wallhead & Ntoumanis, 2004).

Table 8 Percentage of Positive, Negative and Non-Significant Effects (Demetriou & Höner, 2012, p. 192)

Variable	positive	negative	no effect
BMI (75)[a]	28.0%	2.7%	69.3%
Motor Performance (66)[a]	69.7%	-	30.3%
Physical Activity (74)[a]	56.8%	6.8%	36.4%
Knowledge (16)[a]	87.5%	-	12.5%
Self-concept (20)[a]	30.0%	-	70.0%
Attitudes (16)[a]	43.8%	12.5%	43.7%

[a]Number of interventions examining this variable.

3.2.2.4 Effectiveness of specific groups of interventions

To examine factors influencing intervention outcomes and to get an initial sense of whether these factors can act as moderating variables, the studies were divided into several subcategories according to the participants' age and the methodological quality, type, duration, and frequency of the interventions (see Table 9). In the category *age* (children/adolescents), three studies were excluded because they included both children and adolescents. In the category *intervention frequency*, 24 studies did not provide sufficient information and were excluded from the analysis.

The nature of the sample and the type of intervention used were important factors associated with positive changes in student *BMI*. Studies involving adolescents achieved significant

differences between IG and CG more frequently (35.3%) compared with studies involving children (25.9%). Furthermore, studies consisting of both a physical activity and a cognitive component were more likely (35.3%) to result in reduced BMI levels than were studies consisting only of a physical activity component (22.6%). Consistent with other reviews (Bize et al., 2007; Conn, Hafdahl, & Brown, 2009), studies of low methodological quality reported significant results (41.7%) more frequently compared to studies of moderate (24.5%) or high methodological quality (30%). Long-term studies (5.9%) and studies in which the intervention was applied more than three times per week (6.9%) reported negative effects on BMI levels. In particular, studies involving children, studies consisting of only a physical activity component and studies with a high frequency of the physical activity component reported positive effects on the students' *motor performance* 76.5%, 78.4%, and 80% of the time, respectively.

With regard to levels of *physical activity*, interventions with both a physical activity and a cognitive component tended to influence the students' levels of physical activity more strongly. Interventions that examined physical activity and consisted of only a physical activity component (12.5%) or those that occurred for only a short duration (10.5%) reported significant effects on student physical activity in favour of the CG. Positive effects on physical activity were found at similar frequencies across studies examining children (58.8%) and those examining adolescents (52.2%).

On the *psychological determinants level*, all studies measuring self-concept and the students' knowledge about the effects of physical activity showed significantly larger improvements in post-intervention scores on these variables for students in the IG compared to students in the CG. Studies involving adolescents were in a better position to induce a positive change on the students' self-concept. Finally, student attitudes towards physical activity were not always positively influenced by the interventions. In particular, long-term studies seemed to have a negative impact on the students' attitudes towards physical activity (33.3%). The detailed information of the results of each study included into this review can be found in the appendix (see Supplemental Table 2a, 2b, and 2c).

Table 9 Percentage of Studies with Significant Effects Concerning the Central Variables (Demetriou & Höner, 2012, p. 192)

		BMI			Motor Performance			Physical Activity			Knowledge			Self-concept			Attitudes		
		N[b]	pos (%)	neg (%)	N[b]	pos (%)	neg (%)	N[b]	pos (%)	neg (%)	N[b]	pos (%)	neg (%)	N[b]	pos (%)	neg (%)	N[b]	pos (%)	neg (%)
Age[c]	Children (91[a])	58	25.9	3.4	51	76.5	_	51	58.8	5.9	11	100	_	11	18.2	_	8	37.5	12.5
	Adolescents (35[a])	17	35.3	-	15	46.7	_	23	52.2	8.7	5	60	_	9	44.4	_	8	50	12.5
Meth. quality	Low (28[a])	12	41.7	-	16	50	_	12	66.7	-	2	50	_	5	20	_	4	50	-
	Moderate (91[a])	53	24.5	3.8	47	74.5	_	53	52.8	9.4	12	100	_	13	30.8	_	11	45.5	9.1
	High (10[a])	10	30	-	3	100	_	9	66.7	-	2	50	_	2	50	_	1	-	100
Interv. type	Physical (57[a])	31	22.6	3.2	37	78.4	_	24	50	12.5	-	-	_	3	33.3	_	5	20	20
	Physical & Cognitive (72[a])	44	31.8	2.3	29	58.6	_	50	60	4	16	87.5	_	17	29.4	_	11	54.5	9.1
Interv. duration	Short term (30[a])	16	12.5	-	15	66.7	_	19	47.4	10.5	4	100	_	6	50	_	2	50	-
	Middle term (65[a])	42	35.7	2.4	36	77.8	_	35	68.6	5.7	7	100	_	6	33.3	_	8	37.5	-
	Long term (34[a])	17	23.5	5.9	15	53.3	_	20	45	5.0	5	60	_	8	12.5	_	6	50	33.3
Interv. freq. (per week)[d]	≤ Once (15[a])	7	28.6	-	6	50	_	11	63.6	-	3	66.7	_	5	40	_	-	-	-
	2-3 times (44[a])	28	25.0	-	24	70.8	_	23	43.5	8.7	7	100	_	5	20	_	6	83.3	-
	≥4 times (46[a])	29	27.6	6.9	25	80	_	25	68.0	4	4	75	_	7	14.3	_	8	12.5	25

[a]Number of studies carried out in that category. [b]Number of studies examining this outcome variable, respectively. [c]Three studies were excluded because they analysed both children and adolescents at the same time. [d]Twenty-four studies that did not provide information regarding the frequency of the intervention were excluded from this analysis.

3.2.2.5 Effects of psychological mediators

For the analyses of mediator effects of psychological determinants at the behavioural level and the health and fitness level, studies must assess outcome variables on these target levels. Nineteen (14.7%) of the 129 studies examined variables on all three target levels, and 34 (26.3%) studies assessed variables on two target levels. The effects of the studies on the key outcomes examined in this review did not differ between studies analysing variables on all three target levels and the other studies.

Only three of the studies selected for this review specifically analysed the mediator effects of psychological variables on student physical activity levels. Haerens et al. (2008) assessed variables on all three outcome levels and examined the mediator effects of psychosocial determinants of physical activity (attitude, social support, self-efficacy, perceived benefits, and barriers) on changes in physical activity in a 1-year prospective intervention study that included programmes with and without parental support. Only self-efficacy in physical activity at school was found to partially mediate the effect of the intervention on total and school-related physical activity change in the IG with parental support. None of the other potential mediators showed positive effects, whereas a suppressor effect was found for attitudes. Given that the effects of self-efficacy and attitudes operated in opposite directions, the total mediated effects of the intervention were not statistically significant. When comparing the intervention programme without parental support with the CG, negative effects were observed on changes in attitudes, self-efficacy for physical activity at home, perceived health benefits, and perceived environmental and motivational barriers. Jurg, Kremers, Candel, van der Wal, and De Meij (2006) assessed outcome variables on two outcome levels and examined the mediator effects of social-cognitive determinants (awareness, attitude, encouragement, descriptive norm (social modelling), self-efficacy, intention, and habit) on the causal pathway between exposure to the intervention and levels of physical activity in children. The intervention successfully promoted physical activity only among primary school children attending sixth grade, and no significant mediator effects were found in this grade. Dishman et al. (2004) evaluated the effects of a school-based multi-component intervention (Lifestyle Education for Activity Program) aimed at increasing physical activity and fitness among adolescent girls in 24 high schools. Researchers assessed outcome variables on all three levels and examined mediator effects of cognitive constructs drawn from social cognitive theory (self-efficacy, outcome-expectancy value, goal setting, and satisfaction). The intervention resulted in statistically significant but small direct effects on self-efficacy, goal setting, and physical activity. Self-efficacy, outcome-expectancy value, and satisfaction were found to have statistically significant direct effects on physical activity. Thus, results confirmed the hypothesis that self-efficacy partially mediated the effect of the intervention on physical activity.

3.2.3 Discussion of the results

In recent years, there has been an increase in the number of research studies examining the effectiveness of school-based physical activity interventions on promoting student health, and much has been accomplished. This systematic review provides detailed information on the aims and designs of school-based interventions with a physical activity component. Furthermore, the effectiveness of the reviewed studies on three target levels as well as the influence of specific factors (e.g., age, gender, and study design) on the interventions' level of evidence was examined. Finally, the mediating effects of psychological variables on physical activity were analysed. Thus, this review provides invaluable information that may guide the development of future programmes in the school setting to improve the health of children and adolescents.

Most of the studies included in this review met two to four of seven methodological quality criteria and were of a moderate methodological quality. The categorisation of studies into groups of low, moderate, and high *methodological quality* was based on normatively chosen criteria. Results regarding methodological quality may be different had other criteria been chosen. It is clear that some of the criteria may be challenging to achieve in the school setting. For example, it may be difficult to achieve randomisation across classes within each school, given that IG students might transmit relevant treatment information to CG students. Furthermore, teachers might have to teach students from both the IG and CG at the same time. Thus, it is questionable as to whether the lesson content of the CG was influenced by the treatment (Flay & Collins, 2005). Thus, the problem of contamination may be less relevant when randomising across the school level, but such studies, which include multiple schools, also take much more effort to implement compared to studies involving only randomisation across the individual or class level. A related problem that has received relatively little attention from researchers is treatment integrity, that is, the degree to which an intervention was implemented as intended. The interpretation of results rests on the assumption that the intervention was carried out as it was designed. Compromised integrity can lead to serious biases in interpretation (Wilkinson, 2006). Very few studies (e.g., Hollar, Messiah, et al., 2010; Slootmaker et al., 2010) document and discuss the extent to which the treatment was carried out as intended.

Another inherent and hitherto unsolved problem is the accurate *assessment of* the levels of *physical activity*. In the reviewed studies, the students' levels of physical activity were most often based on the participants' subjective reports assessed by a wide variety of physical activity questionnaires. The reported reliability of the used questionnaires varied (moderate to good), but many authors did not provide the exact reliability of the questionnaires. In other words, little attention has been given to the validity of these instruments. As already stated in section 2.1.2 it is challenging to clearly describe the validity of physical activity questionnaires, as a golden standard simply does not exist. Thus, it is necessary to validate

subjective reports of physical activity by simultaneously gathering data using more objective measures, e.g., from accelerometers, pedometers, and heart rate monitors.

To review the effectiveness of school-based interventions with a physical activity component, a modified model by Kahn et al. (2002) was used as a grid of analysis (see Figure 6). The effectiveness of the interventions on the *health and fitness target level* was especially evident in terms of motor performance, given that 69.7% of the studies examining this variable had a significant positive effect in favour of the IG. This may also be explained by the fact that most studies measured endurance or strength that was closely associated with the intervention itself. Intervention effects on BMI appeared to be limited, with only 28% of the studies that assessed the students' BMI achieving significant positive effects. This is consistent with recent findings in the meta-analysis of K. C. Harris et al. (2009). To bring about reductions in BMI, complex, multi-structured longitudinal interventions are required. The reason for the small influence of the interventions may be explained by the fact that the target groups were not overweight children and, in most cases, BMI reduction was not a predominant aim of the study. Furthermore, the validity of the BMI as an indicator of weight status in children and adolescents should also be discussed, taking into account the possibility that a formula based on height and weight might make too simplistic assumptions about distribution of muscle and bone mass (Burkhauser & Cawley, 2008).

On the *behavioural level*, interventions had a considerable positive effect on student physical activity. About 56.8% of the studies measuring physical activity achieved a significant positive effect in favour of the IG. In particular, when physical activity enhancement was the primary aim of the study, small to medium effects were achieved (e.g., Haerens et al., 2008). These results are promising and show that interventions in the school setting can influence student physical activity. Yet, we should need to consider the 6.8% of the studies measuring physical activity that led to a reduction of physical activity in the IG compared to the CG. Although a negative impact on student physical activity occurred only in few studies (students in the CG achieving higher levels of physical activity compared to the IG), this finding needs to be viewed critically. Whereas these negative effects may be a consequence of measurement bias, they may also come from increased psychological pressure resulting from the intervention, which, as a consequence, might lead to an aversion towards physical activity. However, it must be emphasised that these are only assumptions and, on the basis of the information given in the studies, no conclusions can be drawn concerning the cause of negative impact.

On the *psychological determinants level*, the review shows that 87.5% of the studies examining knowledge about health issues and the effects of physical activity achieved a positive effect on this variable. Some negative effects, with students from the CG demonstrating more positive attitudes towards physical activity than students from the IG, were observed. The fact that only a small number of interventions positively influence the

students' self-concept must be taken seriously, with the mechanisms of the interventions reconsidered critically.

This review shows that the participants' age, type of intervention (only a physical activity component vs. a combination of a physical activity and a cognitive component), frequency and duration of the intervention studies, and methodological quality had an impact on the intervention effects. Variables, such as gender or the participants' fitness level, must be further analysed to design and implement programmes tailored to different groups and, thus, achieve optimal intervention effects in the future. It needs to be considered that although decreases in student physical activity levels and health motivate most health-promotion interventions, most studies do not examine samples consisting of students with low physical activity levels as a separate group. Usually, all students are treated as one group independent of their initial physical activity levels, with the statistical analysis of results based on mean scores. This might lead to interpretation bias because students who vary in initial fitness level may respond differently to the treatment.

According to Michie and Abraham (2004), intervention studies need to address three key questions (Do they work? How well do they work? How do they work?) to provide effective evidence-based interventions in the future. In this review, the first question was answered adequately by presenting the significant differences between IG and CG on the outcome variables. In particular, interventions had a considerable influence on the students' motor performance (69.7%), physical activity (56.8%), and knowledge (87.5%). The second question could not be answered to a satisfactory extent, given that the majority of studies did not provide information about effect sizes. On the basis of the few effect sizes reported, it was observed that the interventions tended to yield small to medium intervention effects on the outcome variables. Finally, the third question requires an understanding of the causal processes and mechanisms underlying psychological changes that account for the observed behavioural change (H. Brown, Hume, & ChinApaw, 2009). Due to the small numbers of studies examining outcome variables on all three target levels, the results of our analysis of *mediator effects* of psychological determinants on physical activity must be interpreted with caution. Haerens et al. (2008) and Dishman et al. (2004) confirmed that self-efficacy mediated the causal pathway between intervention and the students' physical activity levels. None of the other psychological determinants examined lent support to the hypothesis that changes in physical activity behaviour can be mediated through psychological determinants of physical activity. In future studies, a stronger focus should be placed on the investigation of these mediator effects. Specifically, research should clarify the extent to which school-based physical activity interventions can positively influence psychological determinants and the ways in which these variables subsequently mediate the effect of interventions on the students' levels of physical activity, health and fitness. To achieve these goals, large-scale studies of a high methodological quality are necessary to generate the much-needed evidence.

Nevertheless, it must be stated that these are very challenging goals that are often as already shown in this systematic review very difficult to be accomplished.

Indeed, Stone and colleagues (1998) consider that school-based physical activity interventions may have a special advantage as they can become institutionalized into the regular curriculum, and influence both staff development and school infrastructures. However, the research base is surprisingly insubstantial with few studies having been conducted outside the USA. The long-term effects remain unknown. There is also insufficient data to determine differential effects by age, gender or ethnicity and there is no conclusive information about the aspects of programme delivery that are responsible for the observed positive effects. The existing literature is not sufficiently extensive to provide definitive guidelines for schools about which types of programmes and strategies are most effective in promoting physical activity. This results to the fact that up to now we are not certain about the programme factors that determine success.

3.3 School-based intervention studies in German language countries

Based on the inclusion criteria determined for the identification of studies for the systematic review, only three studies conducted in German language countries were identified (Graf et al., 2008; Graf et al., 2005; Haas, Väth, Bappert, & Bös, 2009; Walther et al., 2009). Nevertheless, it is known that in German language countries several further research projects exist in this field. Therefore, a second more differentiated search was carried out based on conference papers, the homepages of the sport institutes in Germany, and the main German scientific journals “Sportwissenschaft” and “Sportunterricht”. This search revealed another 13 German projects corresponding to the inclusion criteria – with exceptions concerning two criteria – also set for the main systematic review described in the previous section. These exceptions were that the studies had to be conducted in German language countries and the publication type was not restricted to journal articles but was much more widened and thus, studies reported in books, dissertations or mainly presented in the internet were also considered. This was necessary because the publication tradition especially in the field of sport pedagogy differs compared to other disciplines with a longer tradition in empirical research. Usually the projects carried out in sport pedagogy in Germany are not reported in journal articles but rather are published in the form of reports in books or dissertations. Thus, it is important to also consider these publication types in order to present a complete picture of the research development in this field in German language countries.

Based on this research further 13 projects carried out in German language countries were retrieved. All of these projects aimed to positively influence the health of primary and high school students in the school setting. To achieve this aim, a variety of programmes were designed and implemented. Several intervention studies designed a programme which was carried out during the already existing PE hours aiming to influence a specific aspect relevant

to students' health such as physical activity levels, physical fitness levels or healthy eating (Dreyhaupt et al., 2012; Günther, 2004a, 2004b; Reuter & Buskies, 2003; Steinmann, 2004). Three studies were identified that analysed the effects of daily PE on a variety of outcome variables (Bös & Obst, 2007; Henze, 2007; Thiele & Seyda, 2011) and three further programmes incorporated several aspects to be carried out during the school day (Landau, 2007; Müller & Petzold, 2002; Nellen-Swiathly & Schindler-Marlow, 2006). Finally, one programme provided the opportunity to go to school on foot accompanied by adults (Brettschneider & Malek, 2006). Most of these programmes were successful in achieving a positive influence of students' health measured by outcome variables such as motor performance, BMI, physical activity and academic performance. Some examples of these German projects are described in the following in more detail and all 12 projects are summarised in table 10.

Steinmann (2004) carried out an innovative programme in the school setting in order to examine the effects of PE on students' fitness status, athletic performance, and attitudes towards the health effects of physical activity. To achieve this aim he used a quasi-experimental design and analysed six fifth grade classes in German high schools. The participating classes were divided into two IGs and one CG. Both IGs carried out a practical PE programme and the second IG was additionally taught some theoretical lessons during biology classes concerning the association between physical activity and health. During the five-week intervention timeframe the CG carried out the regular PE lessons. The results gained from this empirical study are promising and show mostly positive intervention effects especially in favour of the IG carrying out the practical and the theoretical components. Concerning motor performance, positive intervention effects on students of both IGs were observed in standing long jump, sit-ups, 6-min run, and 30m sprint. In the test measuring the maximum strength of the arms and the reaction speed no significant differences between the IGs and the CG could be observed. Positive intervention effects were measured in favour of the IG carrying out the practical and the theoretical elements in the cognitive and affective dimensions of the questionnaire assessing students' attitudes towards the health effects of PE. Finally, significant positive intervention effects were also found in athletic performance in the disciplines long jump and 50m sprint but not in the heavy ball throw.

A second empirical study carried out in this field is the largest school-based health promotion programme carried out in Germany by a workgroup in the federal state Baden-Württemberg (Dreyhaupt et al., 2012). This school-based programme aimed to promote a healthier lifestyle in primary aged school children. In more detail, the main goals of the programme were to increase children's physical activity levels, to decrease the consumption of sugar-sweetened drinks, and to decrease the time spent sedentary by promoting active choices. Also, it was aimed to increase students' mental and emotional abilities. This cluster-randomised study included 427 primary schools and measurements were taken in the years 2010/2011 and 2011/2012. The interventions effectiveness was assessed on three main outcome variables:

changes in waist circumference, skinfold thickness, and 6-min run. The intervention programme was fully integrated in the school environment during the existing school hours and in recess. Particularly motivated teachers were trained as project delivery consultants that were assigned to train about 900 primary school teachers to be able to teach a series of specific health-promotion lessons as part of their routine work. Along with the outcome measures also process measures were assessed to examine the quality of the programme. The intervention programme was designed by a team of scientists in collaboration with primary school teachers based on the salutogenetic and social cognitive theory. Additionally, the programme was oriented towards an action approach. The intervention included 20 units per school year and was carried out from the first to fourth grade in primary school. These 20 lessons were spread over the entire academic year with the exception of two physical activity exercises that were carried out daily. These were the active recess and five to seven minutes of daily exercises. Additionally, "family homework" was assigned to the students that included exercises that should be carried out with the parents. Unfortunately, the results of the programme are not available yet. Nevertheless, this project will soon provide high evidence based results on whether it is possible to achieve health effects in students based on a programme involving children, teachers, and parents with relatively little effort.

A third project that was carried out in Germany aimed to examine the health effects of daily PE on socio-psychological factors as well as motor performance (Thiele & Seyda, 2011). Altogether 27 schools participated in this quasi-experimental project. Of these schools, 25 carried out a daily PE class but only eight schools were evaluated in detail by the research team. Two schools carried out the regular PE lessons and were set as the CG schools. It was assumed that the daily PE lessons would cause changes on several levels. First, the intervention effects were examined directly on students' self-concept and their coordination levels. Additionally, the teachers were questioned on the possible effects of daily PE on students and the changes in PE itself. Also organisational changes and staff development were analysed. For this purposes qualitative as well as quantitative procedures for the data assessment were used. Teachers and students were asked what expectations they had concerning the daily PE. Both adults and youngsters responded to this question in a similar way. They assumed that daily PE would have positive effects on students' motor performance, on the overall learning ability and concentration, their cooperation with other students, decrease aggression levels, and an overall positive effect on their personality development. Nevertheless, these positive expectations could not be confirmed in the statistical analysis of the data gained from the questionnaires filled out by the students. Here, no positive intervention effects were found on students' self-concept and their motor performance. At this point it needs to be emphasised that the results gained from the other two studies (Bös & Obst, 2007; Henze, 2007) analysing the effects of daily PE were not able to confirm positive intervention effects on students motor performance, BMI, and social behaviour.

Concluding, it can be said that when taking into account the great importance of the school setting for the promotion of students' health and the fact that health promotion should be one of the central targets of PE, it is striking that up to now only few intervention studies have been carried out in this field in Germany. These programmes seem to be especially effective in improving students' physical fitness levels since nine of the ten studies examining this variable led to significant intervention effects in favour of the IG. Interestingly though, the large study by Thiele and Seyda (2011) examining the effects of daily PE could not confirm this hypothesis. This is an indication that the mere increase in PE hours is not sufficient to provide improvements in students' physical fitness levels. Instead, a programme needs to specifically address students' physical fitness in order to achieve positive results. In general, it is especially important to examine the health effects that can be achieved through PE when taking into account the specific circumstances in which PE is currently being carried out in Germany. Therefore, more research is needed that can determine the health effects that can be achieved when PE is only carried out two or three times per week as it is currently manifested in the PE curriculum. Only in this way conclusions can be drawn concerning the extent to which PE can contribute to young people's health.

Table 10 School-Based Physical Activity Intervention Studies in German Language Countries

Author/ Project	Aim	Study design	Assessed variables	Intervention programme	Results
Bös & Obst (2007) Daily PE - a pilot study (Tägliche Sportstunde - Modellversuch)	Effects of an additional daily PE on motor performance and social behaviour (aggression and accident risk).	Duration: four years Study sample: 1 IG and 1 CG in primary school: 1st to 4th grade	o Motor performance AST-Test o Accidents in PE lessons o Behaviour in school o Observations of aggressive behaviour	Daily PE	o Positive intervention effects in the motor performance especially in coordination o Positive intervention effects on social behaviour o Positive intervention effects on aggressive behaviour
Brettschneider & Malek (2006) Walking bus - the active way to school (Walking bus - der aktive Schulweg)	To increase security during the walk from the students' house to school and to increase students' physical activity levels.	Duration: one year Study sample: 585 students in first and second class in junior school	o Physical activity - pedometers o Physical activity behaviour in the afternoon o Mathematical performance, concentration, reading performance	Children were provided with the opportunity to walk to school accompanied by a grown up person (walking bus). Specific points (bus stations) and times were set, where the children were able to join the walking bus.	o Daily physical activity increased on average by 35 minutes o Increase of sports club members o Secure traffic behaviour o Positive effect on students' social behaviour
Conzelmann, Schmidt, & Valkanover (2011) Berne intervention study in physical education (Berner Interventionsstudie Schulsport)	The aim was to achieve a positive influence on students' personality and specifically to positively address students' self-concept and motor performance.	Duration: 20 weeks Study sample: 446 students, in 23 fifth grade classes in Berne	o Self-worth o General self-concept o Hope for success/ anxiety of failure (total hope) o Social, physical, and team-ability self-efficacy o Adoption of a perspective o Self-concept of sport specific ability, of motor performance, and	Three modules (play, dare, and performance) were developed and carried out by PE teachers in the two out of three weekly PE hours available.	Positive intervention effect on: social self-efficacy, self-concept of social acceptance, hope for success, sport specific anxiety, physical self-concept, Self-concept of sport specific ability, self-concept motor performance (endurance), total hope, and on an adequate motor performance self-concept.

Author/ Project	Aim	Study design	Assessed variables	Intervention programme	Results
			of social acceptance o Physical self-concept o Achievement motive o Sport specific anxiety o Motor performance		
Dreyhaupt et al. (2012) Join the healthy boat (Komm mit in das gesunde Boot - Grundschul)	Increase the competence for leading a healthy lifestyle.	Duration: one school year Study sample: 154 first and second classes of junior school	Main variables: o Motor performance - 6-min run o Waist circumference o Skinfold thickness	o 20 standardised lessons on physical activity, diet, and free time behaviour. o Daily 3-5 min of exercise during a lesson o Information to the parents	Results are not available yet.
Günther (2004a, 2004b) FGO- Training with the theraband (FGO- Training mit dem Theraband)	To examine the effects of FGO strength training in PE	Duration: half a year Study sample: 964 students (14-18 years) in special needs school, secondary school, and high school	o Total body strength test o Social-psychological variables (motivation to participate, physical motor performance, physical attractiveness)	o Functional gymnastics oriented (FGO) training with the theraband: o A box including 40 cards with exercises easy to understand and carry out by students. o Training of endurance, flexibility, psychological and physical ability to relax. o Promote knowledge on health prevention, health promoting behaviours, and training methods. o Training during PE (one hour twice a week or two consecutive hours once a week).	o Positive intervention effects on strength-endurance o Students training twice a week achieved sig. higher strength values

Author/ Project	Aim	Study design	Assessed variables	Intervention programme	Results
Henze (2007) Fit for Pisa: More physical activity in the school (Fit für Pisa: Mehr Bewegung in der Schule)	Influence of daily PE on students' medical, motor, and emotional development	Duration: four years Study sample: five primary schools, more than 126 students	o Motor performance o BMI o Emotional well-being	Daily PE: beyond the regular PE additional hours were taught by trainers of a sports club.	Positive intervention effects on motor performance and BMI
Landau (2007) The moving classroom (Das mobile Klassenzimmer)	To reduce sitting still during school hours and to increase students' spinal strength through exercises during school lessons and new furniture in the classrooms.	Duration: three school years Study sample: One IG and two CG classes Second grade in primary school	o Motor performance o Spinal strength – KTK test o Academic performance	o New furniture was provided that could be especially adjusted to each student and had a degree of flexibility. Several exercises were carried out during each lesson that integrated the new furniture. o Education on the function of the spine und a healthy behaviour towards the spine.	o Positive intervention effects on students' psycho-motor competence o Decrease of hyperactivity in hyperactive children o Decrease of students with spinal strength weakness o Positive intervention effects on students' academic performance
Müller & Petzold (2002) Longitudinal study moving primary school (Längsschnittstudie bewegte Grundschule)	Education of children's action competence on health-behaviour topics	Duration: four years Study sample: seven primary schools (four IG schools and three CG schools)	o Motor performance - AST test o Self-concept o academic performance tests o Anthropometric measurements	o Orientation on the concept of the "moving school": o Active lessons, school breaks, and PE o Education and materials for the support of teachers in teaching students a healthy lifestyle. o Information for parents and students	o Positive intervention effects on working speed (without an increase in accuracy), concentration, social behaviour (increase in social contacts, decrease of aggressive behaviour and outsiders), self-concept, and coordination o Stabilisation of school- and learning-enjoyment o Increase in coordination o No intervention effects on

Author/ Project	Aim	Study design	Assessed variables	Intervention programme	Results
					BMI, strength, and endurance
Nellen-Swiathly & Schindler-Marlow (2006) Health gains popularity – Motor promotion in the primary school (Gesund macht Schule Motorische Förderung in der Primarstufe (MoPi))	To promote health in primary school students and to sensitise teachers, parents, and students on health behaviour.	Study sample: 10 schools	o Motor performance - Dordel-Koch-Test o BMI	o Materials were provided to the teachers for the school lessons and information was given to the parents on the topic physical activity and relaxation. o Medical doctors accompanied the project. o Teachers, parents, and doctors were trained on the subject health.	Positive intervention effects on motor performance
Reuter & Buskies (2003) Soft strength training in PE (Sanftes Krafttraining im Sportunterricht)	Prevention of muscular deficits and false posture through strength training.	Duration: three, seven and nine weeks Study sample: 195 students between 10 and 16 years	o Motor performance o Body weight and body fat o Well-being scale	o Study 1: seven and nine weeks of soft strength training once or twice per week respectively o Study 2: three weeks of soft strength training three times per week	o Positive intervention effects in MP at post intervention and follow-up. The programme providing strength training led to higher improvements but also the once per week training led to significant intervention effects. o Reduction in body fat in the 15% heaviest students o Reduction in the state of „anger“
Steinmann (2004) Health, fitness, and performance	An intervention to examine the effects of a health-promotion PE	Duration: five weeks Study sample:	o Motor performance o Athletic performance (long jump, 50m sprint,	During two out of the three PE hours provided, a specific intervention programme to	o Positive intervention effects on motor performance and athletic performance in both

Author/ Project	Aim	Study design	Assessed variables	Intervention programme	Results
(Gesundheit, Fitness und Leistung)	programme on students' fitness status, athletic performance, and attitudes towards the health effects of physical activity.	six fifth grade classes, two intervention groups and one control group	heavy ball throw) o Attitudes towards the health effects of physical activity	increase fitness and promote the athletic competence was carried out. The second IG also attended a specific biology course in which topics such as endurance and strength or the cardiovascular system were theoretically addressed.	IGs. o Positive intervention effects on attitudes in the IG with the practical and theoretical element
Thiele & Seyda (2011) Daily physical education in primary schools in the federal state Nordrhein-Westfalen (Tägliche Sportstunde an Grundschulen in NRW)	Effects of daily PE on socio-psychological factors as well as motor performance	Duration: four years Study sample: 25 IG primary schools, 2 CG primary schools	o Self-concept o Motor performance – coordination	Daily PE	No significant intervention effects.
Wydra & Leweck (2007) Short-term training of physical fitness in PE (Kurzfristige Trainierbarkeit der Fitness im Schulsport)	Short-term fitness promotion in PE	Duration: eight weeks Study sample: 107 students in fifth and sixth grade	o Motor performance o Effort and willingness to make an effort	During one of the two PE lessons provided, students carried out an intense fitness programme to enhance speed and strength.	Positive effects on motor performance.

3.4 Chapter summary

For the design of effective intervention programmes to promote young people's health in the school setting, it is a premise to gain an overview over the current state of the empirical research findings in this field. It is essential to know what kind of intervention programmes were carried out in the past years and it is also substantial to know which interventions were effective and which were not. Therefore, also for this research project it was essential to systematically view the empirical studies that were carried out in the past years before designing HealthyPEP (see chapter 4).

Consequently, in this chapter, in a first step (see section 3.2), the international literature was systematically reviewed and analysed in a systematic review that presented the current status concerning physical activity in school-based intervention programmes carried out internationally (Demetriou & Höner, 2012). The systematic review included 129 intervention studies that fulfilled the predefined inclusion criteria. Most of these studies were of moderate methodological quality according to the chosen criteria in this systematic review. The analysis of the effects of the studies on the three target levels (psychological determinants of physical activity, physical activity behaviour, and health and fitness) revealed that these programmes especially achieved positive effects on students' knowledge (87.5%), motor performance (69.7%), and physical activity levels (56.8%). Additionally, it was found that participants' age, the type of intervention (only a physical activity component vs. a combination of a physical activity and a cognitive component), frequency and duration of the intervention studies, and methodological quality had a moderating effect on the intervention effects. Finally, also in this systematic review it was confirmed that only very few studies could accomplish the difficult task of examining the mediator effects of psychological determinants of physical activity.

In a second step, additional interventions carried out in German language countries that were not included into the systematic review were presented (see section 3.3). These interventions did not fulfil the inclusion criteria for the systematic review but are equally important in order to present a complete picture of the current status of the empirical research in this field. Altogether another 13 studies were presented that were especially effective in improving students' physical fitness levels. Based on these studies it becomes clear that specific programmes need to be developed to enhance students' fitness and that a mere increase in PE is insufficient.

It can be concluded that more research is needed in this field in order to determine the health effects that can be achieved in PE. Especially in Germany, studies are needed that examine the effects of two or three PE hours per week as it is currently laid down in the PE curriculum. Only in this way conclusions can be drawn concerning the extent to which PE can contribute to young people's health.

4 Intervention Study: Development and Evaluation of HealthyPEP

Based on the recent theoretical and empirical findings (see chapters 2 and 3), in the following chapter the intervention study of this research project is described. After stating the objectives of this study (see section 4.1), first, the development of HealthyPEP[2] (see section 4.2), and second, the comprehensive evaluation of HealthyPEP (see section 4.3) based on Mittag (2006) is presented.

4.1 Objectives of the empirical study

The empirical work of this research project had a twofold aim. The first objective was the *development of HealthyPEP* that should be a programme for the health enhancement of young students during PE. HealthyPEP was designed based on the current theoretical and empirical findings in sports science concerning the methods of physical fitness enhancement and the influence of psychological determinants of physical activity during PE in young students.
The second aim was to carry out a *comprehensive evaluation of HealthyPEP* based on Mittag (2006) and to examine its short- and middle-term effects on students' health. Therefore, first *preliminary analyses* were carried out to examine baseline differences between the IG and the CG and to carry out a lost to follow-up analysis, in which differences in the number of dropouts between IG and CG as well as differences in the baseline values between the dropouts and the study adherers were examined. Second, the implementation of HealthyPEP was evaluated using several *process measures*. These included the objective perspective of university students as well as the evaluation of HealthyPEP from the perspective of the teachers and the students participating in the programme. The assessment of process measures pursues the aim to continuously observe how well the intended programme was carried out and how accurate the prescribed components of the programme were adapted by the teachers. This is particularly important as intervention programmes can fail for various reasons, as for example because the programme was neither entirely nor correctly carried out (Mittag, 2006). Third, the *intervention effects* on the three target levels were examined. These were a) the psychological determinants level, in which the variables attitudes, knowledge, motivation, and self-efficacy were measured, b) the behaviour level, in which physical activity levels were viewed, and c) the health and fitness level, in which motor performance, BMI, and health-related quality of life (HRQOL) were assessed. The effects of HealthyPEP were measured by first analysing short- (T1-T2) and middle-term (T1-T3) group differences within each group. Here, it was hypothesised that differences existed in the IG and the CG on all variables assessed on the three outcome levels. Second, the short- (T2) and middle-term (T3) differences between the IG and the CG on the measured outcome variables were examined and it was hypothesised that short- and middle-term differences existed between the groups on

[2] The HealthyPEP material provided to the teachers and the students are provided in the Appendix.

all examined variables. Finally, *additional analyses* were carried out to receive a clear picture of the effects of HealthyPEP. Therefore, possible interventions' side effects on students' levels of cooperation were examined. Additionally, moderating effects of the class composition (mixed-gender classes, girls, boys), initial BMI levels (underweight, normal weight, overweight), and initial motor performance levels (low, medium, high) on students' motor performance and BMI levels were analysed and last, the influence of the school clustering effects were viewed.

4.2 Development of HealthyPEP

Based on the theoretical considerations and the findings of the systematic review it becomes clear that there are still many unanswered questions concerning the effects of PE on students' health. For example, it is not clear how broad the health effects of PE can be, and even when positive intervention effects occur it is not clear from what specific intervention elements these effects have resulted from (Baranowski, Anderson, & Carmack, 1998; Demetriou & Höner, 2012). Also questions concerning methodological aspects and the overall study design, which is used to evaluate these intervention programmes, remain unanswered. Studies need to be designed according to the existing circumstances in the setting in which they are planned to be carried out but also according to criteria that will guarantee high evidence based results.

Especially in Germany, the existing research gap concerning empirical evidence on the health effects of PE is particularly large and therefore further intervention studies are needed. The empirical study of this project aims to contribute to the research needed in this field. The "Healthy Physical Education Programme" (HealthyPEP) was designed based, first, on the knowledge and information gained through the pedagogical, psychological, and training science considerations (see section 2.2) and, second, on the systematic review of the international studies and the summary of the German studies that is gathering the results of the current research in this field (see chapter 3) HealthyPEP was designed to consist out of eight health-promotion lessons, lasting 90 minutes each, which should be carried out in the PE classes of sixth grade high school students. In the following chapter, the scientific conclusions for the design of HealthyPEP are discussed and furthermore, each of the eight lessons of HealthyPEP are described in detail.

4.2.1 Scientific considerations for the design of HealthyPEP

Pedagogical considerations

The key aim of the school is to educate young people and provide them with the capabilities for an independent and fulfilled life. It should provide them with the knowledge and the skills for lifelong learning and the adoption of a healthy lifestyle including regular physical activity (Balz & Neumann, 2007). The pedagogical considerations (see section 2.2.1) have shown that

the school is an ideal setting but also at the same time it has the obligation to promote students' health. The considerations from the perspective of sport pedagogy provide the explanation and the legitimacy as to why PE needs to adopt and follow the target of students' health promotion. As stated by Kurz (2008b) this target is one of the key objectives of PE as it should promote students' fitness and introduce the necessary skills and knowledge for young people to lead an active lifestyle. Health promotion has been adopted as one of the main perspectives of PE in the PE curriculum where it is clearly stated that PE lessons should aim to educate students towards a physically active and healthy lifestyle. This can be achieved by providing opportunities for the students to experience the sports culture and by influencing young people's personality, knowledge, and skill through physical activity. Additionally, PE can promote students' health in two ways: First, by a direct enhancement of physical fitness through PE and, second, in an indirect way by educating students to be able to independently adopt a healthy and active lifestyle (Neumann, 2004; Scheid & Prohl, 2011). In order to address students health through PE, physical training in order to develop students' physical fitness and a theoretical education on the health effects of physical activity should be carried out during PE (Ministerium für Kultus Jugend und Sport Baden-Württemberg, 2004).

Training science considerations

From the perspective of training science, several aspects concerning the design of HealthyPEP need to be considered (see section 2.2.2). Only when the lessons are planned according to the training science standards of this age group and the PE circumstances, effects are likely to be achieved on students' health (Steinmann, 2004). Nevertheless, some of the theoretical recommendations need to be critically viewed and their usability in PE needs to be questioned. For example Hohmann (2007) emphasises the need of time-limited PE programmes to evaluate the effects on a specific PE aim such as students' health promotion and states that ten weeks is a suitable and recommendable timeframe for this. Following the first contact with the IG teachers (see section 4.2.2), it became clear that a timeframe of eight weeks was the maximum time they were willing to participate in the study. Nevertheless, when we included the measurements of the students, the overall investigation timeframe resulted within the ten weeks as recommended by Hohmann (2007).

The training science considerations concerning *content, equipment and material, methods, and structure of the lessons* were used for the design of HealthyPEP. In general, it needs to be stated that the HealthyPEP lessons were carried out once a week, which is a very limited and problematic frequency. Nevertheless, it was aimed to use the time provided during every lesson as effectively as possible. Therefore, the exercises were chosen in a way to be able to address all students independent of their physical fitness levels and to provide them with the opportunities to participate in their own pace without being overwhelmed or unchallenged.

As emphasised by Steinmann (2004) strength and endurance are the fundamental elements of fitness that especially need to be addressed during the intervention timeframe. He states that strength and endurance can be addressed during separate lessons, simultaneously during the same lesson, or in the same lesson with different exercises promoting each element separately. It is important to consider that especially in this young age group, the training of the general strength and endurance does not systematically differ. Therefore, in HealthyPEP, in some of the lessons both strength and endurance were addressed during the same lesson using a variety of exercises and in other lessons the focus was set either mainly on endurance or mainly on strength. In order to use the limited time available for PE as effectively and efficiently as possible, the *material*s used during the lessons were chosen very carefully. It was important not to overload the lessons with equipment and thus to waste a lot of time for their setup. For example, long benches, medicine balls, ropes, and mats were used, but mostly the students' own body was used and therefore, no additional materials were required. For the students' strength promotion, the *methods* of soft training and one set of repetitions during circuit training were mostly chosen (Deddens & Duwenbeck, 2006; Duwenbeck & Deddens, 2003; LaFleche, 2012). Nevertheless, during some of the exercises, as for example during the strength exercises, carried out twice in these eight weeks in the form of a circuit training (see lesson 1 and lesson 7 in section 4.2.2) the students reached high intensity levels, which clearly exceed the limits of the load recommended by the soft training method. For the enhancement of students' endurance, the continuous method, the extensive interval method, and the fartlek method are recommended (König, 2011). This recommendation to mostly use the continuous method in order to enhance students' endurance during PE is problematic in the practical implementation. It seems difficult to conduct and carry out a reasonable amount of components that aim at the enhancement of students' endurance and at the same time are interesting and motivating for the students. The question arises whether an optimal training of students' endurance will much rather be achieved based on a combination of extensive and intensive endurance methods during PE. Therefore, in HealthyPEP, a variety of endurance exercises representing both endurance methods were carried out. For example based on the continuous method, an exercise in which students were assigned to estimate the duration of three minutes and accordingly keep running during this time was carried out. The shuttle-run test, which is a continuous endurance element reaching high intensity levels was also carried out twice during HealthyPEP. Furthermore, the "memory relay", which can be seen as an intensive endurance method, was carried out in which the students were divided into several groups and were given the assignment to find matching pairs of cards that were spread on the floor on the one side of the hall. Three students from each group had to run to the other side of the hall and unveil two of the cards. If the cards were matching the students were allowed to take them with them and otherwise they had to run back without the cards. This procedure was repeated until all the cards were on the other side of the hall. All eight lessons were *structured* in the same way to increase standardisation and began with the warm-up part of the

lesson which physically and psychologically prepared the students for the upcoming lesson. The main part was structured in a way to place strength exercises before the main endurance part of the lesson. Finally, a cool-down element was carried out in order to calm the students down and dismiss them for the next lesson in a relaxed state.

Psychological considerations

Based on the psychological considerations (see section 2.2.2) and the findings from the systematic review (see section 3.2) it was determined that HealthyPEP should influence the following psychological determinants of physical activity: attitudes, motivation, self-efficacy, and knowledge. It was concluded that these variables are important when promoting an active lifestyle among young people and therefore, they should be addressed in intervention programmes.

As stated by Baranowski et al. (1998), little is known and it is highly unclear what aspects of the programmes conducted are promoting physical activity and what aspects are ineffective. Unfortunately, this statement is valid even today (Demetriou & Höner, 2012). The intervention programmes described in the previous systematic review (see chapter 3) confirmed that not sufficient information concerning the programme content is provided when publishing the results of intervention studies. Usually, in the journal articles a small section is dedicated to the description of the intervention programme presenting only sparse information about it. Much more, the focus is laid on the study results independent as to how they occurred. Concluding it can be said that the interventions were not consistently effective in increasing physical activity among children and youth and that up to now insufficient knowledge exists on effective methods to help children increase their physical activity levels outside the school setting.

More recently attempts have been carried out towards a better understanding on how and why some intervention programmes worked and others did not work (Abraham & Michie, 2008; Albarracín et al., 2005). Abraham and Michie (2008) systematically categorised all the implemented *behaviour change techniques* (BCT) used in social science research to establish behaviour change. Altogether, they defined 26 BCT that reflect a variety of theoretical accounts of behaviour change. These techniques were systematically analysed by tracking the assumptions hidden behind every psychological theory considered. Several theories, as for example the theory of reasoned action, the theory of planned behavior, social-cognitive theory, and the information-motivation-behavioral skill model imply that providing information about the consequences of an action may affect attitudes toward a behaviour. Thus, these theories represent the same behaviour change technique. The authors created a summary of these behavioural change techniques which now can be used to answer the question how an intervention exactly works or not. This procedure is also very useful for the examination of the effectiveness of intervention programmes in meta-analyses. The

classification of behavioural change techniques in meta-analyses can provide high evidence information as to which techniques are more effective in promoting a specified behaviour. For example, if interventions including the techniques "provide information on consequences", "provide information about others' approval", and "prompt intention formation" were found to be noticeably more effective in promoting a specified behaviour than interventions that did not include these techniques, this would support the theory of reasoned action and related theories. The authors emphasise that characterizing interventions in terms of the techniques being used and relating these to effectiveness can rule out the knowledge of potential change processes and highlight theories likely to be most useful to intervention designers. In this way, it can be distinguished between competing theories of behaviour change. In the absence of such characterization of BCT, the implications of intervention evaluations for theoretical development may remain unclear (Abraham & Michie, 2008; Rothman, 2004).

Following this work, Michie, Abraham, Whittington, McAteer, and Gupta (2009) carried out a meta-analysis of 122 evaluation studies and examined which techniques were most effective for the promotion of health behaviours such as regular physical activity and healthy eating. They found out that those including self-monitoring and at least one of four other self-regulatory techniques derived from control theory (Carver & Scheier, 1982), which include "prompt intention formation", "prompt specific goal setting", "provide feedback on performance", "prompt self-monitoring of behaviour", and "prompt review of behavioural goals" were significantly more effective than interventions not including these techniques. Moreover, the number of BCT included in each intervention programme did not increase effectiveness. A reason for this might be that the quality of the implementation of BCT might suffer with a rising number of techniques that are assigned to be carried out.

The findings by Abraham and Michie (2008) and Michie et al. (2009) were used for the design of HealthyPEP where several BCT were chosen to encourage and promote students psychological determinants of physical activity. Consequently, it was hypothesised that by influencing these variables positively, students would more likely adopt higher physical activity levels in the future. Altogether, five BCT were used in HealthyPEP: First, information was provided to the students concerning the health-behaviour link. This information was mostly given to the students during the theoretical parts of HealthyPEP (see section 4.2.2). In some parts of the lessons the students were assigned to study worksheets and to answer specific questions. The teachers also provided additional information, which were discussed with the students during the lesson. Second, the teachers were instructed to give a general encouragement to the students during the lessons concerning the accomplishment of the assigned homework, which included physical activity exercises during the afternoon. Third, HealthyPEP was designed to provide students with mastery experiences and to give them the opportunity to witness their own improvement. Therefore, in HealthyPEP a number of exercises were repeated (e.g., the shuttle-run test) and the students were instructed to document their results in their booklets (see section 4.2.2). In this way they could view their

development and observe changes in their physical fitness. Fourth, during HealthyPEP the students were instructed to reward themselves for accomplished tasks during PE but also for homework carried out. The students rewarded themselves by noting a predefined number of bonus points in their booklets. At the end of HealthyPEP students gathering a high amount of bonus points were specifically praised by the PE teachers. Fifth, the students were given homework in the form of physical activity exercises that had to be carried out in the afternoon or during the weekends. Thus, the students were given the opportunity to experience the effects of regular training and to raise their awareness of the relationship between regular physical activity and health. Several components of the programme were repeated during the treatment period in order to provide opportunities for the students to master the exercise.

Methodological Considerations for the implementation of HealthyPEP

Beyond the considerations made on the content of the lessons a number of methodological, organisational, and practical reflexions were carried out to increase the quality of the health-promotion PE lessons.

Hohmann (2007) suggests carrying out intervention programmes lasting for about ten weeks. After talking to several teachers it was clear that an intervention programme exceeding a duration of eight weeks would not be accepted by the IG teachers. Therefore the health-promotion PE lessons were designed to correspond with the teachers demand. When adding the PE lessons needed for the data assessment for the evaluation of the study, the total investigation time amounted to a period of ten weeks. The teachers emphasised that this was the maximum of time they would be willing to participate in the study.

The *evaluation of the programme concept* is a fundamental component for the comprehensive evaluation of intervention programmes. Based on its definition by Mittag (2006), this term is very broad and it includes aspects such as the description of the existing problem, the aims of the intervention study, the description of the people involved in the study, the study sample, the data assessment methods, and the presentation of the assumed hypotheses. All these indispensable components of a systematic intervention project will be described in the next chapter. Here, the term evaluation of the programme concept is restricted to the analysis and the testing of various aspects of the treatment and the materials used before the start of the official intervention. Therefore, the health promotion PE lessons for sixth grade students designed by the researcher were tested by experienced high school teachers several times. They provided feedback concerning the feasibility and the suitability of the content for sixth grade students' health promotion. Consequently, the lesson content and structure was adequately adjusted based on the teachers' feedback.

It was important to take measures to increase *treatment integrity* in terms of the extent to which the teachers implemented the health promoting PE lessons. Therefore, the lessons were designed in a standardised design and were documented in detail, in order to be clear and not

to cause misinterpretation mistakes due to an unclear description of exercises and procedures of the lesson. Additionally, the IG teachers were provided with all the material needed to teach these lessons. These consisted of a file with the detailed description of each health-promotion PE lesson and all the extra material needed to carry out these lessons. A number of process measures (e.g., lesson observations, interviews with the IG teachers) were carried out to evaluate the treatment integrity and are described later (see chapter 4).

In order to ensure the quality of HealthyPEP in the intervention schools, the *teachers were instructed* by the researcher on how to carry out the lessons. It was made clear to the teachers that they had to adjust the lesson content to be able to carry it out with their class depending on the size of the class and the circumstances on every particular day. Some exercises would then need to be cut off or expanded. It was also made clear to the teachers that the target of the intervention was not the not the evaluation of the teachers' performance but much more the evaluation of the effectiveness of this programme on several health variables of students. Teachers were also encouraged to use the results of the shuttle run test to evaluate their students and on the basis of the results provide grades for that school term.

4.2.2 Description of HealthyPEP

In the following section, HealthyPEP that was carried out over a timeframe of eight weeks and consisted of eight 90-minute health-promotion PE lessons is described in detail. As theoretically emphasised by Kurz (2008b), PE lessons should address students' health both in a theoretical and in a practical way. Therefore, HealthyPEP consisted of a combination of age-appropriate practical training, theoretical elements, and some additional components (e.g., homework and bonus points for various assignments, see Table 11). The structure of all lessons was the same consisting of a warm-up introduction part, a main part, and a final cool-down part. Also, a number of the additional elements (e.g., the mood measurement, homework, and documentation of the favourite exercises and games in the booklet) were carried out during each lesson. The content of HealthyPEP was based on a combination of new and already existing and in the literature documented games, relays, and exercises for the promotion of mainly strength and endurance (Aschebrock, Edler-Koeller, & Maass, 2010; Bader, Chounard, Eberle, Kromer, & Mayer, 2003; A. Becker, 2009; Belz & Frey, 2009; Beudels & Anders, 2002; Blume, 1995; Brugger, Schmid, & Bucher, 2007; Deutsche Turnerjugend, 1995; Hottenrott & Gronwald, 2009, 2010; Jäger, 2009; Kruber & Kikow, 2007; Lange & Sinning, 2009; Reim, 2009; Tille, 2009). In the following, a more detailed description of each lesson of HealthyPEP is provided and an overview is given in table 11.

The *practical elements* during HealthyPEP aimed to provide students the opportunity to experience the effects of regular training and to raise awareness of the relationship between regular physical activity and health. Several components of the programme were repeated during the treatment period in order to provide opportunities for the students to experience

mastery. Also many *theoretical elements* were integrated into HealthyPEP. Their aim was to raise students' awareness of the relationship between regular physical activity and health. These elements were constructed so that students would receive a small input from the teacher or from a small handout and were asked to work on it in small groups. Subsequently, questions were discussed with the entire class and the teacher provided some more information. The theoretical elements were designed to be suitable for young students. HealthyPEP picked up on these theoretical elements and integrated them into the practical elements of the lesson.

The teachers were instructed to implement a number of *additional elements* during HealthyPEP and these are described in the following text. A summary of these additional elements is shown in table 11. Students of the IG received a small *booklet* at the beginning of HealthyPEP in which they were instructed to note their homework, their results of the shuttle-run test and the strength exercises (see lesson 1 and 7), their favourite exercises and games, and bonus points for the accomplishment of assignments. The students were instructed to have their booklet with them at every PE lesson. Students were also encouraged to give themselves *bonus points* for various accomplished assignments as for example for accomplished homework and a good participation in PE. The bonus points were gathered until the end of HealthyPEP and students that received many points over the investigation timeframe were especially praised by the teacher. Furthermore, the students were asked to document their *favourite exercises and games* carried out in each PE lesson in their booklet. This collection of exercises and games should serve as basis for ideas of possibilities to be active in the afternoon alone, with friends or family members. Additionally, the results of the *shuttle-run test* and a number of *strength exercises*, which were carried out twice during HealthyPEP (lesson 1 and 7) should also be documented in the booklet. The aim was to provide the students with feedback on their results and to give them the chance to observe their development over the weeks. As already stated, students were given various practical or theoretical assignments for *homework* with the aim to intensify and manifest the content carried out during PE and to integrate physical activity into the afternoon schedule of the children. The "marathon" from Stuttgart to Athens was the biggest homework given. Here, students were instructed to go running 10 times for about 15 to 20 minutes each time during the intervention period. The students had to note in their booklet the date and time of each run. At the end of the intervention, the students that had accomplished the marathon were handed out a certificate as a reward. Finally, students were encouraged by the teacher to give a vague *estimation of their mood* at the beginning and at the end of each PE lesson. The teacher showed the students a poster revealing a smiley with its "thump up" indicating a positive mood, a smiley with its "thumb horizontally" representing a medium mood, and finally, a smiley with its "thumb down" symbolising a negative mood. The children were encouraged to raise their thumb according to their mood and thus provide information to the

teacher on their mental state. Aim of the mood measurement was to raise students' awareness of their mood state and how the mood changes during PE.

Lesson 1 consisted of an introduction into HealthyPEP and the handing out of the booklets. During the main part of the lesson the students took part in a series of strength exercises such as climbing steps, throwing a medicine ball on the wall, sit-ups, press-ups and rope jumping. Following these exercises, all students completed the shuttle-run test, which is a test to estimate the maximum oxygen uptake (VO2 max) (Léger & Lambert, 1982). This test is especially useful for testing the fitness of students at school. The test involves continuous running between two lines 20m apart in time of the recorded "beep sounds". The students stand behind one of the lines and begin running when instructed by the CD. The speed at the start is quite slow and the students continue running between the two lines, turning when signalled by the recorded beeps. As the test proceeds, the interval between each beep is reduced, forcing the students to increase their speed over the course of the test, until it is impossible to keep up with the beep sounds. If the line is not reached in time for each beep, the student must run to the line turn and try to catch up with the pace within two more beeps. Also, if the line is reached before the beep sounds, the student must wait until the beep sounds. The test is stopped if the student fails to reach the line (within two meters) for two consecutive ends. The recording is typically structured into 21 'levels', each of which lasts around 62 seconds. Usually, the interval of beeps is calculated as requiring a speed at the start of 8.5 km/h, increasing by 0.5 km/h with each level thereafter. The highest level attained before failing to keep up is recorded as the score for that test (Tomkinson, Léger, Olds, & Cazorla, 2003). Finally, at the end of this lesson, the "Noah's ark" game was carried out as a cool down. During this game the teacher spreads slips of paper with animal names on the floor so that each student could receive a paper. The students were instructed to run around the hall until the moment the teacher called "Noah's Flood", at which they had to take one of the papers lying on the floor. For each animal two papers existed and the students had to try to find their "partner" by imitating the animal written on the paper. As soon as the students found their partner they had to run once around the hall and then head to the ark, which was a mat in the middle of the hall. This game was repeated several times.

Lesson 2 consisted of a combination of practical and theoretical elements with the aim to provide students with knowledge and practical experiences on the topic endurance and heart rate. Before beginning the lesson students were asked about their mood and then the homework that was given to them in the previous lesson was once more discussed. In the first part of the lesson, students were provided with a leaflet with information on the pulse, its frequency in different ages groups, and methods with which the heart rate can be measured. On a second leaflet, the students were asked to answer four questions on this topic.

As a warm-up the students carried out a three-minute "guess-run", in which they had to run across the hall in a constant speed and estimate a timeframe of three minutes. When they

believed that three minutes had passed they had to stop running, sit down on the floor, and measure their heart rate. The student with the closest guess was praised by the teacher. In the main part of the lesson the students participated in practical activities. Here, they were told to perform several exercises and after each exercise they had to measure their heart rate as learned in the first part of the lesson. Furthermore, an endurance relay (lottery-relay) was carried out. Here, the number 1-49 were spread out upside down at the one side of the sports hall. The class was divided into four groups and each group received a lottery ticket, in which they had to mark six numbers. Three students from each team had to run across the hall and choose a number. The team that found all numbers marked in the lottery ticket won the game.

In the final part of the lesson, an exchange between the students and the teachers, based on the elements of the lesson, was carried out. The teacher asked the students how they experienced the lesson, which elements were especially tiring and during which exercises their heart rate especially increased. Finally, the association between physical activity and heart rate was discussed. The teacher assigned homework to the students with the target to further engage the students on the topic endurance, physical activity, heart rate, and health.

Lesson 3 aimed to improve students' strength, provide them with theoretical knowledge on the topic physical activity and strength, and finally perform a number of strength exercises during PE which they could also carry out at home. In the first part of the lesson, the children were provided with a leaflet containing information about strength and physical activity and a leaflet with questions, which they should answer and discuss with the teacher. Following this, a warm up game was carried out as a preparation for the strength exercises. Enough material for the exercises was placed in different areas of the hall so that all students could exercise simultaneously. The exercises were the following: jumping on a bench, jumping over a bench, throwing a medicine ball on the wall, sit-ups, press-ups, skipping rope, jumping on a box, and sitting on an imaginary chair. In the last part of the lesson, a hockey match was carried out in which the students used one of their shoes as a hockey stick. Finally, the students were assigned to carry out five of the newly learned exercises with friends or members of the family. Thus, the students were encouraged to build a repertoire of exercises which they could easily perform at home.

Lesson 4 addressed for a second time the topic of endurance and heart rate. After discussing the homework of the previous lesson, the lesson started with a theoretical component including a leaflet with questions that should be answered by the students and then discussed with the entire class. Following this, the homework "marathon" was introduced. Here, the students were assigned to run ten times a free chosen distance of about 1-2 kilometres during the afternoon in the next weeks. The date, time, and distance of the run should be noted in the booklet. After a warm-up game, the main part of the lesson consisted of an endurance coordination course planned to last for about 40 minutes and was accompanied by music. Eight teams were built and each team received five cards on which the number of the song

was written and the exercises that should be carried out during that song such as jumping with one leg over hoops, jump over benches, and pull themselves over long benches. The lesson ended with a "mat-relay" in which two teams were created and each team received a large mat. The target was to move the large mat on the other side of the hall as fast as possible. To achieve this, four students run simultaneously towards the mat and jumped on it. The students had to run back to the beginning of the hall and only when reaching the start line the next group of students was allowed to start running towards the mat. The team that first crossed the start line with the mat won the game. Finally, homework was assigned to the students for the next lesson.

L*esson 5* targeted the increase of students' knowledge on the importance of a strong and healthy spine and to provide practical exercises with which children can achieve this. The first part of the lesson consisted of a theoretical component in which the teacher gave information to the students concerning the spine. Additionally, the students had to answer some relevant questions on a leaflet. In the second part of the lesson, the "memory relay" was carried out in which the students were divided into several groups and were given the assignment to find matching pairs of cards that were spread on the floor on the one side of the hall. Three students of each group had to run to the other side of the hall and unveil two of the cards. If the cards were matching the students were allowed to take them with them. Otherwise they had to run back without the cards. This procedure was repeated until all the cards were on the other side of the hall. During the main part of the lesson, the students carried out a number of strength and stabilisation exercises in the group as for example the "flying fish" where the students are lying on the floor in two parallel rows with their heads next to each other. One of the students should be carried over this row by the students lying on the floor. Additionally, an endurance game was carried out where the class was divided into teams and each team consisted of a maximum number of five students. Each group began the "7 day race" at a set starting line in the hall. One student of each team had to run to the other side of the hall and back, pick-up a second student and run the same distance again. After each run one more student joined the group until the entire group run together. Following this, after each run one student was dropped until the last student run alone the final run. The team completing the race first won the game. Before dismissing the students to the next class, homework was assigned for the next lesson. Here, the students should check the posture of their family members and show them the exercises they had learned during this PE lesson.

Lesson 6 consisted of mainly endurance games and an introduction to acrobatics. The first out of two endurance games was the "board game" in which four teams were created and each received a board on which a road map consisting out of several fields was drawn. Some of the fields on the board described specific exercises while other fields where empty. The students were also given a pair of dices and a token. According to the field on the board where the token was placed, the students had to follow the instructions and carry out the exercises such as run one round in the hall with high knees/ circling arms/ or sidesteps. When the field on the

board was empty the students had to run once around the hall without any specific additional exercises. The winner of the board game was the team that reached the end of the board first. During the second game "Bingo", the students were given a card with several numbers and instructions to exercises that had to be carried out when the dice showed that specific number. The team that managed to cross out all the numbers on the bingo-card first, won the competition. In the second part of the lesson, information on acrobatics was given to the students by the teachers and then they were encouraged to try out some acrobatic positions with a partner, and if there was time left these exercises should be demonstrated to the entire class. The acrobatic exercises aimed to increase the strength of the students and teach them to improve their posture.

Lesson 7 was a repetition of the first lesson in which the students mainly carried out the strength exercises in a circuit form and the shuttle-run test.

*Lesson 8, t*he final lesson of HealthyPEP included elements on the topic "rough-and-tumble play". A number of games and exercises were carried out in this framework with the aim to promote students strength and to encourage them to experience body contact with their classmates. An example of these games was "clothes peg", where every student had to adjust a clothes peg on his or her T-shirt. The students had to steal the clothes peg from each other, or in a variation form to get rid of their peg, while putting it on the clothes of another student. A second game was called "come on my side". The students were paired and were standing opposite to each other separated by a line in the hall. While holding each other's hands they had to try to pull their partner over to their side of the line. A further game was called "move the turtle". One of the students lay in an abdominal position on a mat and his or her partner had to try and turn him or her around. The lesson ended with a discussion between the teacher and the students concerning possibilities for being regularly physically active during the afternoon and on the weekends. This includes the questions with which people, when, and where students could be physically active. Finally, reasons for being physically active and the positive effects of regular physical activity were emphasised. In a last action, the children who completed the "marathon" were praised by the teacher and were given a certificate for their participation in a marathon.

Motivational input during the follow-up

Following the main intervention programme of HealthyPEP, the teachers were instructed to provide a further *motivational input* for the students. Therefore, the IG was assigned to carry out the shuttle-run test another two times during the follow-up timeframe during the three month period after the main intervention. The target of this additional component was to provide a motivational input for the students to keep being physically active beyond the school hours in order to maintain high levels or even obtain improvements in the test.

Table 11 Content and Targets of the HealthyPEP Lessons (Höner & Demetriou, 2012a)

PE Lesson	**Content of the lessons**			**Targets**
	Practical elements	Theoretical elements	Further elements	
1	• Introduction into the programme by the teacher • Shuttle-run Test • Strength exercises in a circuit training	Discussion about the importance of strength and endurance for health.	• Documentation of the shuttle-run test and the strength exercises results in the booklet • PA homework • Mood measure: raise awareness concerning state of mood.	• Endurance and strength • Awareness about the importance of strength and endurance
2	• Endurance exercises and games • Heart rate measurement after various exercises.	• Relationship between endurance, PA and pulse: o Worksheet to be filled out in small groups. o Teacher-led discussion with the class. • Reflexion of the experiences between endurance and heart rate.	• Bonus points for various assignments • Homework • Mood measure	• Endurance • Understanding of the relationship between PA and endurance
3	Strength exercises in a circuit training	Relationship between strength exercises and muscles: o Worksheet to be filled out in small groups. o Teacher-led discussion with the class.	• Bonus points • Homework • Mood measure	• Strength • Understanding of the relationship between PA, strength, and health
4	Endurance: • "Long distance" run • Various endurance games/exercises	• Improvement of endurance: o Worksheet with information. o Worksheet to be filled out in small groups. • Teacher-led discussion with the class.	• Bonus points • Homework • Mood measure	• Endurance • Understanding of the relationship between PA, endurance, and health
5	Strength exercises - stabilisation/protection of the spinal column	• Relationship between PA/strength and the spinal column: o Worksheet with information. o Worksheet to be filled out in small groups. • Teacher-led discussion with the class.	• Bonus-points • Homework • Mood measure	• Strength • Understanding of the relationship between PA and a healthy spinal column

PE Lesson	Content of the lessons			Targets
	Practical elements	Theoretical elements	Further elements	
6	• Exercises for the promotion of endurance • Acrobatics	Discussion about the experiences during the PE lesson.	• Bonus-points • Homework • Mood measure	• Endurance and strength
7	• Shuttle-run Test • Strength exercises in a circuit training	-	• Documentation of the shuttle-run test and the strength exercises results in the booklet • Bonus points • Homework • Mood measure	• Endurance and strength
8	Strength exercises: roughhousing	Discussion about: o What opportunities for PA at home/during the afternoon are there? o With whom can I exercise? o Why is it important to be regularly physically active?	• Bonus points • Mood-measure	• Strength • Sensitisation about regular PA

Note: PA=physical activity

4.3 Evaluation of HealthyPEP

The study methods chosen to evaluate HealthyPEP are presented in the following section in detail. These include a description of the students participating in the programme, the study design, a brief description of HealthyPEP as well as the regular PE lessons that the CG carried out. Additionally, the process measures selected to evaluate the programme implementation, the variables chosen for the outcome evaluation of the programme effectiveness as well as additional measures are described. Also, the procedure for the data assessment and the methods used for their analysis are presented in separate sections. Finally, after presenting the intervention study results from all assessed process and outcome measures, these findings are interpreted taking into account several methodological problems that occurred during the course of the study.

4.3.1 Study methods

4.3.1.1 Study sample

The study sample consisted of *N=516* sixth grade PE students (mean age 11.90 ± .76 years). Slightly more girls (54.7%) participated in the study. Thus, assuming an adherence rate of about 80%, a small to medium intervention effect (*f*=.175) could have been analysed with a statistical power (1-*ß*) of 94% for the whole sample or 75% (girls) and 66% (boys) for gender specific analyses, respectively.

Participants were recruited from high school in the district of Tübingen in the German federal state of Baden-Württemberg. Information about the study and request for participation were sent to the school directors by the regional council and interested schools were contacted by the researchers. The ethics department of the medical faculty at the University of Tübingen, the regional council, school directors, and teachers approved the implementation of this study. Students' parents were informed about the study and gave their consent for their children to participate in the programme.

The students were assigned to the intervention group (IG: *N*=297) and the control group (CG: *N*=219) at the school sites in order to achieve a similar distribution in coeducational and gender-segregated PE classes. This led to an IG consisting of three schools (ten classes) and a CG consisting of four schools (eight classes). Six classes consisted of boys and girls (four IG, two CG), seven classes contained only girls (three IG, four CG) and five contained only boys (three IG, two CG) (see Figure 9).

4.3.1.2 Study design and procedure of the data assessment

During the academic year 2010/2011, a *quasi-experimental design* was used to examine the effects of HealthyPEP (see Figure 9). All students in the chosen classes participated in the programme because it was adopted into the curriculum. The measurements of the IG and CG took place during the same period. All measurements at baseline (T1: November 2010 - January 2011), one week after the intervention (T2: January 2011 - March 2011) and three months after the end of the intervention (T3: April 2011 - July 2011) were carried out during PE lessons in school (see Table 12). Thus, it was aimed to examine the short- and middle-term (T1-T2 and T1-T3, respectively) effects of the intervention on three target levels.

The IG teachers were not blinded to the treatment condition because they had to be instructed about the intervention. CG teachers were informed that they were participating in a study examining the development of students' motor performance. The university students assessing the data in the schools were blinded to conditions (with the exception of the head researcher).

Since the German motor performance test needed at least five trained persons to be carried out, a team of sports science university students was built for the assessment of the motor performance data. Basically, the team was made up of regular university students working on their bachelor or diploma thesis in the course of this project and of some university students who took part at only two testings during the entire examination timeframe. These students were trained by the researcher during the course of a university seminar.

The data assessment included a questionnaire[3] (15 minutes) and a motor performance test (75 minutes). On the basis of the preliminary examination and the reactions of the children while answering the questionnaires, it was decided to design the length of the final questionnaires not to need more than 15 minutes to be filled out. Thus, the study sample was divided into two groups concerning the answering of the questionnaires. Table 13 shows which group of students answered each variable. At baseline and at post-intervention, the implementation of the motor performance took place during two PE hours whereas the filling out of the questionnaire took place during a third PE hour or during a different school hour. During the follow-up test, the data of the motor performance test and of the questionnaire were both assessed during only two PE hours.

Treatment and regular PE lessons

The intervention was carried out within a timeframe of eight weeks and consisted of eight *health-promotion PE lessons,* each of which lasted 90 minutes and an additional motivational input during the follow-up period (see section 4.2.2). The teachers were instructed to teach all eight health-promotion PE lessons even if a PE hour was cancelled (e.g., because of an illness of the teacher). In those cases, the treatment period was expanded for a week.

[3] The questionnaires are provided in the Appendix.

The IG was compared to a CG that was taught the regular PE lessons. These lessons were carried out with the same frequency and duration as the IG lessons. The curriculum taught in the CG was not the same in all CG classes because the German PE curriculum does not provide exact guidelines on lesson content in grade six. Thus, the content of the lessons included activities such as gymnastics, swimming and the traditional ball games. In general, the content was characterised by a transfer of various techniques in different sports rather than by a focus on health and fitness.

In contrast to the regular PE lessons, health and fitness was the central pedagogical perspective for the IG lessons, which mainly consisted of strength and endurance training taught via numerous games and exercises. The lessons combined age-appropriate practical training, theoretical elements, and some additional components (e.g., homework and bonus points for various assignments). These elements represented the main difference between the IG and CG lessons (see Table 11). Based on the behaviour change techniques categorised by Abraham and Michie (2008), the intervention lessons aimed to provide information about the behaviour-health link (through worksheets and discussions), general encouragement, instruction, feedback on performance, contingent rewards (bonus points for various completed assignments), and to set tasks (homework). Thus, the students were given the opportunity to experience the effects of regular training and to raise their awareness of the relationship between regular physical activity and health. Several components of the programme were repeated during the treatment period in order to provide opportunities for the students to master the exercise (see section 4.2.2).

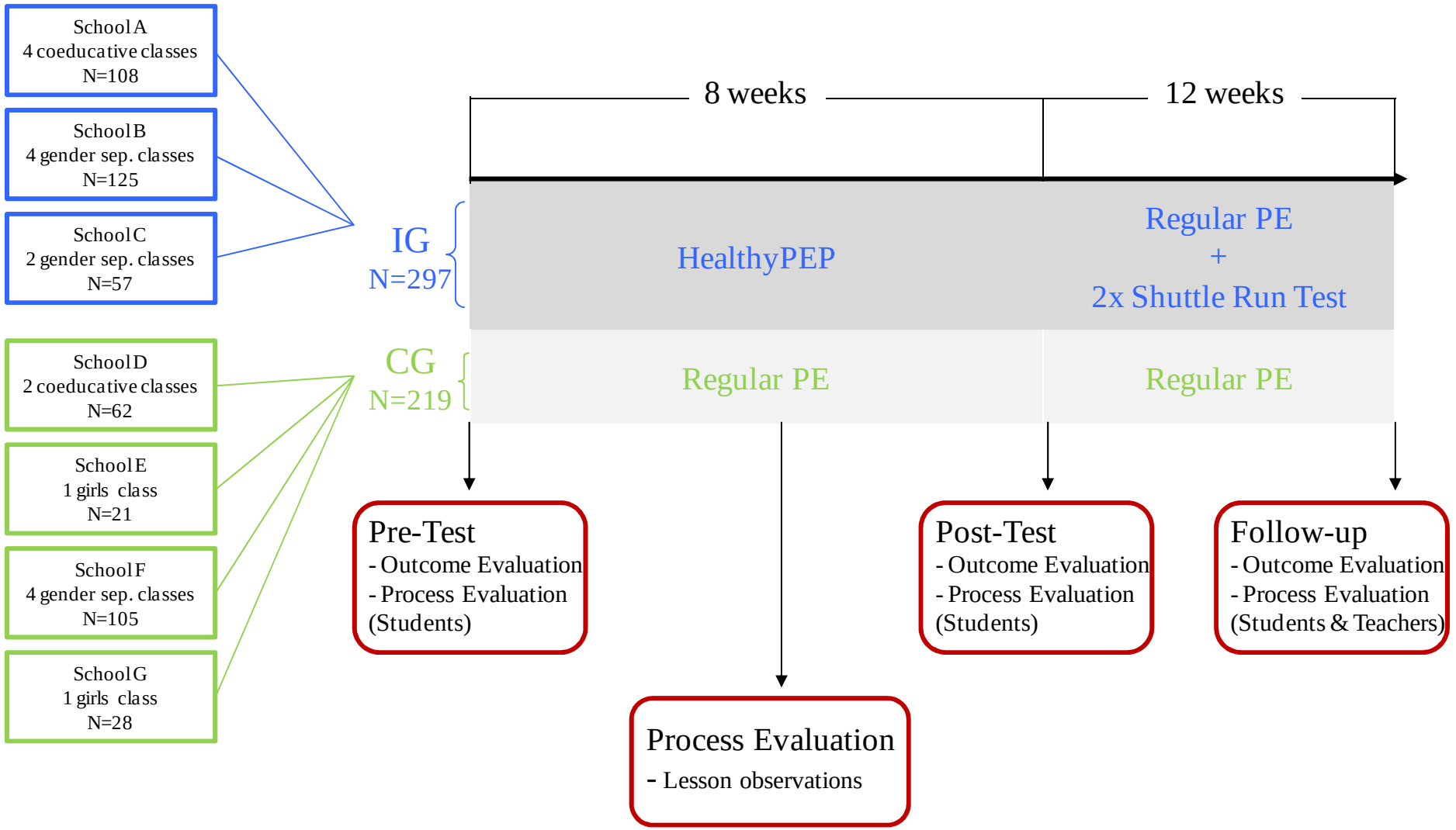

Figure 9 Description of the Study Sample Consisting out of Seven Schools Divided into the IG and CG and the Study Design for the Evaluation of HealthyPEP.

Table 12 Timeframe of the Procedure of the Data Assessment for the Intervention Study

		2010							**2011**																											
Group	**Class**	**November**			**December**				**January**				**February**				**March**				**April**					**May**				**June**				**July**		
Week		46	47	48	49	50	51	52	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
IG	1																																			
	2																																			
CG	3																																			
	4																																			
IG	5																																			
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CG	16																																			
CG	17																																			
IG	18																																			

4.3.1.3 Measures

Based on theoretical considerations on the evaluation of intervention studies in the field of health promotion, it is emphasised that not only the analysis of the interventions' outcomes is important (Mittag, 2006; Potter, 2006a, 2006b; Rossi, Lipsey, & Freeman, 2004; Westermann, 2002). It is equally significant first, to promote and observe factors that maximise the chances that a programme will be successful and second, to examine the extent to which the intended programme was implemented in the specific setting. Additionally, further analyses are required to examine possible side-effects of an intervention, moderating variables, and other influencing factors such as the school effects. Only by completing these steps it can be assured that the measured outcome effects have been caused by the treatment and not by other factors.

4.3.1.3.1 Process measures

Several strategies were used to evaluate the programme implementation of HealthyPEP. First, a series of PE lesson observations took place by trained university students to examine treatment integrity of the teachers of the IG and to gain information about the content of the regular PE lessons. Second, guideline-based interviews were conducted to obtain information from the IG teachers on several aspects of the programme implementation and last, the students were requested to evaluate HealthyPEP during the course of the questionnaire measurements.

Treatment integrity and regular PE: Lessons observations

In order to gain information about whether HealthyPEP was carried out by the IG teachers as designed and to further receive information on the content of the regular PE lessons that were compared with HealthyPEP, a standardized sheet was developed (see the Appendix) (Melchinger, 2011). The observation sheet consisted of four parts: First, general information about the PE lessons (e.g., date of the observation, time of the beginning and the ending of the lesson), second, an overall description of the lesson content and the duration of each element, and third, a standardised six point Likert scale (ranging from 1 to 6), in which the observers were asked to estimate the content of the PE lesson. This scale consisted out of 15 items such as *"Students are constantly in motion", "Focus lies on strength", "The relationship between physical activity and health is explicitly addressed", and "The teacher is competent"* (for the entire observation sheet, see the Appendix).

Two university students tested the extent to which the results documented in the observation sheet were independent of the observer during eight PE hours. The results showed that 74.6% and 18.6% of the rated items differed maximally one point or two points between the two observers respectively. In 6.8% of the items, a difference of more than two points existed between the observers. This revealed that these items were not estimated objectively by the

university students. Because these last items differed from lesson to lesson, it was not possible to conclude that specific items were not in a position to objectively describe the PE lessons and consequently to omit them from the observation sheet.

Teachers' evaluation of HealthyPEP lessons: Guideline-based interviews

In order to receive the IG teachers' view concerning several aspects of HealthyPEP, a guideline-based interview was carried out with each teacher at the end of the intervention (T2), at the same time of the students' post-test. All eight IG teachers agreed to provide information during the interview on the following aspects:

a) General information about the pre-arrangements of HealthyPEP

In this first part of the interview, the teachers were asked to provide information about the aim of HealthyPEP and the extent to which this aim corresponded with the official PE curriculum. Also they were asked about the time and effort they had needed to prepare each PE lesson and to compare this with the effort invested during their regular PE lessons before HealthyPEP. Finally, the teachers were asked to provide information on whether the necessary material and equipment was available to carry out the lessons adequately.

b) The extent to which HealthyPEP was successfully implemented

In the second part of the interview, the teachers were asked to name differences in regard to the content between HealthyPEP and the regular PE lessons they used to teach. Also, they were invited to comment on how well the implementation of HealthyPEP had succeeded and what problems they had faced during the implementation timeframe. Additionally, they were asked to provide detailed information to which extent each PE lesson had to be adapted, which elements had to be omitted or changed in order to be taught in that particular class. Finally, teachers rated the extent to which the elements of HealthyPEP were familiar to them.

c) Perceived significance of HealthyPEP

During the third part of the interview, the teachers were asked to voice their opinion concerning the importance of the content taught during the project. This was further addressed in detail concerning the practical and the theoretical elements of the treatment. Further on, the teachers gave information on whether they considered the structure of the eight lessons to be meaningful and, finally, the degree to which the students did their homework and used the booklet.

d) General concluding remarks

In the final section of the structured interview, the teachers were asked to make some concluding remarks concerning HealthyPEP. They were asked whether the students were motivated to participate in the lessons during the treatment and in which of the lesson components they were especially motivated or unmotivated to participate. The teachers also provided information about the motivation of the students during the entire treatment, about the direct and indirect feedback of the students concerning HealthyPEP, whether they

believed that the students had learned something through the theoretical elements of the intervention, and whether the teachers thought that the students became fitter and participated in more sports during the afternoon. Finally, the teachers were asked whether they would integrate certain aspects of HealthyPEP into their regular PE lessons.

Students' evaluation of HealthyPEP lessons: Questionnaire

In a final step, it was considered important to obtain the view of the students concerning HealthyPEP. Thus, at all three measurement points the students of the IG and the CG were asked to evaluate how they experienced PE during the last three weeks. In this way, the within-group changes as well as between-group changes could be examined. For this purpose, items such as '*In the last three weeks PE was better than usual/ strenuous/ varying/ interesting/ motivating/ fun', 'I was satisfied with PE', 'PE motivated me to do more sports in the afternoon' or 'I learned a lot during PE'* were used.

4.3.1.3.2 Outcome measures

The aim of the study was to evaluate the short- and middle-term effects of HealthyPEP on a broad level of outcome variables. It was considered important not to restrict the examined intervention effects on one outcome level as this might have led to limited interpretation possibilities of the interventions' effects. As Fuchs (2003) states, every intervention is designed to achieve changes on a global level which is the superior target of an intervention programme. Only once the global target is set, it can be examined how this target can be achieved. Based on this knowledge, the intervention programme can be designed to influence or change the required behaviour of the participants in the wanted direction (behaviour level). Theoretical models of behaviour change have shown that interventions are usually not in a position to directly influence the desired behaviour. Thus, also the modification of determining factors of this behaviour need to be taken into account (see section 2.2.3).

Therefore, for the evaluation of HealthyPEP, variables on three target levels based on theoretical considerations (see section 2.2) and findings from the systematic review (see section 3.2) were assessed. These were a) the psychological determinants of physical activity level (motivation towards physical activity and PE, attitudes towards physical activity and PE, self-efficacy, and knowledge of the relationship between physical activity and health), b) the behaviour level (physical activity), and c) the health and fitness level (motor performance, BMI, and HRQOL) (see Figure 10 and Table 13).

The primary aim of HealthyPEP was to determine the influence of the variables on the global health and fitness level. It was expected that this aim would be achieved through the direct influence of HealthyPEP but also through the change of the psychological determinants of physical activity and physical activity itself. Figure 10 shows the expected way in which HealthyPEP is assumed to influence the three target levels. The bold arrow shows the

relationship between the intervention programme and the three target levels that are targeted to be changed. It was expected that HealthyPEP would influence the three target levels in a positive direction, for example that a direct effect on students' physical activity behaviour through the changed PE lesson that already includes more physical activity would occur. Additionally, it was expected that not only the direct influence of HealthyPEP would lead to a change in the three outcome levels but also influences between the three levels (shown with dashed arrows) would result. For example, the change of the psychological determinants of physical activity could influence the physical activity levels of a student. The diverse direction of this relationship would also be possible, as for example, an increase in physical activity levels due to HealthyPEP might show increased levels of students' motivation or attitudes towards physical activity. Nevertheless, as also shown in the systematic review, only very few studies examined the mediating effects of the psychological determinants of physical activity on physical activity itself as well as on the health and fitness variables (Demetriou & Höner, 2012). It must be stated that this is a highly challenging task that requires as a requisite the successful influence of the psychological determinants by the intervention programme in the first place, before being able to analyse any existing mediating effects.

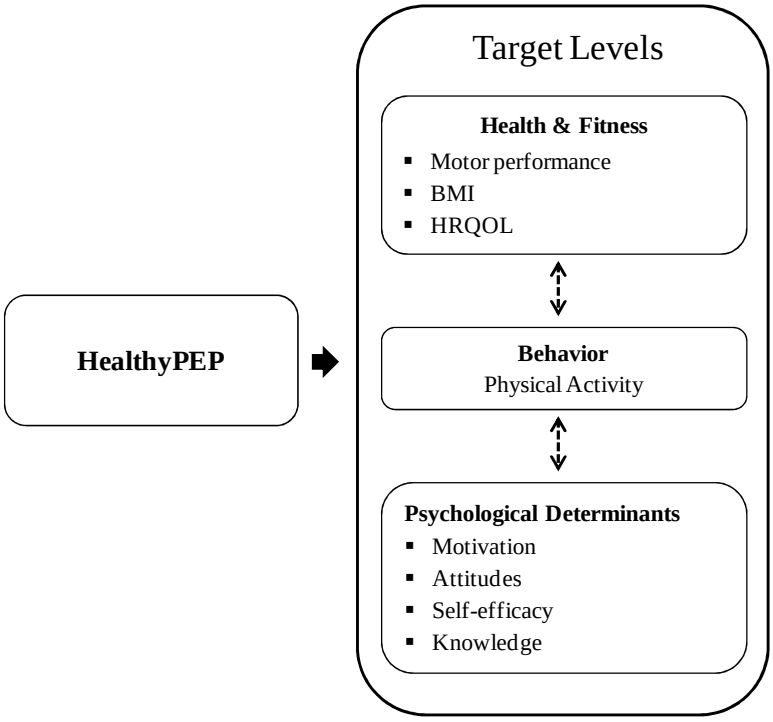

Figure 10 Target Levels of HealthyPEP (adapted by Demetriou & Höner, 2012, p. 187).

In the following sections, the measurement instruments for the assessment of the chosen outcome variables are described and their psychometric properties based on reference samples (when available) and on the sample of this study are presented. Table 13 presents all assessed variables during this study, their theoretical background, the measurement instruments used to asses these, and finally, the group of students that provided information on these variables.

Table 13 Assessed Outcome Variables: Theoretical Background and Measurement Instruments

Target level	Theoretical background	Outcomes	Instruments	Reliability (reference group)	Reliability (this study sample)	Group
Psychological determinants of physical activity	Triandis (1975) Ajzen (1991)	Attitudes towards health effects of PA	Steinmann (2004)	-	$\alpha = .74$	A
		Attitudes towards PE	Mrazek, Schuessler, & Brauer (1982)	$\alpha \geq .91$	$\alpha = .91$	A
	Deci & Ryan (1985) Rheinberg (2008)	Motivation towards regular physical activity	Sport Motivation Scale (SMS) Pelletier et al. (1995) Seelig & Fuchs (2006)	-	$\alpha \geq .62$	B
		Motivation: Enjoyment in PE	Intrinsic Motivation Inventory (IMI) Markland & Hardy (1997)	-	$\alpha = .84$	B
	Bandura (1986)	Self-efficacy	SSA-Scale Fuchs & Schwarzer (1994)	-	$\alpha = .85$	A
	Keating et al. (2009)	Knowledge of health effects of PA	Developed for this study	-	-	A
Physical activity behaviour	Bös et al. (2009) Lampert, Mensick, Romahn, & Woll (2007)	MVPA (WHO)	MoMo-AFB-11-17 Woll et al. (2007)	$r = .83$	$r = .47$	A
		Physical activity in the sports club		$r = 1.00$	$r = .64$	A
		Physical activity outside the sports club		$r = .93$	$r = .47$	A
Health & Fitness	Steinmann (2004) Bös (2009) Frey & Hildenbrandt (1995)	Motor performance	German motor performance test (DMT 6-18) Bös (2009)	$.52 < r \leq .94$	$r = .85$ (score)	AB
	Cole (2000)	BMI	Weight, height	-	$r = .97$	AB
	Ravens-Sieberer, Ellert, & Erhart (2007)	Health-related quality of life	KINDL^{R} Ravens-Sieberer & Bullinger (2000)	$\alpha \geq .70$	$\alpha = .84$ (score)	B

Note. The retest reliability of this intervention study sample was based on the T1 and T2 values of the CG. Cronbach's α was measured based on the T1 values of the entire study sample.

Psychological determinants of physical activity

Attitudes towards health effects of physical activity

Students' attitudes towards the health effects of physical activity were measured using a modified and shortened version of the questionnaire by Steinmann (2004). This questionnaire consists of a cognitive, a conative, and an affective dimension (Triandis, 1975). From the 43 items of the initial version, 10 items were chosen for the questionnaire of this study. Four items can be attributed to the cognitive dimension (e.g., *'regular exercise is healthy'*), four to the affective dimension (e.g., *'I feel better and healthy after being physically active'*), and two items to the conative dimension (e.g., *'people who are regularly physically active live longer'*). Pre-test examinations of this questionnaire did not confirm the three dimensions and therefore the ten items were treated as one factor. Reliability of the scale in form of internal consistency was tested with Cronbachs' α and reached a value of α = .74. Responses were indicated on a seven-point Likert scale ranging from "not at all true" to "very true".

Attitudes towards PE

To assess students' attitudes towards PE, the German questionnaire by Mrazek et al. (1982) was used. Psychometric properties of the questionnaire were measured by Mrazek et al. (1982) with a sample of 484 children in the fifth, seventh, and ninth class. A factor analysis showed that the items loaded on one factor, which explained 73.69% of the variance. All items loaded between .40 and .83 on this first factor (Mdn = .73). The reliability of the questionnaire in terms of internal consistency was very high reaching Cronbach's α values between .91 and .95. For this study, only eight items were chosen which were answered on a seven point Likert scale reaching from "not at all true" to "very true". These were for example *'no other school subject is as good as PE'* or *'I don't like PE'*. Reliability in terms of internal consistency of the eight items in this study was α = .91.

Motivation towards regular physical activity

For the assessment of students' motivation towards regular physical activity, several questionnaires were considered and were modified in order to create a questionnaire suitable for children. The questionnaires used were the Sport Motivation Scale (SMS) by Pelletier et al. (1995), the Situational Motivation Scale (SIMS) by Guay, Vallerand, and Blanchard (2000), and the Sport- and Movement-related Self-concordance Scale by Seelig and Fuchs (2006).

The SMS (Pelletier et al., 1995) was created to assess an athlete's intrinsic motivation (to know, to accomplish, to experience stimulation), extrinsic motivation (external, introjected, identified), and amotivation toward sport participation. This questionnaire represents a slightly deviated form of the self-determination continuum (Deci & Ryan, 1985, 2004;

Martens & Webber, 2002). The SIMS is designed to assess the constructs of intrinsic motivation, identified regulation, external regulation, and amotivation in regard to a specific situation (Guay et al., 2000). Situational motivation refers to the motivation individuals experience when they are currently engaging in an activity. It refers to the here-and-now of motivation (Vallerand, 1997). Finally, the sport- and movement-related self-concordance scale by Seelig and Fuchs (2006) represents the German language instrument for measuring the self-concordance of sport- and exercise-related goals. Also this scale is theoretically based on the self-determination theory by Deci and Ryan (1985, 2004). All three instruments were designed to measure the different facets of motivation in adults. Thus, the chosen items of these scales needed to be adjusted in order to measure sixth grade students' motivation towards regular physical activity.

Altogether 22 items were chosen that represented the three forms of motivation based on the self-determination theory by Deci and Ryan (2004). These were the intrinsic motivation (e.g., *'I am physically active because the activity is interesting/fun'*), the identified motivation (e.g, *'I am physically active because I want to do something for my health'*), and the external motivation (e.g., *'I am physically active because I don't have another option'*) which included two items that represented the introjected motivation (e.g., *'I am physically active, because I have the feeling that I should do so in order to feel good'*). Because the differentiation between these extrinsic forms of motivation is very thin, it was especially difficult to differentiate the items accordingly for this young age group. Therefore, the external and introjected forms of motivation were merged into one category and represented the external-introjected motivation of children towards regular physical activity.

The items were rated on a seven point Likert scale ranging from "not at all true" to "very true". Psychometric properties of this scale revealed satisfactory reliabilities. The subscale external-introjected motivation had a Cronbach's $\alpha = .62$ (one item was omitted from all further analyses in order to increase the reliability of the scale), the identified motivation $\alpha = .79$ and the intrinsic motivation $\alpha = .75$.

Motivation in PE

Motivation in PE was assessed using the enjoyment scale of the Intrinsic Motivation Inventory (IMI) (Markland & Hardy, 1997). According to Mcauley, Duncan, and Tammen (1989) and McAuley, Wraith, and Duncan (1991), the IMI determines an individual's level of intrinsic motivation as an additive function of the four underlying dimensions: perceived competence, interest-enjoyment, pressure-tension, and effort-importance. The full set of 27 items has been rarely used, and it has been emphasised that the inclusion or exclusion of any factor does not affect the properties of the remaining factors. In addition, the subscales can be shortened by eliminating redundant items without compromising their reliability. Finally, the

generic scale items can easily be modified to reflect intrinsic motivation for any particular activity (Markland & Hardy, 1997).

In the course of this study, students' intrinsic motivation towards PE in the last three weeks was measured using the interest/enjoyment subscale of the IMI. Originally the scale consists of seven items such as *'I enjoyed doing this activity very much'* or *'I would describe this activity as very interesting'*. The items of this scale were translated into German and were modified to specifically assess students' intrinsic motivation of PE in the last three weeks. After a first test of the questionnaire, two items were omitted to increase the reliability of the scale. The items were rated on a seven point Likert scale reaching from "not at all true" to "very true". Reliability in terms of internal consistency was high reaching a Cronbach's α of α = .84.

Self-efficacy

To assess students' self-efficacy levels, the German SSA-Scale by Fuchs and Schwarzer (1994) that consists out of 12 items was used (e.g., *'I am sure that I can carry out the planned physical activity even if I am very tired/I have worries/ friends are over for a visit'*). Students were asked if they were confident to exercise regularly even if several barriers were faced. Answers were provided on a seven point Likert scale ranging from "not sure" to "very sure". A Cronbach's α coefficient of α = .85 was calculated on subjects' pre-test scores.

Knowledge

A questionnaire was needed that specifically measured the gained knowledge based on the theoretical components of HealthyPEP. Therefore, a questionnaire was designed with multiple choice type answers to measure students' knowledge about the health effects of physical activity especially for this study. Altogether nine questions were formulated and several possible answers were provided. Students were also given the possibility to note that they did not know the correct answer. The questions included here were for example *'How does the pulse rate change after a long term endurance training?'*, *'How many muscles does a human have?'* or *'What kind of training is best for an upright posture?'*.

Physical activity behaviour

For the measurement of students' physical activity levels, the German questionnaire MoMo-AFB-11-17 constructed by Woll et al. (2007) was used. The questionnaire was too long to be entirely used for this study and therefore only the questions assessing the overall MVPA levels, the exercise levels in the sports club, and the exercise levels outside the sports club were used. In the following, the chosen items used to assess students' physical activity levels in this intervention study are described.

In the first part of the questionnaire, students' *overall MVPA* was assessed. Here, MVPA was defined as any activity that increases your heart rate and makes you get out of breath some of the time. Examples of such activities (running, brisk walking, rollerblading, biking, dancing, and football) were also provided to the students in order to clarify to what kind of activities students should refer to when answering these questions (Parry-Langdon & Roberts, 2004). Two questions were used to measure students' overall MVPA. In both questions, they were asked to name the number of days in a week, ranging from 0 days to 7 days, in which they were at least 60 minutes physically active *('Over the past seven days, on how many days were you physically active of a total of at least 60 min per day?'* and *'Over a typical or usual week, on how many days are you physically active for a total of at least 60 minutes per day?'*) (Parry-Langdon & Roberts, 2004; J. J. Prochaska, Sallis, & Long, 2001). For the analysis of the overall MVPA, the two questions on the physical activity of a) the last week and b) a usual week were averaged resulting into one score (J. J. Prochaska et al., 2001). An average score of five or more meets the primary guideline of at least 60 minutes of MVPA on five or more days. Additionally, the use of these questions enables a comparison between this study sample and international data. The retest-reliability in the reference sample was satisfactory reaching a value of r = .83 (Romahn, 2008). In the CG of the sample of this study, the reliability values were lower. The retest-reliability between T1 and T2 was questionable reaching a value of r = .47, between T2 and T3 it was somewhat higher r = .74, and finally, between T1 and T3 a reliability of r = .62 was measured.

In a further block of questions, the students were asked to provide information on their amount of *exercise within a sports club*. First, it was asked whether the students were members in a sports club and if yes, they were asked to provide information on the sport they were playing, the frequency with which they played this sport or trained each week, and the duration of each sports session. The students had the option to provide information on two sports they were practicing in the club. The retest-reliability of the reference group reached a value of r = 1.00. Although no further details were provided in the research project by Romahn (2008), it is assumed that this correlation refers only to the question whether students were member in a sports club and does not describe the reliability of the total minutes students spent exercising in a sports club. During this study, the retest-reliability concerning the minutes exercising in a sports club was calculated based on the CG. The results concerning the retest-reliability of this item in this study were r = .64 (T1-T2), r = .47 (T2-T3), and r = .56 (T1-T3).

Similarly to the previous question, students were also requested to give information on their amount of *exercise outside of the sports club*. Here, the same questions were placed as in the previous part. It was asked about the sport they played, the frequency with which it was carried out, and the duration of each session. Also concerning this item, the retest-reliability values were high in the reference sample with r = .93 (Romahn, 2008). The retest-reliability based on the CG of this study was r = .47 (T1-T2), r = .20 (T2-T3), and r = .39 (T1-T3).

Health and fitness

The final block of outcome measures consisted of the variables motor performance, BMI, and HRQOL that formed the health and fitness target level.

Motor performance

Students' motor performance was measured using the German motor performance test, DMT 6-18 (Bös, 2009; Tittlbach et al., 2011), which was developed within the scope of the German Society of Sport Science. The instrument consists of eight tests that measure students' endurance, strength, speed, coordination and flexibility: a 20m sprint, a standing long jump, press-ups, sit-ups, backwards balancing on bars with different widths, sideways jumping, stand-and-reach flexibility, and a 6-minute run (see Table 14). With this test, the current motor abilities but also changes over time in children and adolescents between the age of 6 to 18 years can be measured. The psychometric properties tested with the sample of this study were satisfactory, with only two exceptions. Test-retest reliability over eight weeks in the CG was r = .85 for the motor performance score and varied from r = .52 to r = .90 for the seven tests. The reliability of the sideways jumps and balancing backwards had only medium retest reliability (r =.52 resp. r =.57).

The original testing of the psychometric measures in the DMT test showed very good objectivity measures between two testing persons (r = .95). A medium reliability of the sideways jumps and balancing backwards was also found in the analyses by Bös (2009). Bös (2009) discusses that this might be caused by the high proportion of coordination tested by these tests, which is more difficult to be measured compared to endurance or strength. In general, the reliability of the test was satisfactory. Bös (2009) found an improvement of 6.3% in the second testing. All learning effects were under 10% but significant – except of the 20m sprint – and indicate a learning effect. From these analyses it can be concluded that the learning effects are bigger in the tests with rather coordinative elements such as balance backwards, press-ups and sideways jumps in comparison to the test consisting more of endurance, strength and sprint. Furthermore, the psychometric properties provided by Bös (2009) concerning the validity of this motor performance test are satisfactory. Content validity was examined by expert ratings concerning the meaningfulness and the feasibility of each test component. Criterion validity was tested by comparing the results of the DMT with the membership of the children and adolescents in sports clubs. It was assumed and confirmed that sports club members would achieve higher values in the DMT.

The statistical analysis of the DMT can be carried out for each motor performance test separately or based on the overall results of the test. For the latter, a motor performance score can be estimated by calculating the arithmetic mean of the Z-values of each test (while excluding the stand-and-reach flexibility).

Table 14 Eight Week Retest-Reliability in Motor Performance Based on the CG of this Intervention Study

Test description, number of CG students, retest reliability values

Motor performance score
Sum of the z-values of each motor performance test (stand-and-reach flexibility test was excluded) and division by seven.
N = 206, r = .85

20m Sprint
The test involves running a maximum sprint over 20 meters, starting from a stationary position with a foot behind the starting line. The time is recorded manually using stopwatches.
N = 187, r = .67

Sit-ups
The maximum number of sit-ups in 40 seconds. The student lies on his back on a mat with knees flexed at 90 degrees. A partner anchors the feet to the ground. The hands are placed by the side of the head and the elbows point towards the knees. The student has to raise the trunk so that the elbows touch the knees. The trunk is lowered back to the floor so that the shoulder blades or upper back touch the floor.
N = 205, r = .63

Press-ups
The maximum number of press-ups in 40 seconds. The student lies on his belly on a mat with his hands touching at the back. Then, the hands are placed next to the shoulders and the body is pressed-up with the body and legs in a straight line, feet slightly apart. When the arms are stretched, the one hand touches the other and then back to the starting position, in which the body is lowered to the ground and the hands touch at the students' back.
N = 205, r = .62

Standing long jump
The student stands behind a line marked on the ground with feet slightly apart. A two foot take-off and landing is used, with swinging of the arms and bending of the knees to provide forward drive. The subject attempts to jump as far as possible, landing on both feet without falling backwards.
N = 205, r = .84

Test description, number of CG students, retest reliability values

Sideways jumps
Over the course of 15 seconds, the student must jump with both legs at the same time, as quickly as possible, sideways over the middle line between two marked squares (50cmx50cm).
N = 203, r = .52

Balance backwards
The students had to balance backwards on bars with different widths (6 cm, 4.5 cm, 3 cm). Each step received one point resulting into a maximum of total points when reaching the other side of the bar.
N = 206, r = .55

Stand and reach flexibility
Students had to stand on a bench and reach as far as possible to the ground and further down. They received positive values when they reached below their toes and negative values if they did not reach their toes. They had to remain in the furthest position they could reach for 2 seconds.
N = 205, r = .90

6-min run
The students run around a marked volleyball field in the sports hall for 6 minutes.
N = 185, r = .81

BMI

The Body Mass Index (BMI) is the most commonly employed index of adiposity status among children and adolescents (Demetriou & Höner, 2012). *BMI* and its normative values in adolescence are dependent on age. A normal BMI of a person aged 11 years is different from a normal BMI of a person aged 17 years. This difference has not been considered in this research project, since here only the changes in BMI are of importance. Standard procedures (electronic scale and stadiometer) were used to measure body weight and body height. Body weight was measured in light clothing without shoes. BMI was calculated by dividing the weight (kilograms) by height squared (meters). Test-retest reliability over eight weeks in the CG was r = .97.

Health-related quality of life (HRQOL)

The generic German questionnaire KINDL-R measures children's HRQOL in terms of subjective perception of physical, mental, social, psychological, and functional aspects of well-being and health (Ravens-Sieberer, Wille, et al., 2008). It is comprised of six sub-scales (physical well-being, emotional well-being, self-esteem, family, friends, and school), each containing four items with a total of 24 items to which the participants are asked to respond on a 5-point Likert scale. Examples for items on the physical well-being scale were *'I felt ill'*, or *'I was tired and worn-out'*. On the emotional scale, items such as *'I had fun'* and *'laughed a lot'* were given. On the self-esteem dimension, items were for example *'I was proud of myself'*, and *'I had lots of good ideas'*. On the family dimension, examples of items were *'I got on well with my parents'*, and *'I felt fine at home'*. On the friends dimension, examples were *'other kids liked me'* or *'I got along well with my friends'*. Finally, on the dimension of everyday functioning, items such as *'doing my schoolwork was easy'*, and *'I worried about bad marks or grades'* were provided.

The sub-scales of these six dimensions were combined to produce a HRQOL score with values ranging from 0 to 100. Psychometric properties reported by Ravens-Sieberer et al. (2007) revealed a high degree of reliability (Cronbach's $\alpha \geq .70$) for most of the subscales and samples and a satisfactory convergent validity of the procedure. In this study, reliability scores were a bit lower, ranging from an α of .46 for the school dimension to an α of .80 for family. Additionally, the other subscales revealed the following values: physical wellbeing $\alpha = .62$, psychological wellbeing $\alpha = .60$, self-worth $\alpha = .67$, and friends $\alpha = .59$. The overall HRQOL score reliability was $\alpha = .84$. For economic reasons, only half of the sample was asked to answer the KINDL-R questionnaire.

4.3.1.3.3 Additional measures

Interventions' side effects: Students' cooperation

PE persuades a number of targets which are manifested in the educational curriculum such as the development of students' personality, teaching of values, the willingness to perform, empathy and cooperation, fairness, team spirit, consideration and integration of weaker students and helpfulness (DOSB, DSLV, & DVS, 2009; Kurz, 2008b). It is not possible to pursue all of these targets at the same time. Instead, different targets must be set and followed over a limited timeframe. Therefore, this intervention study focuses on the aim of students' health enhancement. Nevertheless, it is important to also examine whether this treatment might have led to unwanted side effects (Mittag, 2006) in a way that students of the IG might not develop in the same way as the CG students in the other targeted goals of PE.

Because it was not possible to assess variables in all fields which PE aims to target, only the willingness of students to help their classmates was examined using a dimension of the LASSO questionnaire (Saldern & Littig, 1987). The scale consisted of eight items as for example *'Most of the students in our class help each other during the lessons'*, *'Students which have understood a specific assignment wait until the other students also understand the exercise/question stated by the teacher'*. The items had to be answered on a 4-point Likert scale ranging from "not at all true" to "very true". The reliability of the scale was very good reaching a Cronbach's $\alpha = .84$.

4.3.1.4 Data analysis

For the comprehensive evaluation of HealthyPEP, several methods including both qualitative and quantitative methods for the assessment of the data were implemented. As stated by Mittag (2006), for an efficient analysis of intervention effects in the school setting, a combination of qualitative and quantitative research methods is required. Due to the fact that different kinds of data were collected during the course of this project, the analysis was not the same for all measures. For the analysis of the process measures, qualitative and quantitative methods were used whereas the outcome measures were evaluated only with quantitative methods.

The ***process measures*** consisted of three aspects: First, the *observations of the health promotion PE lessons* and the regular PE lessons were analysed using a quantitative analysis procedure. Here, in the first step, the data gained from the standardised observation sheet specifically developed for this intervention study were systematically described and in the second step, *t*-tests were carried out to examine differences between the two groups. Second, the gained data from the *interview-based evaluation of the PE lessons by the teachers* were analysed using a qualitative perspective. The results gained from the interviews were systematically summarised and presented for each question stated in the interview. Third, the

data gained by the *questionnaire-based* s*tudents' evaluation* of the health-promotion PE programme were analysed using descriptive and inferential statistical procedures. These procedures were similar to the ones described in the following for the outcome variables. The main focus of the analysis was set on the examination of within-group differences in the timeframe of the main intervention (T1-T2) and during the follow-up (T2-T3). Additionally, between-group differences were analysed at T2 and T3 (for the detailed statistical procedure see the following text).

The examined ***outcome variables*** were analysed using descriptive and inferential statistical procedures. In the following section, the procedure of the statistical analyses of the assessed outcome variables as well as the students' evaluation of the health promotion PE lessons are described. In a first step, gender was not taken into account. Only in a second step, since gender was an effect modifier, all analyses were carried out separately for girls and boys. Analyses were performed using SPSS version 19.

1. *Baseline group differences* were tested using independent *t*-tests and chi-square tests depending on the level of measurement to ensure that the IG and the CG did not significantly differ at T1. The statistical significance level was set at $p = .05$.

2. *Lost to follow-up analysis* was performed using a chi-square test to examine differences between the number of dropouts in the IG and the CG at T2 and T3, respectively. Furthermore, independent *t*-tests were used to analyse differences in all of the outcome variables at T1 between the dropouts and adherers at T2 and T3, respectively (Des Jarlais, Lyles, & Crepaz, 2004). Similar to the baseline group differences analysis, also here the statistical significance level was set at $p = .05$.

3. *Missing values* from the KINDL-R questionnaire for the assessment of HRQOL were calculated as the mean of the available items when at least 50% of the items of each scale were answered.

4. Short- (T1-T2) and middle-term (T1-T3) *within-group differences* were tested using *t*-tests in order to examine the direction and the stability of the intervention effects. Additionally, figures were drawn that describe the development of students in these outcome variables. The developments need to be interpreted with caution because the numbers of students vary across the measurements and are therefore drawn with dashed lines. In these figures, T1 includes the students that were measured in the first data assessment, T2 represents the students whose data exist at the measurement T1 and T2, and finally, T3 represents the students that participated in the T1 and T3 data collection.

5. To estimate the short- and middle-term *intervention effects*, group differences were first examined concerning the entire study sample without separating the students by gender, and second, gender separated analyses were carried out. The group differences were calculated by ANCOVA using the baseline values (T1) of the analysed dependent variable

and baseline BMI values as the covariates (C. S. Davis, 2010; Vickers & Altman, 2001). Concerning the differences between IG and CG at T2 and T3, the intervention was evaluated as effective when the statistical test reached a probability of error smaller than 5%. In these cases it was interpreted that a significant difference existed between the IG and the CG.

6. For the further interpretation of the within and between differences, two *effect sizes* were calculated: Cohen's d and η^2. Cohen's d was estimated using the standard deviation of the entire group at T1 (Kazis, Anderson, & Meenan, 1989; Leonhart, 2004). For the within-group differences, only Cohen's d was used and for the interpretation of the intervention effects, both effect sizes were calculated (Bortz & Schuster, 2010). Only by providing standardised effect sizes, comparisons across different measures and studies are possible.

7. Because students were allocated into IG or CG on school level, *school clustering effects* might occur. A multi-level analysis to examine these school effects could not be carried out because at least 30 schools would be required (Maas & Hox, 2004). Also a regression analysis with dummy variables, as recommended for smaller sample sizes (Demidenko, 2004), to estimate the explained variance by the factors group and school is not expedient because both factors are confounded to a certain extent. Therefore, ANCOVAs within each group were calculated to examine significant differences between the three IG schools and between the four CG schools on the main outcome variables in which significant intervention effects were measured. These were self-efficacy, motor performance score, and BMI.

8. Several analyses were carried out to examine whether possible *moderating variables* existed that influenced the relationship between the intervention programme and the outcome variables. Therefore, it was examined whether the class composition, students' initial BMI levels, and the initial motor performance level variables had a moderating effect on the study outcomes. The class composition consisted of three groups: a) mixed-gender classes, b) only girls classes, and c) only boys classes. Concerning students' baseline BMI levels, three categories were created. These included the "underweight" group of students with the lowest BMI levels at baseline ($BMI \leq 16.5$), the "normal weight" group ($16.5 < BMI \leq 20$), and finally, the "overweight" group, which had the highest baseline BMI levels ($BMI > 20$). Also concerning the baseline motor performance levels, three categories were built. These included students with low motor performance levels (MP score ≤ 105), students with medium levels ($105 <$ MP score ≤ 110), and finally, the group of students with high baseline motor performance levels (MP score > 110). Differences between IG and CG in these subcategories were calculated by ANCOVA using the baseline values (T1) of the analysed dependent variable as the covariate and the level of significance was set to $p = .05$. This procedure is analogous to the concept of statistical

interaction, with the association A→C varying across levels of the moderator B (Bauman et al., 2002).

9. *Sum score calculations* were made for motor performance and the KINDL questionnaire in order to provide an estimation of the intervention effects of the overall construct. The motor performance score was created by calculating the z-values of each motor performance test and then summing up the seven tests (stand-and-reach test was excluded from this calculation) and dividing them by seven. Concerning the KINDL questionnaire the average of the 24 items used to assess students' HRQOL was used to define the sum score of the scale.

4.3.2 Study results

In this section the results of the evaluation of HealthyPEP are presented. All the analyses were carried out for the entire groups without differentiating by gender and also for the two genders separately. First, preliminary analyses were conducted that included the baseline characteristics of the two groups and the description of the dropouts in the lost to follow-up examination (see section 4.3.2.1). Second, the results on the process measures concerning the study implementation are presented (see section 4.3.2.2), third the intervention effects (see section 4.3.2.3) and finally, some additional analyses to complete the picture of the study results are presented (see section 4.3.2.4).

4.3.2.1 Preliminary analysis

4.3.2.1.1 Baseline characteristics

The data analysis revealed no *baseline differences* between IG and CG on the psychological determinants of physical activity or physical activity behaviour itself (see Table 15). There were also no baseline differences in motor performance except in sideways jumps in the entire group (d=0.22). Significant baseline differences between the IG and the CG existed in girls' BMI (d=0.35). Finally, concerning the demographic variables, no significant age or gender differences were found, but there was a significant difference in gender distribution ($\chi^2(1, 513)=3.94$; $p=.047$). The significant difference in sideways jumps was not considered a confounding variable because it was not assumed to influence students' development in the other examined variables during the study investigation timeframe. The significant difference between gender distributions was not further considered as the intervention effects were also analysed separately for both sexes.

Table 15 Baseline Differences Between the IG and the CG in the Outcome Variables

Variable	Group	IG		CG						
		N	M ± SD	N	M ± SD	T	df	p	95% CI	d
Attitudes tow. health effects of PA	Total	128	5.78 ± .76	67	5.64 ± .77	1.19	193	.24	-.09; .37	0.18
	Girls	89	5.74 ± .70	33	5.68 ± .74	.46	120	.65	-.22; .35	0.09
	Boys	39	5.86 ± .91	34	5.61 ± .82	1.24	71	.22	-.15; .66	0.29
Attitudes towards PE	Total	126	5.54 ± 1.20	67	5.37 ± 1.47	.85	191	.40	-.22; .56	0.13
	Girls	88	5.50 ± 1.20	33	5.02 ± 1.60	1.75	119	.08	-.06; 1.01	0.36
	Boys	38	5.63 ± 1.22	34	5.70 ± 1.27	-.25	70	.80	-.66; .51	0.06
Self-efficacy	Total	124	4.45 ± 1.19	67	4.34 ± 1.28	.59	189	.55	-.26; .48	0.09
	Girls	87	4.52 ± 1.15	33	4.18 ± 1.25	1.43	118	.16	-.13; .82	0.29
	Boys	37	4.27 ± 1.28	34	4.49 ± 1.31	-.72	69	.48	-.83; .39	0.17
Enjoyment in PE	Total	114	5.29 ± 1.50	109	5.40 ± 1.28	-.56	221	.58	-.47; .26	0.07
	Girls	41	5.47 ± 1.50	72	5.50 ± 1.17	-.11	111	.91	-.53; .48	0.02
	Boys	73	5.19 ± 1.49	37	5.20 ± 1.46	-.02	108	.99	-.60; .59	0.00
External motivation	Total	116	3.56 ± 1.11	110	3.47 ± .96	.65	224	.51	-.18; .36	0.09
	Girls	42	3.33 ± 1.04	73	3.30 ± .93	.17	113	.86	-.34; .40	0.03
	Boys	74	3.70 ± 1.13	37	3.82 ± .94	-.57	109	.57	-.55; .30	0.12
Identified motivation	Total	116	4.33 ± 1.19	110	4.21 ± 1.01	.79	224	.43	-.17; .41	0.11
	Girls	42	4.05 ± 1.15	73	4.09 ± .96	-.22	113	.83	-.44; .35	0.04
	Boys	74	4.49 ± 1.19	37	4.45 ± 1.09	.16	109	.88	-.42; .50	0.03
Intrinsic motivation	Total	115	5.24 ± 1.25	109	5.19 ± 1.10	.30	222	.77	-.26; .36	0.04
	Girls	41	5.15 ± 1.25	73	5.11 ± 1.22	.14	112	.89	-.44; .51	0.03
	Boys	74	5.29 ± 1.26	36	5.34 ± .80	-.25	108	.80	-.51; .40	0.05
Knowledge	Total	126	4.71 ± 1.70	66	4.68 ± 1.41	.13	190	.89	-.45; .51	0.02
	Girls	89	4.79 ± 1.61	33	5.03 ± 1.24	-.79	120	.43	-.86; .37	0.16
	Boys	37	4.54 ± 1.91	33	4.33 ± 1.49	.50	68	.62	-.62; 1.03	0.12
MVPA	Total	124	3.90 ± 1.66	66	3.64 ± 1.52	1.05	188	.29	-.23; .74	0.16
	Girls	87	3.87 ± 1.60	33	3.55 ± 1.45	.99	118	.33	-.32; .95	0.20
	Boys	37	3.97 ± 1.82	33	3.73 ± 1.61	.60	68	.55	-.58; 1.07	0.14
Minutes spent in a sports club per week	Total	88	207.27 ± 202.07	49	258.70 ± 211.32	-1.41	135	.16	-123.84; 20.98	0.25
	Girls	61	199.51 ± 212.68	21	217.64 ± 253.09	-0.32	80	.75	-130.65; 94.38	0.08
	Boys	27	224.81 ± 178.27	28	289.50 ± 172.17	-1.37	53	.18	-159.46; 30.09	0.37
Minutes spent outside a sports club per week	Total	69	228.59 ± 208.10	40	217.63 ± 215.23	.26	107	.80	-72.05; 93.98	0.05
	Girls	47	203.35 ± 185.60	17	175.59 ± 144.16	.56	62	.58	-71.72; 127.25	0.16
	Boys	22	282.50 ± 245.55	23	248.70 ± 254.23	.45	43	.65	-116.57; 184.17	0.14
Motor performance score	Total	249	107.49 ± 6.19	183	107.31 ± 6.54	.29	430	.78	-1.04; 1.39	0.03
	Girls	125	106.10 ± 5.93	109	105.63 ± 6.56	.59	232	.56	-1.13; 2.09	0.08
	Boys	124	108.89 ± 6.16	74	109.80 ± 5.71	-1.04	196	.30	-2.65; .82	0.15
Sit-ups	Total	250	22.70 ± 4.98	182	22.49 ± 5.49	.42	430	.67	-.78; 1.21	0.04
	Girls	125	21.06 ± 4.34	109	20.80 ± 5.31	.41	232	.68	-.99; 1.50	0.05
	Boys	124	24.36 ± 5.07	73	25.01 ± 4.76	-.89	195	.37	-2.09; .79	0.13
Press-ups	Total	249	16.46 ± 3.07	183	16.36 ± 3.28	.33	430	.74	-.50; .71	0.03
	Girls	124	15.25 ± 2.62	109	15.51 ± 3.09	-.70	231	.48	-1.00; .47	0.09
	Boys	124	17.66 ± 3.03	74	17.61 ± 3.17	.12	196	.91	-.84; .95	0.02
20m sprint	Total	227	3.80 ± .31	182	3.76 ± .32	1.45	407	.15	-.02; .11	0.14
	Girls	108	3.86 ± .32	108	3.82 ± .32	.80	214	.43	-.05; .12	0.11
	Boys	118	3.75 ± .29	74	3.66 ± .30	1.97	190	.05	.00; .17	0.29

Variable	Group	IG		CG						
		N	M ± SD	N	M ± SD	T	df	p	95% CI	d
Standing long jump	Total	249	159.40 ± 19.47	182	158.01 ± 20.73	.72	429	.48	-2.44; 5.23	0.07
	Girls	124	155.52 ± 18.71	109	151.15 ± 19.11	1.76	231	.08	-.52; 9.26	0.23
	Boys	124	163.32 ± 19.57	73	168.25 ± 18.85	-1.73	195	.09	-10.54; .69	0.25
Sideways jumps	Total	249	40.56 ± 5.52	183	39.28 ± 6.20	2.27	430	**.02**	.17; 2.40	0.22
	Girls	124	40.41 ± 5.04	109	39.03 ± 5.95	1.92	231	.06	-.03; 2.80	0.25
	Boys	124	40.70 ± 5.99	74	39.65 ± 6.57	1.15	196	.25	-.75; 2.85	0.17
Balance backwards	Total	250	37.92 ± 8.30	183	38.21 ± 8.25	-.36	431	.72	-1.87; 1.30	0.03
	Girls	125	38.71 ± 7.35	109	38.91 ± 7.69	-.20	232	.84	-2.14; 1.74	0.03
	Boys	124	37.13 ± 9.15	74	37.18 ± 8.98	-.03	196	.97	-2.68; 2.59	0.01
Forward bend	Total	250	.43 ± 8.02	183	.98 ± 7.90	-.70	431	.48	-2.07; .98	0.07
	Girls	125	3.21 ± 7.77	109	2.99 ± 7.38	.22	232	.82	-1.74; 2.18	0.03
	Boys	124	-2.42 ± 7.28	74	-1.99 ± 7.73	-.40	196	.69	-2.59; 1.73	0.06
6-min run	Total	240	1077.55 ± 129.87	181	1073.84 ± 131.98	.29	419	.77	-21.60; 29.01	0.03
	Girls	119	1038.63 ± 108.78	108	1025.12 ± 108.20	.94	225	.35	-14.91; 41.93	0.12
	Boys	120	1116.22 ± 138.26	73	1145.92 ± 131.61	-1.47	191	.14	-69.46; 1.05	0.22
BMI	Total	249	18.21 ± 2.66	182	18.44 ± 2.94	-.84	429	.40	-.76; .31	0.08
	Girls	125	17.89 ± 2.43	108	18.86 ± 3.12	-2.66	231	**.01**	-1.69; -.25	0.35
	Boys	124	18.54 ± 2.85	74	17.84 ± 2.57	1.75	196	.08	-.09; 1.50	0.26
HRQOL Score	Total	109	95.67 ± 10.45	103	94.66 ± 10.63	.69	210	.49	-1.85; 3.86	0.10
	Girls	37	97.46 ± 10.10	68	94.81 ± 10.66	1.24	103	.22	-1.59; 6.89	0.25
	Boys	72	94.75 ± 10.57	35	94.38 ± 10.73	.17	105	.87	-3.98; 4.71	0.03
Physical wellbeing	Total	113	15.53 ± 2.72	108	15.43 ± 2.88	.28	219	.78	-.64; .85	0.04
	Girls	40	15.30 ± 3.23	72	15.24 ± 3.12	.10	110	.92	-1.17; 1.30	0.02
	Boys	73	15.66 ± 2.40	36	15.81 ± 2.32	-.31	107	.76	-1.11; .81	0.06
Psychol. wellbeing	Total	116	17.20 ± 2.18	109	17.03 ± 2.16	.61	223	.54	-.39; .75	0.08
	Girls	42	17.71 ± 2.05	73	17.21 ± 2.04	1.28	113	.20	-.28; 1.29	0.25
	Boys	74	16.91 ± 2.22	36	16.67 ± 2.38	.54	108	.59	-.67; 1.16	0.11
Self-worth	Total	114	13.94 ± 3.28	109	14.11 ± 2.93	-.42	221	.67	-1.00; .65	0.06
	Girls	41	14.39 ± 2.70	73	13.91 ± 3.16	.82	112	.41	-.68; 1.64	0.16
	Boys	73	13.68 ± 3.56	36	14.53 ± 2.40	-1.29	107	.20	-2.15; .46	0.26
Family	Total	114	17.95 ± 2.40	107	17.47 ± 2.84	1.36	219	.18	-.22; 1.18	0.18
	Girls	40	18.18 ± 2.45	70	17.79 ± 2.38	.82	108	.42	-.56; 1.33	0.16
	Boys	74	17.82 ± 2.38	37	16.86 ± 3.51	1.70	109	.09	-.16; 2.08	0.34
Friends	Total	113	15.50 ± 2.81	109	16.02 ± 2.56	-1.47	220	.14	-1.24; .18	0.20
	Girls	39	16.22 ± 2.70	72	16.04 ± 2.58	.35	109	.72	-.85; 1.22	0.07
	Boys	74	15.11 ± 2.80	37	16.00 ± 2.54	-1.62	109	.11	-1.97; .20	0.33
School	Total	116	15.36 ± 2.42	110	14.88 ± 2.56	1.44	224	.15	-.18; 1.13	0.19
	Girls	42	15.67 ± 2.25	73	15.04 ± 2.65	1.29	113	.20	-.34; 1.59	0.25
	Boys	74	15.19 ± 2.51	37	14.58 ± 2.37	1.23	109	.22	-.37; 1.60	0.25

4.3.2.1.2 Lost to follow-up

In a first step, the number of lost to follow-up students during this study was examined (see Table 16, left side). It was shown that significant differences in the number of dropouts between the IG and the CG at T2 and T3 in the outcome target level of the psychological determinants of physical activity and the physical activity behaviour level. Specifically,

differences in the number of dropouts existed in attitudes towards physical activity, attitudes towards the health effects of PE, self-efficacy, knowledge, MVPA, minutes spent exercising outside of a sports club, and in the number of minutes spent exercising in a sports club (only at T2). There were no significant differences in the number of dropouts between the two groups concerning students' motivation towards physical activity and PE as well as all the variables on the health and fitness target level (motor performance, BMI, HRQOL). The lowest number of adherers was 55% concerning the variable indicating the minutes students spent exercising outside of a sports club at T2. In all these cases significantly more dropouts existed in the CG compared to the IG. These results are an indication that HealthyPEP was not a reason for the students to participate less in PE. The higher numbers of dropouts in the CG are mostly due to the fact that the CG teachers did not return the questionnaires to the researcher as instructed. One teacher of a CG did not return the questionnaires filled out by his students at T2. Even after several requests, these questionnaires were not retrieved. Additional reasons for students dropping out of the study were mostly due to illnesses. Nevertheless, these reasons were not explicitly investigated and are therefore not known.

In a second step, baseline differences between the dropouts and the adherers were analysed (see Table 16, right side). A significant difference existed only in students' attitudes towards PE at T2: Students adhering to the study had more positive attitudes towards PE compared to the dropouts. This result is assumed to reflect the fact that students with lower attitudes towards PE avoid participating in PE to a higher extent.

Table 16 Lost to Follow-up Analysis - Differences in Number of Dropouts (Left Side) and Baseline Values (Right Side)

			N					T1 values			
	Time		IG (%)	CG (%)	χ^2	p		M ± SD	t	df	p
Attitudes towards health effects of PA	T2	A	132 (87)	45 (56)	28.33	**<.001**	A	5.75 ± .76	.57	193	.57
		D	20 (13)	36 (44)			D	5.67 ± .80			
	T3	A	132 (87)	60 (74)	5.94	**.02**	A	5.74 ± .76	.24	193	.81
		D	20 (13)	21 (26)			D	5.70 ± .82			
Attitudes towards PE	T2	A	131 (86)	45 (56)	28.02	**<.001**	A	5.62 ± 1.23	3.11	190	**<.001**
		D	20 (13)	36 (44)			D	4.89 ± 1.44			
	T3	A	132 (87)	60 (74)	5.94	**.02**	A	5.52 ± 1.30	1.14	191	.26
		D	20 (13)	21 (26)			D	5.21 ± 1.30			
Self-efficacy	T2	A	130 (86)	46 (57)	23.61	**<.001**	A	4.40 ± 1.18	-.08	189	.93
		D	22 (14)	35 (43)			D	4.42 ± 1.42			
	T3	A	128 (84)	58 (72)	5.21	**.03**	A	4.39 ± 1.20	-.33	189	.74
		D	24 (16)	23 (28)			D	4.48 ± 1.36			
Enjoyment in PE	T2	A	117 (77)	113 (82)	.14	.76	A	5.34 ± 1.41	.04	221	.97
		D	29 (20)	25 (18)			D	5.33 ± 1.31			
	T3	A	117 (80)	115 (83)	.48	.54	A	5.37 ± 1.38	.84	221	.40
		D	29 (20)	23 (17)			D	5.14 ± 1.50			
External motivation	T2	A	119 (82)	113 (82)	.05	.88	A	3.51 ± 1.05	-.36	224	.72
		D	27 (18)	24 (18)			D	3.58 ± .95			
	T3	A	118 (81)	116 (84)	.35	.64	A	3.50 ± 1.05	-.62	224	.53
		D	27 (19)	22 (16)			D	3.63 ± .92			
Identified motivation	T2	A	119 (82)	113 (82)	.01	1.00	A	4.27 ± 1.12	.07	224	.94
		D	27 (18)	25 (18)			D	4.26 ± 1.06			
	T3	A	109 (75)	116 (84)	3.81	.06	A	4.30 ± 1.11	.92	224	.36
		D	37 (25)	22 (16)			D	4.10 ± 1.10			

			N					T1 values			
	Time		IG (%)	CG (%)	χ^2	p		M ± SD	t	df	p
Intrinsic motivation	T2	A	119 (82)	113 (82)	.01	1.00	A	5.24 ± 1.15	.76	222	.45
		D	27 (18)	25 (18)			D	5.07 ± 1.36			
	T3	A	118 (81)	116 (85)	.73	.43	A	5.25 ± 1.13	1.61	221	.11
		D	28 (19)	21 (15)			D	4.87 ± 1.44			
Knowledge	T2	A	130 (86)	46 (57)	23.61	**<.001**	A	4.78 ± 1.57	1.38	190	.17
		D	22 (14)	35 (43)			D	4.38 ± 1.71			
	T3	A	130 (86)	60 (74)	4.61	**.04**	A	4.77 ± 1.60	1.43	190	.16
		D	22 (14)	21 (26)			D	4.30 ± 1.61			
MVPA	T2	A	127 (84)	45 (56)	21.43	**<.001**	A	3.87 ± 1.59	1.07	188	.29
		D	25 (16)	36 (44)			D	3.56 ± 1.72			
	T3	A	130 (86)	60 (74)	4.61	**.04**	A	3.81 ± 1.59	-.02	188	.98
		D	22 (14)	21 (26)			D	3.81 ± 1.78			
Minutes spend in a sports club per week	T2	A	97(88)	40(68)	10.40	**<.001**	A	210.01 ± 193.60	-0.54	133	.59
		D	13(12)	19(32)			D	234.77 ± 207.73			
	T3	A	96(85)	51(85)	0.00	1.00	A	220.36 ± 204.71	-0.53	135	.60
		D	17(15)	9(15)			D	246.43 ± 223.19			
Minutes spend outside a sports club per week	T2	A	92(78)	30(55)	9.90	**<.001**	A	205.24 ± 178.99	-1.41	107	.16
		D	26(22)	25(45)			D	265.43 ± 261.76			
	T3	A	103(83)	37(64)	8.27	**.01**	A	212.23 ± 197.04	-0.84	105	.40
		D	21(17)	21(36)			D	248.97 ± 239.40			
Motor performance score	T2	A	233 (78)	180 (82)	1.10	.29	A	107.21 ± 8.36	.25	431	.80
		D	64 (22)	39 (18)			D	106.95 ± 7.13			
	T3	A	246 (83)	168 (77)	2.97	.08	A	107.32 ± 8.31	.74	430	.46
		D	51 (17)	51 (23)			D	106.53 ± 7.39			
BMI	T2	A	232 (78)	182 (83)	2.30	.13	A	18.31 ± 2.78	-.04	429	.97
		D	65 (22)	36 (17)			D	18.32 ± 2.83			
	T3	A	246 (83)	167 (76)	3.41	.07	A	18.22 ± 2.69	-1.50	429	.13
		D	51 (17)	52 (24)			D	18.76 ± 3.18			
KINDL Score	T2	A	112 (77)	108 (78)	.10	.75	A	95.36 ± 10.92	.54	210	.59
		D	34 (23)	30 (22)			D	94.34 ± 8.55			
	T3	A	112 (77)	108 (79)	.18	.67	A	95.70 ± 10.21	1.50	210	.13
		D	34 (23)	29 (21)			D	92.93 ± 11.64			

Note. A=Adherers; D=Dropouts.

4.3.2.2 Process measures

This first subsection of the results refers to the findings of the process measures that aimed to examine the degree to which the programme was successfully implemented. Therefore, three different procedures were used; first, the treatment integrity of HealthyPEP intervention lessons as well as the content of the regular PE lessons were observed, second, the teachers' evaluation of HealthyPEP lessons was assessed using guideline-based interviews, and third, the students' evaluation of HealthyPEP was measured by questionnaires.

4.3.2.2.1 Treatment integrity and regular PE: Lesson observations

Altogether, 24 lesson observations were carried out during the intervention timeframe by three trained university students. Of these, 17 observations were carried out in IG classes and seven in CG classes. Based on the parameters used to describe the lessons observed, it was concluded that on average the lessons lasted 85-minutes. Also concerning the hall situation and the equipment available, no particular differences were observed.

In a first step, it was analysed whether the teachers of the IG classes carried the health promotion PE lessons out as advised. In order to examine this, the content of the observed lessons was compared to the instructions of that particular health-promotion lesson. The observations revealed that teachers of the IG classes implemented the lessons to a satisfactory extent. Only minor changes were made, such as adapting the lesson content to the size of the class or omitting some parts because of lack of time.

The observations in the CG classes showed that the content of these lessons was very broad and very different, depending on the teacher. For example, the activities during two double PE lessons of one teacher was swimming. During these lessons, the children were taught basic freestyle swimming techniques. Similar to the health-promotion PE lessons, also here, the lessons were divided into a warm-up, a main part, and a cool-down part of the lesson. The exercises became more difficult during the course of the lesson but the lesson focussed on learning specific swimming techniques. The main topic during the third double PE lesson observed was volleyball. Also here, the focus of the lesson was to teach students the basic techniques of this sports game such as the overhand pass. Throughout this lesson no endurance or strength exercises were carried out. In the fourth observed lesson, the main topic taught was basketball. The main target of the lesson was to teach the students basic techniques needed to be able to play the game. These were dribbling and several passing techniques. Overall, 20 minutes were used to explain these techniques to the students theoretically. Following this, as a warm-up, an endurance game and several strength exercises, which included the basketball or a partner, were carried out. The aim of the fifth observed lesson was to teach the students team handball. Specifically, the technique of the set shot and the jump shot were practiced. During the sixth observed lesson in a CG class, artistic gymnastics were the main element. The students were given some time to practice several floor exercises, in which they would be examined in the following lesson. In a second part of the lesson, the students carried out two four-minute runs. In the recovery pause between the two runs, stretching exercises were carried out. Following the practical experience, the teacher verbally emphasised the importance of the recovery pause between or after intense endurance elements. Finally, dodge ball was played for another 15 minutes and then the students were released to the next class. The seventh lesson was observed in the same class as the previous one. Again, two four-minute runs were performed with a recovery pause in between. During the main part of the lesson, the students were divided into four groups and gymnastic jumps were exercised. In the last part of the lesson, again the dodge ball was played as a final element of the lesson. Also during the eighth observed lesson, gymnastics were performed. Here, several pieces of equipment were set up and the children were divided into four groups practicing exercises on the floor, the high bar, the uneven bars, and the balance beam.

Differences between the IG and the CG concerning the lesson content, its character, and the circumstances of the lesson were assessed using a number of standardised items. Significant differences existed only in favour of the IG on the item describing the motivation of the

teacher (d = .38). The item questioning whether the teacher explicitly addressed the relationship between physical activity and health during PE was marginally significant and showed a medium effect size (d = .35). Concerning all other items, there were no significant differences between the two groups (see Table 17).

Table 17 Differences Between HealthyPEP (N=17) and the Regular PE Lessons (N=7)

Variable	IG M ± SD	CG M ± SD	T	df	p	95% CI	d
Students are constantly in move	4.13 ± 1.15	4.43 ± 1.27	-.57	21	.58	-1.42; .81	0.10
Focus lies on strength	3.47 ± 1.01	3.71 ± 1.50	-.47	22	.64	-1.33;.84	0.08
Focus lies on endurance	3.82 ± 1.51	2.86 ± 1.57	1.41	22	.17	-.46; 2.39	0.26
The teacher addresses theoretical aspects	3.18 ± 1.55	2.29 ±.95	1.40	22	.17	-.42; 2.21	0.24
Focus lies on movement and games	2.12 ± 1.80	2.86 ± 1.86	-.91	22	.37	-2.43; .95	0.12
Focus lies on sports techniques	2.29 ± 1.93	3.29 ± 2.06	-1.12	22	.27	-2.82; .84	0.16
The relationship between physical activity and health is explicitly addressed	3.29 ± 1.83	1.71 ± 1.50	2.02	22	.06	-.04; 3.20	0.35
The students are disciplined	4.41 ± 1.23	4.00 ± 1.83	.65	22	.52	-.91; 1.73	0.12
The students are motivated	4.94 ± 1.14	5.14 ± 1.46	-.36	22	.72	-1.36 ; .95	0.06
The teacher is liked	5.65 ± .61	5.29 ± .76	1.24	22	.23	-.24; .97	0.16
The teacher is competent	5.71 ± .69	5.43 ± .79	.86	22	.40	-.39; .94	0.12
The teacher is motivated	5.82 ± .39	5.00 ± 1.26	2.46	21	**.02**[a]	.13; 1.52	0.38
There is sufficient equipment	5.12 ± .93	5.29 ± 1.11	-.38	22	.71	-1.08; .75	0.06
The hall situation is good	5.06 ± 1.09	4.43 ± 1.51	1.15	22	.26	-.50; 1.76	0.21
There are interruptions during the lesson	2.12 ± 1.17	2.14 ± 1.46	-.04	22	.96	-1.19; 1.14	0.01

[a] Intervention effect in favour of the IG.

4.3.2.2.2 Teachers' evaluation of HealthyPEP lessons: Guideline-based interviews

The nine IG teachers agreed to provide information concerning various aspects of the intervention programme during a guideline-based interview carried out by a university student. The guideline-based interviews were structured into four parts and the key findings are described in the following (the details answers of the teachers are provided in the Appendix).

During the first block of ***general questions***, the teachers were asked whether the *aim of the intervention* was clear to them. This question was positively answered. The teachers summarised that the lessons aimed to emphasise endurance and strength in a practical and theoretical way. Additionally, the teachers stated that the overall aim of the project was to evaluate the changes that occurred among the students during the investigation timeframe from a scientific perspective. Some of the teachers emphasised that the content of the lessons was only partly in *terms with the regular PE curriculum* whereas other teachers emphasised that the programme did not deviate from the formal guidelines of the PE curriculum. When asking the teachers whether the content of the health promotion PE lessons differed from their usual lessons, the answers were quite different. Eight teachers confirmed that there was a

difference. Two of these teachers emphasised that the theoretical part of the lesson was new in this age group whereas others noted that they usually focused on specific sports. Strength and endurance only took up a small part of their lesson. Only one teacher said that the content of the intervention lessons did not differ to a great extent to her usual lessons. The teachers declared that they were using the material and the information given to them by the researcher to *prepare for the upcoming lesson*. Some changes needed to be made in this course to adapt the lesson to the requirements of the class. The average preparation time for each lesson took about 30 minutes. Three teachers noted that the material provided for each lesson made the preparation of the lessons easier for them and that they needed less time to prepare. The other teachers did not confirm this statement. Two teachers said that in the beginning of the intervention programme they needed more time to prepare and as time passed and they got more familiar with this procedure the preparation time was reduced. All of the teachers confirmed that *sufficient material* was provided by the researcher or was already available in the schools. All teachers stated that the *structure of the lessons* was clear, easy to follow, and made sense regarding its content.

The degree to which the process of the ***practical implementation of the lessons*** was smooth, easy, and unproblematic differed considerably among the classes. Problems that occurred during the health-promotion PE lesson were, to a great extent, of motivational nature on behalf of the students. Two teachers said that the motivation of the students to participate in the lessons was high in the beginning and decreased during the eight weeks. One teacher of a girls class said that the girls expressed the wish to carry out known elements from previous PE lessons. On the contrary, another teacher of a girls class said that her students expressed the wish for a variation of the exercises. A teacher of a boys class emphasised the wish of his students to carry out ball games. Three teachers noted that the lessons were carried out without any particular problems. Different statements were given by the teachers on the question asking about the extent to which they *modified the health-promotion PE lessons*. Most teachers noted that they did not always have enough time to carry out the last elements of each lesson. Three of the teachers of a boys' class emphasised that at the end of the programme they replaced several games with ball games, which the boys generally liked to play. Nevertheless, eight of the questioned teachers confirmed that they carried out almost all of the scheduled games.

Responses by the teachers were mixed regarding the question how well the *theoretical components* were able to be implemented. Two of the teachers emphasised that they did not have any problems when carrying out the theoretical parts of the lessons. On the other side, several teachers emphasised that they had to motivate the students to a large extent and convince them to concentrate on these theoretical parts. Several teachers explained that during the theoretical parts the teachers had to discipline the students to quite a large extent. Additionally, the teachers emphasised that the students were not used to being taught theory to such an extent during PE. Therefore, the theory elements were partly difficult to be carried

out precisely. One teacher noted that the students had to get used to the fact that they had to bring the booklet and a pencil into PE class.

Concerning the ***content of the lessons***, the teachers confirmed that they knew most of the exercises but that they had not carried them out previously with that particular class. An overall positive attitude was expressed concerning the general question whether they believed that this kind of lesson was reasonable and meaningful for this age group, with two limitations. The teachers emphasised that eight weeks was a very long timeframe and that the motivation of the students decreased a lot after the first six weeks. One teacher suggested carrying out the entire HealthyPEP programme while including breaks, in which the traditional sports could be played. A similar suggestion was made by another teacher, who emphasised that the HealthyPEP content should be administered on the basis of traditional sports. A third teacher noted that more ball games should have had been included into the programme. Nevertheless, the teachers declared that the structure of the lessons was clear and easy to understand. They also said that the theory elements were adequate for this age group and that the students enjoyed them. Even though, most of the teachers emphasised that due to the limited time for PE, the theoretical elements were too long. The teachers were also positive that their students had carried out their assigned homework and they highly praised the booklet, which was intensely used by the students. One teacher recommended including all theoretical aspects into the booklet in order to increase its importance.

The ***general conclusion*** of the teachers on the health-promotion PE lessons was that the motivation of the students was very high at the beginning and that it decreased during the end of the programme. The lack of ball games was a handicap of the programme. The teachers were optimistic that the students gained knowledge concerning the association between physical activity and health and that they became fitter during the course of the study. Most teachers emphasised that the intensity of these lessons was higher than usual. They also believed that the students who were not members in a sports club did more sports in the afternoon due to the homework in PE during this period. The teachers also emphasised that the motivation of the students to participate in the German motor performance also decreased during the investigation timeframe. Almost all teachers emphasised that the duration of the intervention programme was too long. Nevertheless, the overall feedback of the teachers was positive. They declared that in the future they would adopt parts of these lessons but they would not recommend carrying out the entire programme on block.

4.3.2.2.3 Students' evaluation of HealthyPEP lessons: Questionnaire

The students participating in the intervention study were asked to evaluate the PE lessons during the course of the process evaluation of HealthyPEP. This evaluation was conducted with the help of a standardised questionnaire and the results are presented in the following. First, the within-group differences during the intervention period (T1-T2) (see Table 18) and

during the follow-up (T2-T3) were examined (see Table 19). Second, the short- (T2) and middle-term (T3) intervention effects were analysed. Both analyses were examined first for the total group without differentiating between gender (see Table 20), and second, for girls and boys separately (see Table 21). There were no significant *baseline differences* between IG and CG concerning the evaluation of the PE lessons (for the detailed results see the Appendix).

Within-group differences

Several significant changes occurred in the short-term (see Figure 11). Girls and boys of the IG rated the PE lessons to be more strenuous than the regular PE (d = .63). IG girls rated PE lessons during this timeframe to be more varied (d = .52), stating that PE motivated them to do more sports in the afternoon (d = .48) and that they learned a lot during this period (d = .58). IG boys evaluated the PE lessons to be more interesting (d = .52) but they stated that they had less fun (d = .78), that they were not as satisfied (d = .60), that they did not feel as comfortable (d = .57), and that they did not look as much forward to PE during HealthyPEP compared to as during regular PE (d = .31). Also, IG boys gave a worse grade to PE for this period (d = .52). The changes that occurred during this timeframe in the CG affected only the CG boys. They rated PE lessons during this timeframe to vary less (d = .51), they declared that they were not as satisfied with PE (d = .65), that they felt not as comfortable during PE (d = .45), that they did not look as much forward to PE (d = .52), that they did not learn a lot (d = .73), and finally, CG boys gave a worse grade to PE for this period (d = .52) compared to PE before the investigation.

During the follow-up (T2-T3), the following changes were revealed (see Figure 11). IG girls rated the resumed regular PE lessons not to be as good as usual (d = .52). IG girls and boys evaluated the lessons not to be as strenuous as usual (d = .62, d = .40). Also the IG girls rated the lessons to be less varying (d = .77), less motivating (d = .49), less motivating towards afternoon sports during this period (d = .68), that they felt less comfortable during PE (d = .48), that they were not looking forward to it as much as in the previous weeks (d = .44), and that they did not learn a lot (d = .36). Finally, IG girls gave a worse grade to PE lessons during this period (d = .46). Both girl groups evaluated the hall situation not to be as good as in the previous weeks (IG: d = .59, CG: d = .31). Additionally, CG boys rated the lesson to be better than usual (d = .42) and more varied (d = .46).

Table 18 Short-Term Within-Group Differences in the Evaluation of HealthyPEP and the Regular PE Lessons

Variable	Group		T1 M ± SD	T2 M ± SD	T	df	p	95% CI	d
Better than usual	total	IG	3.22 ± 1.16	3.21 ± 1.29	.07	93	.95	-.31; .33	0.01
		CG	3.29 ± 1.09	3.22 ± 1.04	.46	94	.64	-.24; .39	0.07
	girls	IG	3.29 ± 1.13	3.69 ± 1.05	-1.56	34	.13	-.92; .12	0.36
		CG	3.30 ± 1.10	3.45 ± .97	-.68	63	.50	-.49; .24	0.11
	boys	IG	3.19 ± 1.18	2.93 ± 1.34	1.29	58	.20	-.14; .65	0.22

Variable	Group		T1 M ± SD	T2 M ± SD	T	df	p	95% CI	d
Strenuous	total	CG	3.23 ± 1.09	2.74 ± 1.03	1.63	30	.11	-.12; 1.09	0.45
		IG	2.66 ± 1.02	3.31 ± 1.03	-5.64	94	**<.001**[a]	-.87; -.42	0.63
	girls	CG	2.27 ± 1.00	2.52 ± 1.05	-1.98	93	.05	-.51; .00	0.26
		IG	2.69 ± 1.08	3.31 ± .87	-3.61	34	**<.001**[a]	-.98; -.27	0.58
	boys	CG	2.24 ± 1.00	2.52 ± 1.06	-1.76	62	.08	-.61; .04	0.29
		IG	2.65 ± .99	3.30 ± 1.12	-4.33	59	**<.001**[a]	-.95; -.35	0.66
Varying	total	CG	2.32 ± 1.01	2.52 ± 1.06	-.90	30	.37	-.63; .24	0.19
		IG	3.56 ± 1.10	3.60 ± 1.20	-.21	93	.83	-.33; .26	0.03
	girls	CG	3.55 ± 1.16	3.27 ± 1.15	1.87	94	.06	-.02; .56	0.23
		IG	3.71 ± 1.10	4.29 ± .89	-2.72	34	**.01**[a]	-1.00; -.14	0.52
	boys	CG	3.78 ± 1.08	3.67 ± 1.02	.63	63	.53	-.24; .45	0.10
		IG	3.47 ± 1.10	3.19 ± 1.18	1.51	58	.14	-.09; .67	0.26
Interesting	total	CG	3.06 ± 1.21	2.45 ± .96	2.31	30	**.03**[b]	.07; 1.15	0.51
		IG	3.68 ± 1.08	3.44 ± 1.24	1.92	94	.06	-.01; .49	0.22
	girls	CG	3.50 ± 1.17	3.46 ± 1.05	.31	95	.76	-.23; .31	0.04
		IG	3.74 ± 1.24	3.97 ± 1.01	-1.03	34	.31	-.68; .22	0.18
	boys	CG	3.66 ± 1.15	3.75 ± .88	-.66	64	.51	-.37; .19	0.08
		IG	3.65 ± .99	3.13 ± 1.26	3.65	59	**<.001**[b]	.23; .80	0.52
Motivating	total	CG	3.16 ± 1.16	2.84 ± 1.10	1.07	30	.29	-.29; .94	0.28
		IG	3.49 ± 1.12	3.52 ± 1.22	-.18	92	.86	-.26; .22	0.02
	girls	CG	3.56 ± 1.21	3.37 ± 1.12	1.40	93	.16	-.08; .46	0.16
		IG	3.59 ± 1.18	3.94 ± 1.10	-1.48	33	.15	-.84; .13	0.30
	boys	CG	3.83 ± 1.05	3.73 ± .93	.62	63	.54	-.21; .40	0.09
		IG	3.44 ± 1.09	3.27 ± 1.23	1.37	58	.18	-.08; .42	0.16
I had fun	total	CG	3.00 ± 1.36	2.60 ± 1.10	1.44	29	.16	-.17; .97	0.29
		IG	4.14 ± 1.12	3.58 ± 1.18	4.63	94	**<.001**[b]	.32; .80	0.50
	girls	CG	4.16 ± 1.07	3.99 ± 1.11	1.14	95	.26	-.12; .46	0.16
		IG	4.00 ± 1.12	3.94 ± .98	.30	35	.77	-.32; .43	0.05
	boys	CG	4.28 ± .98	4.28 ± .91	.00	64	1.00	-.30; .30	0.00
		IG	4.22 ± 1.12	3.36 ± 1.24	6	58	**<.001**[b]	.58; 1.15	0.78
I was satisfied with PE	total	CG	3.90 ± 1.22	3.39 ± 1.26	1.59	30	.12	-.15; 1.18	0.42
		IG	3.90 ± 1.14	3.53 ± 1.07	3.29	93	**<.001**[b]	.15; .60	0.33
	girls	CG	4.03 ± 1.05	3.76 ± 1.06	2.00	94	.05	.00; .55	0.26
		IG	3.80 ± 1.16	3.94 ± .91	-.69	34	.49	-.56; .27	0.12
	boys	CG	4.14 ± .99	4.09 ± .87	.32	63	.75	-.25; .34	0.05
		IG	3.97 ± 1.13	3.29 ± 1.10	5.79	58	**<.001**[b]	.44; .91	0.60
I felt comfortable	total	CG	3.81 ± 1.14	3.06 ± 1.09	2.71	30	**.01**[b]	.18; 1.30	0.65
		IG	4.02 ± .99	3.59 ± 1.04	4.14	93	**<.001**[b]	.23; .65	0.44
	girls	CG	4.04 ± 1.06	3.84 ± 1.02	1.65	93	.10	-.04; .45	0.19
		IG	4.09 ± .92	3.91 ± .95	1.03	34	.31	-.17; .51	0.19
	boys	CG	4.17 ± .94	4.14 ± .90	.22	62	.83	-.26; .32	0.03
		IG	3.98 ± 1.04	3.39 ± 1.05	4.47	58	**<.001**[b]	.33; .86	0.57
PE motivated me to do more sports in the afternoon	total	CG	3.77 ± 1.23	3.23 ± .99	2.53	30	**.02**[b]	.11; .99	0.45
		IG	3.08 ± 1.28	3.23 ± 1.28	-1.01	94	.31	-.44; .14	0.12
	girls	CG	2.79 ± 1.38	2.85 ± 1.33	-.42	93	.68	-.37; .24	0.05
		IG	3.09 ± 1.31	3.71 ± 1.27	-2.28	34	**.03**[a]	-1.19; -.07	0.48
	boys	CG	2.95 ± 1.42	3.19 ± 1.28	-1.24	62	.22	-.62; .14	0.17
		IG	3.08 ± 1.27	2.95 ± 1.20	.85	59	.40	-.18; .45	0.11
I liked my PE teacher	total	CG	2.45 ± 1.26	2.16 ± 1.16	1.22	30	.23	-.19; .78	0.23
		IG	3.69 ± .98	3.67 ± 1.03	.20	94	.84	-.19; .23	0.02
	girls	CG	3.82 ± 1.21	3.71 ± 1.10	.86	92	.39	-.14; .36	0.09
		IG	3.81 ± .95	3.97 ± .97	-.90	35	.37	-.54; .21	0.18
	boys	CG	4.09 ± 1.03	4.05 ± .93	.32	63	.75	-.25; .34	0.05
		IG	3.63 ± 1.00	3.49 ± 1.02	1.05	58	.30	-.12; .39	0.14
The hall situation was good	total	CG	3.21 ± 1.35	2.97 ± 1.09	1	28	.33	-.25; .74	0.18
		IG	3.63 ± .98	3.55 ± 1.08	.70	95	.48	-.13; .28	0.07
	girls	CG	3.74 ± 1.14	3.81 ± 1.06	-.52	90	.60	-.37; .22	0.07
		IG	3.75 ± .73	3.89 ± .82	-.78	35	.44	-.50; .22	0.19
	boys	CG	3.85 ± 1.11	4.02 ± .99	-.90	60	.37	-.53; .20	0.15

Variable	Group		T1 M ± SD	T2 M ± SD	T	df	p	95% CI	d
I was looking forward to each PE lesson	boys	IG	3.55 ± 1.10	3.35 ± 1.18	1.60	59	.12	-.05; .45	0.18
		CG	3.50 ± 1.20	3.40 ± 1.10	.39	29	.70	-.42; .62	0.08
	total	IG	3.76 ± 1.25	3.46 ± 1.26	2.85	95	**.01**[b]	.09; .51	0.24
		CG	4.01 ± 1.17	3.85 ± 1.17	1.14	94	.26	-.12; .43	0.13
	girls	IG	3.89 ± 1.17	3.75 ± 1.11	.72	35	.47	-.25; .53	0.12
		CG	4.08 ± 1.20	4.13 ± 1.00	-.28	63	.78	-.38; .29	0.04
I learned a lot	boys	IG	3.68 ± 1.30	3.28 ± 1.32	3.23	59	**<.001**[b]	.15; .65	0.31
		CG	3.87 ± 1.12	3.29 ± 1.30	2.57	30	**.02**[b]	.12; 1.04	0.52
	total	IG	3.36 ± 1.09	3.57 ± 1.28	-1.56	95	.12	-.47; .06	0.19
		CG	3.49 ± 1.13	3.34 ± 1.23	.95	94	.34	-.17; .49	0.14
	girls	IG	3.47 ± 1.16	4.14 ± 1.07	-3.28	35	**<.001**[a]	-1.08; -.25	0.58
		CG	3.53 ± 1.13	3.70 ± 1.14	-.88	63	.38	-.56; .22	0.15
Grade PE	boys	IG	3.30 ± 1.05	3.23 ± 1.28	.40	59	.69	-.27; .40	0.06
		CG	3.42 ± 1.15	2.58 ± 1.09	3.10	30	**<.001**[b]	.29; 1.39	0.73
	total	IG	2.01 ± .96	2.27 ± 1.16	-2.61	88	**.01**[b]	-.46; -.06	0.27
		CG	1.86 ± .84	2.01 ± .89	-1.37	89	.18	-.38; .07	0.18
	girls	IG	1.97 ± .87	1.79 ± .73	1.53	33	.14	-.06; .41	0.20
		CG	1.76 ± .71	1.75 ± .69	.14	62	.89	-.21; .24	0.02
	boys	IG	2.04 ± 1.02	2.56 ± 1.27	-4	54	**<.001**[b]	-.79; -.26	0.52
		CG	2.07 ± 1.07	2.63 ± 1.01	-2.11	26	**.04**[b]	-1.10; -.01	0.52

[a] Intervention effect in favour of the IG.
[b] Intervention effect in favour of the CG.

Table 19 Middle-Term Within-Group Differences in the Evaluation of HealthyPEP and the Regular PE Lessons

Variable	Group		T2 M ± SD	T3 M ± SD	T	df	p	95% CI	d
Better than usual	total	IG	3.14 ± 1.26	2.98 ± 1.17	1.21	104	.23	-0.10; 0.43	0.13
		CG	3.18 ± 1.03	3.21 ± 1.06	-0.23	103	.82	-0.28; 0.22	0.03
	girls	IG	3.58 ± 1.06	3.03 ± 0.79	3.01	37	**<.001**[b]	0.18; 0.92	0.52
		CG	3.46 ± 0.95	3.28 ± 1.18	1.08	67	.28	-0.15; 0.50	0.19
	boys	IG	2.90 ± 1.30	2.96 ± 1.34	-0.34	66	.74	-0.41; 0.29	0.05
		CG	2.67 ± 0.99	3.08 ± 0.77	-2.26	35	**.03**[a]	-0.79; -0.04	0.42
Strenuous	total	IG	3.23 ± 1.03	2.75 ± 1.26	3.20	105	**<.001**[b]	0.18; 0.76	0.46
		CG	2.58 ± 1.02	2.65 ± 0.94	-0.73	103	.47	-0.29; 0.13	0.08
	girls	IG	3.34 ± 0.85	2.82 ± 1.04	2.65	37	**.01**[b]	0.12; 0.93	0.62
		CG	2.57 ± 1.04	2.59 ± 0.96	-0.22	68	.82	-0.29; 0.23	0.03
	boys	IG	3.16 ± 1.11	2.72 ± 1.37	2.18	67	**.03**[b]	0.04; 0.85	0.40
		CG	2.60 ± 1.01	2.77 ± 0.91	-0.95	34	.35	-0.54; 0.20	0.17
Varying	total	IG	3.51 ± 1.21	3.25 ± 1.19	2.15	105	**.03**[b]	0.02; 0.51	0.22
		CG	3.25 ± 1.15	3.35 ± 1.02	-0.91	104	.36	-0.33; 0.12	0.09
	girls	IG	4.13 ± 0.99	3.37 ± 0.97	3.73	37	**<.001**[b]	0.35; 1.18	0.77
		CG	3.68 ± 0.99	3.61 ± 0.97	0.52	68	.61	-0.21; 0.35	0.07
	boys	IG	3.16 ± 1.18	3.18 ± 1.30	-0.10	67	.92	-0.30; 0.27	0.01
		CG	2.42 ± 0.97	2.86 ± 0.93	-2.35	35	**.02**[a]	-0.83; -0.06	0.46
Interesting	total	IG	3.38 ± 1.24	3.29 ± 1.28	0.81	104	.42	-0.14; 0.33	0.08
		CG	3.49 ± 1.06	3.49 ± 1.04	0.00	103	1.00	-0.22; 0.22	0.00
	girls	IG	3.89 ± 1.01	3.50 ± 0.92	1.89	37	.07	-0.03; 0.82	0.39
		CG	3.80 ± 0.92	3.68 ± 1.05	0.97	68	.34	-0.12; 0.35	0.13
	boys	IG	3.09 ± 1.26	3.16 ± 1.44	-0.54	66	.59	-0.35; 0.20	0.06
		CG	2.89 ± 1.08	3.11 ± 0.93	-1.00	34	.32	-0.69; 0.24	0.21
Motivating	total	IG	3.45 ± 1.21	3.17 ± 1.27	2.26	104	**.03**[b]	0.03; 0.52	0.23
		CG	3.43 ± 1.11	3.41 ± 1.12	0.17	103	.86	-0.20; 0.24	0.02
	girls	IG	3.86 ± 1.11	3.32 ± 1.00	2.25	36	**.03**[b]	0.05; 1.03	0.49
		CG	3.82 ± 0.93	3.71 ± 1.07	1.03	67	.31	-0.11; 0.34	0.13
	boys	IG	3.22 ± 1.21	3.09 ± 1.39	0.99	67	.33	-0.14; 0.40	0.11
		CG	2.69 ± 1.06	2.86 ± 1.02	-0.71	35	.48	-0.64; 0.31	0.16
I had fun	total	IG	3.51 ± 1.19	3.54 ± 1.34	-0.22	104	.83	-0.29; 0.23	0.02

Variable	Group		T2 M ± SD	T3 M ± SD	T	df	p	95% CI	d
I was satisfied with PE	girls	CG	3.96 ± 1.10	3.95 ± 1.10	0.07	104	.94	-0.25; 0.27	0.01
		IG	3.87 ± 1.02	3.66 ± 0.99	0.97	37	.34	-0.23; 0.65	0.21
	boys	CG	4.29 ± 0.89	4.19 ± 1.06	0.70	68	.49	-0.19; 0.39	0.11
		IG	3.31 ± 1.25	3.48 ± 1.51	-1.03	66	.31	-0.48; 0.16	0.13
	total	CG	3.33 ± 1.20	3.50 ± 1.03	-0.62	35	.54	-0.71; 0.38	0.14
		IG	3.50 ± 1.09	3.42 ± 1.27	0.70	104	.49	-0.16; 0.33	0.08
		CG	3.76 ± 1.06	3.81 ± 1.09	-0.43	103	.67	-0.27; 0.17	0.05
I felt comfortable	girls	IG	3.92 ± 0.88	3.53 ± 0.92	1.96	37	.06	-0.01; 0.80	0.45
		CG	4.10 ± 0.88	4.03 ± 1.02	0.62	67	.54	-0.16; 0.31	0.08
	boys	IG	3.27 ± 1.14	3.36 ± 1.43	-0.59	66	.56	-0.39; 0.21	0.08
		CG	3.11 ± 1.06	3.39 ± 1.10	-1.22	35	.23	-0.74; 0.18	0.26
	total	IG	3.59 ± 1.05	3.49 ± 1.23	0.82	103	.42	-0.14; 0.33	0.09
		CG	3.86 ± 1.01	3.82 ± 1.04	0.37	101	.71	-0.17; 0.25	0.04
PE motivated me to do more sports in the afternoon	girls	IG	3.89 ± 0.92	3.44 ± 1.00	2.30	35	**.03**[b]	0.05; 0.84	0.48
		CG	4.17 ± 0.87	3.97 ± 1.07	1.54	65	.13	-0.06; 0.45	0.23
	boys	IG	3.43 ± 1.08	3.51 ± 1.34	-0.61	67	.54	-0.38; 0.20	0.08
		CG	3.31 ± 1.01	3.56 ± 0.94	-1.43	35	.16	-0.61; 0.11	0.25
	total	IG	3.25 ± 1.27	2.88 ± 1.29	2.59	105	**.01**[b]	0.09; 0.65	0.29
		CG	2.92 ± 1.31	2.92 ± 1.36	0.00	102	1.00	-0.27; 0.27	0.00
I liked my PE teacher	girls	IG	3.82 ± 1.16	3.03 ± 1.15	2.87	37	**.01**[b]	0.23; 1.35	0.68
		CG	3.24 ± 1.23	3.10 ± 1.42	0.83	66	.41	-0.19; 0.46	0.11
	boys	IG	2.93 ± 1.23	2.79 ± 1.37	0.86	67	.39	-0.17; 0.44	0.11
		CG	2.33 ± 1.26	2.58 ± 1.18	-1.07	35	.29	-0.72; 0.22	0.20
	total	IG	3.59 ± 1.06	3.45 ± 1.16	1.60	102	.11	-0.03; 0.33	0.14
		CG	3.73 ± 1.11	3.86 ± 0.95	-1.45	100	.15	-0.30; 0.05	0.12
The hall situation was good	girls	IG	3.95 ± 0.96	3.66 ± 0.99	1.81	37	.08	-0.03; 0.61	0.30
		CG	4.12 ± 0.92	4.20 ± 0.88	-0.68	65	.50	-0.30; 0.15	0.08
	boys	IG	3.38 ± 1.07	3.32 ± 1.24	0.56	64	.58	-0.16; 0.28	0.06
		CG	3.00 ± 1.08	3.23 ± 0.73	-1.54	34	.13	-0.53; 0.07	0.21
	total	IG	3.53 ± 1.10	3.21 ± 1.15	3.18	102	**<.001**[b]	0.12; 0.52	0.29
		CG	3.77 ± 1.09	3.52 ± 1.01	2.14	102	**.03**[b]	0.02; 0.47	0.22
I was looking forward to each PE lesson	girls	IG	3.92 ± 0.85	3.42 ± 1.00	3.34	37	**<.001**[b]	0.20; 0.80	0.59
		CG	4.01 ± 1.01	3.70 ± 1.10	2.17	66	**.03**[b]	0.02; 0.60	0.31
	boys	IG	3.31 ± 1.17	3.09 ± 1.22	1.63	64	.11	-0.05; 0.48	0.18
		CG	3.31 ± 1.09	3.19 ± 0.71	0.61	35	.54	-0.26; 0.48	0.10
	total	IG	3.37 ± 1.29	3.29 ± 1.29	0.64	103	.52	-0.16; 0.32	0.06
		CG	3.86 ± 1.15	3.81 ± 1.13	0.41	104	.68	-0.18; 0.28	0.04
I learned a lot	girls	IG	3.71 ± 1.09	3.24 ± 1.05	2.83	37	**.01**[b]	0.13; 0.81	0.44
		CG	4.14 ± 0.97	3.91 ± 1.21	1.71	68	.09	-0.04; 0.50	0.24
	boys	IG	3.17 ± 1.35	3.32 ± 1.42	-0.96	65	.34	-0.47; 0.16	0.11
		CG	3.31 ± 1.26	3.61 ± 0.93	-1.48	35	.15	-0.72; 0.11	0.24
	total	IG	3.52 ± 1.31	3.42 ± 1.25	0.72	103	.47	-0.17; 0.36	0.07
		CG	3.35 ± 1.19	3.30 ± 1.11	0.45	102	.66	-0.17; 0.26	0.04
Grade PE	girls	IG	4.08 ± 1.10	3.68 ± 0.93	2.31	37	**.03**[b]	0.05; 0.74	0.36
		CG	3.73 ± 1.11	3.63 ± 1.04	0.80	66	.43	-0.16; 0.37	0.09
	boys	IG	3.20 ± 1.33	3.27 ± 1.39	-0.42	65	.68	-0.44; 0.29	0.06
		CG	2.64 ± 1.02	2.69 ± 0.98	-0.28	35	.78	-0.45; 0.34	0.05
	total	IG	2.31 ± 1.17	2.51 ± 1.33	-1.96	98	.05	-0.40; 0.00	0.17
		CG	1.98 ± 0.88	2.05 ± 1.04	-0.92	101	.36	-0.23; 0.08	0.08
	girls	IG	1.83 ± 0.75	2.17 ± 0.95	-2.65	34	**.01**[b]	-0.61; -0.08	0.46
		CG	1.71 ± 0.71	1.80 ± 0.95	-0.86	68	.39	-0.29; 0.11	0.12
	boys	IG	2.58 ± 1.28	2.70 ± 1.47	-0.85	63	.40	-0.39; 0.16	0.09
		CG	2.55 ± 0.94	2.59 ± 1.04	-0.35	32	.73	-0.31; 0.22	0.05

[a] Intervention effect in favour of the IG.
[b] Intervention effect in favour of the CG.

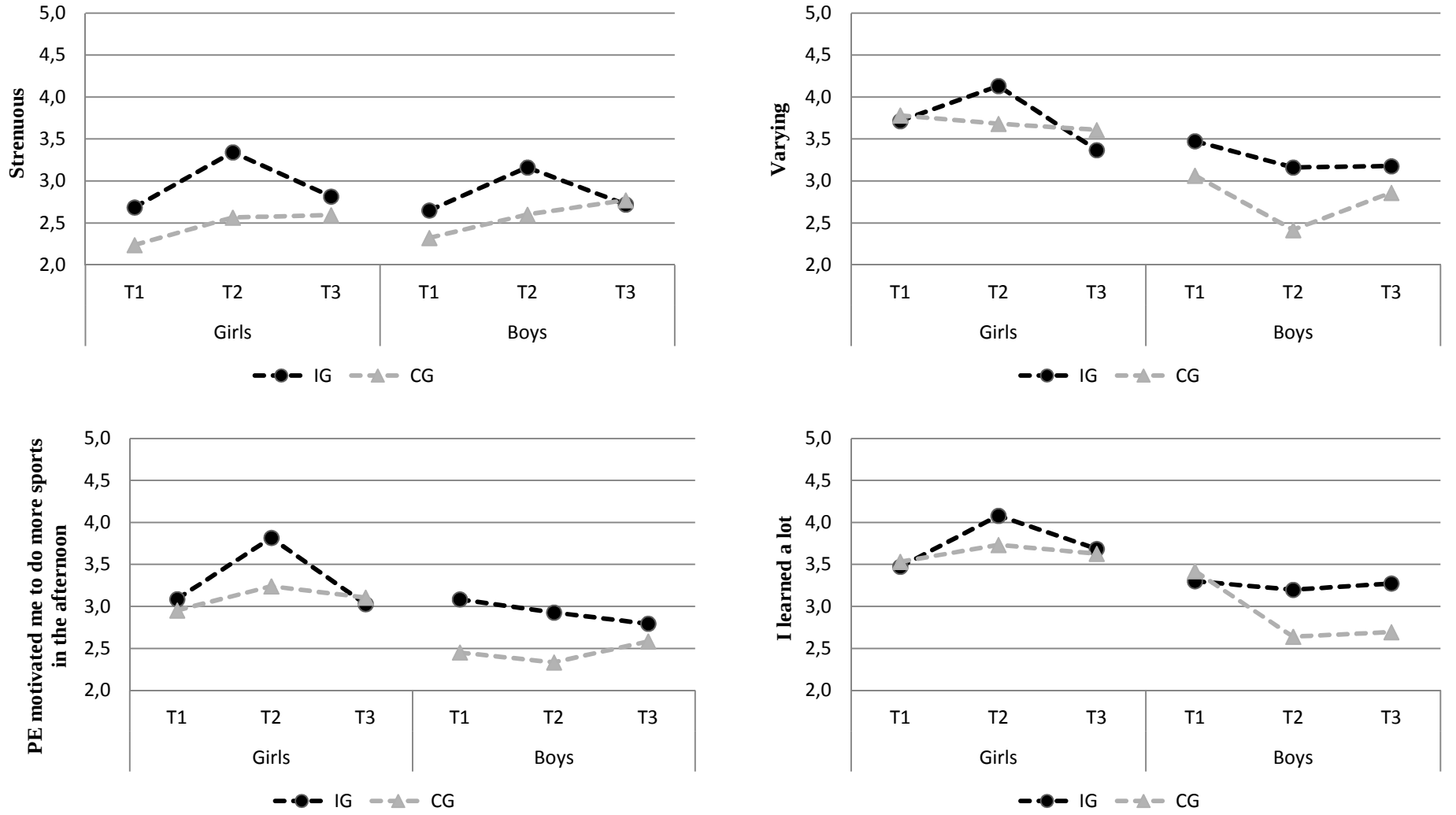

Figure 11 Students' Evaluation of PE Over the Investigation Timeframe (Strenuous, Varying, Motivation to Afternoon Sports, Amount of Learning) (IG Girls: T1=42, T2=35, T3=38; CG Girls: T1=71, T2=64, T3=67) (IG Boys: T1=74, T2=60, T3=60; CG Boys: T1=37, T2=31, T3=31).

Between-group differences

In a next step, the intervention effects on the students' evaluation of PE were analysed. When considering the study sample independent of gender, two significant differences between the two groups occurred at T2: IG students rated PE to be more strenuous compared to the CG (d = 0.62) and CG students evaluated PE to be more fun (d = 0.35). At T3, the CG students rated their PE teacher better (d = .28) and also noted to look forward to each PE lesson to a higher degree compared to the IG students (d = .28).

Table 20 Between-Group Differences in the Evaluation of HealthyPEP Lessons and the Regular PE at T2 and T3 (Total)

Evaluation Items	Time	Total IG		Total CG					
		N	M ± SE	N	M ± SE	F	p	η^2	d
Better than usual	T2	94	3.22 ± .12	95	3.22 ± .12	.00	.99	.00	0.00
	T3	97	3.12 ± .11	98	3.16 ± .11	.08	.78	.00	0.04
Strenuous	T2	94	3.24 ± .10	95	2.59 ± .10	19.53	**<.001**[a]	.62	0.62
	T3	98	2.72 ± .11	96	2.71 ± .11	.00	.95	.00	0.01
Varying	T2	94	3.59 ± .12	95	3.28 ± .12	3.62	.06	.27	0.27
	T3	98	3.34 ± .11	97	3.32 ± .11	.02	.88	.00	0.02
Interesting	T2	95	3.41 ± .11	96	3.49 ± .11	.29	.59	.07	0.07
	T3	98	3.37 ± .11	97	3.44 ± .11	.17	.68	.00	0.06
Motivating	T2	93	3.53 ± .11	94	3.36 ± .11	1.27	.26	.15	0.15
	T3	97	3.33 ± .11	96	3.34 ± .11	.01	.93	.00	0.01
Fun	T2	95	3.58 ± .11	96	3.99 ± .11	6.56	**.01**[b]	.35	0.35
	T3	99	3.67 ± .11	98	3.87 ± .11	1.61	.21	.01	0.17
I was satisfied with PE	T2	94	3.55 ± .10	95	3.74 ± .10	1.55	.21	.17	0.17
	T3	98	3.58 ± .11	98	3.73 ± .11	.96	.33	.00	0.13
I felt comfortable during PE	T2	94	3.59 ± .10	94	3.84 ± .10	3.24	.07	.24	0.24
	T3	95	3.59 ± .11	97	3.71 ± .11	.61	.44	.00	0.11
PE motivated me to do more sports in the afternoon	T2	95	3.17 ± .12	94	2.91 ± .12	2.29	.13	.20	0.20
	T3	97	2.93 ± .13	98	2.82 ± .12	.42	.52	.00	0.09
I liked my PE teacher	T2	95	3.70 ± .10	93	3.68 ± .10	.02	.90	.02	0.02
	T3	98	3.60 ± .09	95	3.90 ± .10	4.94	**.03**[b]	.03	0.28
The hall situation was good	T2	96	3.57 ± .10	91	3.79 ± .11	2.25	.14	.21	0.21
	T3	98	3.34 ± .11	92	3.47 ± .11	.79	.38	.00	0.12
I was looking forward to each PE lesson	T2	96	3.52 ± .11	95	3.79 ± .11	3.07	.08	.22	0.22
	T3	98	3.43 ± .11	97	3.76 ± .11	5.07	**.03**[b]	.03	0.28
I learned a lot during PE	T2	96	3.59 ± .13	95	3.32 ± .13	2.33	.13	.22	0.22
	T3	98	3.52 ± .11	98	3.31 ± .11	1.72	.19	.01	0.18
PE Grade	T2	89	2.23 ± .10	90	2.05 ± .10	1.64	.20	.17	0.17
	T3	96	2.35 ± .10	94	2.10 ± .10	3.17	.08	.02	0.22

[a] Intervention effect in favour of the IG.
[b] Intervention effect in favour of the CG.

Table 21 Between-Group Differences in the Evaluation of HealthyPEP Lessons and the Regular PE at T2 and T3 (Girls and Boys)

Evaluation Items	Time	Girls								Boys							
		IG		CG						IG		CG					
		N	M ± SE	N	M ± SE	F	p	d	η^2	N	M ± SE	N	M ± SE	F	p	d	η^2
Better than usual	T2	35	3.69 ± .17	64	3.45 ± .13	1.21	.27	0.23	.01	59	2.93 ± .16	31	2.74 ± .22	.51	.48	0.15	.01
	T3	36	3.15 ± .17	67	3.26 ± .13	.26	.61	0.00	.10	61	3.09 ± .14	31	2.98 ± .19	.23	.63	0.00	.09
Strenuous	T2	35	3.23 ± .16	63	2.57 ± .12	10.34	**<.001**[a]	0.67	.10	60	3.25 ± .13	31	2.61 ± .19	7.91	**.01**[a]	0.57	.08
	T3	37	2.74 ± .17	65	2.61 ± .12	.42	.52	0.00	.13	61	2.71 ± .14	31	2.90 ± .20	.58	.45	0.01	.14
Varying	T2	35	4.29 ± .16	64	3.67 ± .12	9.32	**<.001**[a]	0.64	.09	59	3.17 ± .14	31	2.49 ± .20	7.36	**.01**[a]	0.57	.08
	T3	37	3.38 ± .16	66	3.60 ± .12	1.26	.26	0.01	.23	61	3.29 ± .14	31	2.79 ± .20	4.26	**.04**[a]	0.05	.41
Interesting	T2	35	3.96 ± .15	65	3.76 ± .11	1.13	.29	0.21	.01	60	3.07 ± .15	31	2.96 ± .21	.20	.65	0.09	.00
	T3	37	3.62 ± .15	67	3.63 ± .11	.00	.97	0.00	.01	61	3.19 ± .15	30	3.08 ± .21	.16	.69	0.00	.07
Motivating	T2	34	3.98 ± .17	64	3.72 ± .12	1.61	.21	0.26	.02	59	3.19 ± .13	30	2.75 ± .19	3.62	.06	0.36	.04
	T3	37	3.44 ± .17	66	3.69 ± .12	1.41	.24	0.01	.24	60	3.17 ± .13	30	2.76 ± .19	3.14	.08	0.03	.31
Fun	T2	36	3.99 ± .15	65	4.25 ± .11	1.88	.17	0.28	.02	59	3.32 ± .15	31	3.46 ± .21	.31	.58	0.12	.00
	T3	38	3.80 ± .16	67	4.13 ± .12	2.60	.11	0.02	.32	61	3.55 ± .15	31	3.37 ± .21	.53	.47	0.01	.13
I was satisfied with PE	T2	35	3.99 ± .15	64	4.07 ± .11	.19	.67	0.09	.00	59	3.26 ± .13	31	3.11 ± .18	.49	.49	0.14	.01
	T3	37	3.68 ± .16	67	3.98 ± .12	2.33	.13	0.02	.30	61	3.48 ± .15	31	3.25 ± .21	.86	.36	0.01	.17
I felt comfortable during PE	T2	35	3.93 ± .15	63	4.13 ± .11	1.19	.28	0.22	.01	59	3.36 ± .12	31	3.29 ± .16	.12	.73	0.07	.00
	T3	35	3.55 ± .18	66	3.91 ± .13	2.70	.10	0.03	.34	60	3.59 ± .13	31	3.34 ± .18	1.19	.28	0.01	.19
PE motivated me to do more sports in the afternoon	T2	35	3.69 ± .21	63	3.20 ± .15	3.55	.06	0.38	.04	60	2.85 ± .14	31	2.35 ± .19	4.50	**.04**[a]	0.42	.05
	T3	37	2.99 ± .21	67	2.97 ± .16	.00	.95	0.00	.01	60	2.87 ± .15	31	2.54 ± .21	1.60	.21	0.02	.25
I liked my PE teacher	T2	36	4.03 ± .15	64	4.02 ± .11	.00	.97	0.01	.00	59	3.43 ± .12	29	3.09 ± .17	2.53	.12	0.33	.03
	T3	38	3.80 ± .14	65	4.23 ± .11	5.68	**.02**[b]	0.05	.47	60	3.38 ± .12	30	3.37 ± .17	.01	.94	0.00	.01
The hall situation was good	T2	36	3.89 ± .16	61	4.01 ± .12	.37	.54	0.13	.00	60	3.34 ± .13	30	3.42 ± .18	.12	.73	0.06	.00
	T3	38	3.48 ± .17	62	3.67 ± .14	.74	.39	0.01	.18	60	3.22 ± .13	30	3.12 ± .18	.21	.65	0.00	.08
I was looking forward to each PE lesson	T2	36	3.79 ± .16	64	4.10 ± .12	2.41	.12	0.31	.02	60	3.33 ± .13	31	3.21 ± .18	.30	.59	0.09	.00
	T3	38	3.39 ± .17	66	3.94 ± .13	6.34	**.01**[b]	0.06	.48	60	3.41 ± .13	31	3.46 ± .18	.05	.82	0.00	.04
I learned a lot during PE	T2	36	4.15 ± .18	64	3.70 ± .14	3.75	.06	0.40	.04	60	3.25 ± .15	31	2.55 ± .21	7.16	**.01**[a]	0.54	.08
	T3	38	3.73 ± .16	67	3.65 ± .12	.15	.70	0.00	.08	60	3.37 ± .14	31	2.61 ± .20	9.64	**<.001**[a]	0.10	.58
PE Grade	T2	34	1.75 ± .11	63	1.77 ± .08	.03	.85	0.04	.00	55	2.57 ± .14	27	2.62 ± .20	.03	.86	0.03	.00
	T3	36	2.03 ± .14	65	1.83 ± .10	1.34	.25	0.01	.21	60	2.59 ± .14	29	2.63 ± .20	.03	.86	0.00	.03

[a] Intervention effect in favour of the IG.
[b] Intervention effect in favour of the CG.

Analysing the two genders separately made a more differentiated approach possible (see Table 21). Regarding the degree of how strenuous the PE lessons were estimated to be, the following results occurred. In the short-term (T2), both girls and boys in the IG compared to the CG, rated HealthyPEP to be significantly more strenuous (d = .67, d = .57 respectively). At T3, there was no significant difference between the two groups on this item. Also concerning the students' estimation on the degree to which the content of the PE lessons varied, at T2, both girls and boys in the IG compared to the CG rated HealthyPEP significantly more varied (d = .64, d = .57 respectively). These differences did not exist at T3. Additionally, in the short-term boys said that PE motivated them to participate in more sports during the afternoon (d = .42) and that they learned more during this period (d = .42).

Summary

The data presented in this first part of the results section refer to the process measures carried out during the intervention timeframe. First, the treatment integrity based on lesson observations was confirmed and the regular PE lessons were observed and described in an exemplary fashion. These regular lessons are mostly characterised by a content focusing on teaching the students basic sports techniques and emphasising only to a smaller degree endurance and strength of the students. Second, the structured interviews carried out with all of the IG teachers revealed that the teachers were satisfied with HealthyPEP with only some limitations concerning the long period of the treatment and the lack of ball games. Finally, the direct evaluation of HealthyPEP by the IG students and the regular PE by the CG students revealed that overall students in both groups tended to come towards a negative evaluation of regular PE during the investigation timeframe. Additionally, the results showed positive evaluation on behalf of the IG students as they estimated HealthyPEP to be more strenuous, varying, to bring more motivation to do sports in the afternoon (only boys), and that they learned a lot during this period (boys).

4.3.2.3 Intervention effects

In the following section, the intervention results on the three outcome levels are described. First, the short-term (T1-T2) and middle-term (T1-T3) *within-group developments* are viewed. The exact statistical values concerning the developments of the gender independent and the gender separated analysis are provided in tables. Additionally, figures were drawn that describe the development of students in these outcome variables. The developments need to be interpreted with caution, because the number of students vary across the measurements and are therefore drawn with dashed lines. In these figures, T1 includes the students that were measured in the first data assessment, T2 represents the students whose data exist at the measurement T1 and T2, and finally, T3 represents the students that participated at the T1 and T3 data collection.

Second, to estimate the short- (T2) and middle-term (T3) *intervention effects*, group differences were examined concerning the entire study sample without separating the students by gender as well as by carrying out the analyses separately for the two genders. The group differences were calculated by ANCOVA using the baseline values of the analysed dependent variable and baseline BMI values as the covariates.

4.3.2.3.1 Psychological determinants of physical activity

Within-group differences

In the first part of this section, the detailed results of the short-term (see Table 22) and the middle-term (see Table 22) within-group analysis of the psychological determinants of physical activity are presented. In the short-term, significant changes were observed in students' attitudes towards the health effects of physical activity and towards PE, their knowledge of the health effects of physical activity, their enjoyment in PE, and their self-efficacy. In the middle-term significant changes were measured in students' attitudes towards the health effects of physical activity, their intrinsic motivation and enjoyment in PE as well as their self-efficacy.

Table 22 Short-Term Within-Group Differences in Psychological Determinants of Physical Activity

Variable	Group		T1 M ± SD	T2 M ± SD	T	df	p	95% CI	d
Attitudes towards health effects of PA	Total	IG	5.77 ± .77	5.93 ±.78	-2.51	115	**<.01**[a]	.28; .03	0.21
		CG	5.65 ± .74	5.65 ±.89	.023	41	.98	.25; .26	0.00
	Girls	IG	5.75 ± .70	5.99 ± .69	-3.41	79	**<.001**[a]	.38; .10	0.34
		CG	5.75 ± .65	5.68 ± .97	.30	17	.77	.38; .51	0.08
	Boys	IG	5.83 ± .92	5.81 ± .95	.18	35	.86	.23; .28	0.02
		CG	5.59 ± .81	5.64 ± .86	-.26	23	.80	.38; .30	0.05
Attitudes towards PE	Total	IG	5.57 ± 1.20	5.47 ± 1.32	1.17	112	.24	.07; .27	0.08
		CG	5.72 ± 1.31	5.87 ± 1.20	-1.43	41	.16	.36; .06	0.12
	Girls	IG	5.57 ± 1.20	5.66 ± 1.15	-1.12	77	.27	.24; .07	0.07
		CG	5.39 ± 1.69	5.50 ± 1.46	-.71	17	.49	.44; .22	0.07
	Boys	IG	5.58 ± 1.25	5.06 ± 1.60	2.52	34	**.02**[b]	.10; .94	0.36
		CG	5.98 ± .90	6.16 ± .91	-1.25	23	.23	.48; .12	0.20
Knowledge of PA health effects	Total	IG	4.87 ± 1.67	5.24 ± 1.53	-2.06	107	**.04**[a]	.72; .01	0.23
		CG	4.66 ± 1.30	4.85 ± 1.31	-.63	41	.53	.79; .41	0.15
	Girls	IG	4.96 ± 1.50	5.33 ± 1.40	-1.84	78	.07	.76; .03	0.25
		CG	5.00 ± 1.14	4.72 ± 1.45	.57	17	.57	.74; 1.30	0.21
	Boys	IG	4.50 ± 1.99	5.06 ± 1.81	-1.59	33	.12	1.27; .16	0.29
		CG	4.42 ± 1.38	4.96 ± 1.23	-1.44	23	.16	1.32; .24	0.41
External motivation	Total	IG	3.56 ± 1.12	3.61 ± .96	-.47	95	.64	.26; .16	0.05
		CG	3.46 ± .98	3.48 ± .96	-.21	95	.83	.23; .19	0.02
	Girls	IG	3.33 ± 1.05	3.29 ± .73	.23	35	.82	.28; .36	0.04
		CG	3.32 ± .95	3.44 ± .96	-1.05	64	.30	.36; .11	0.13
	Boys	IG	3.70 ± 1.15	3.80 ± 1.03	-.73	59	.47	.38; .18	0.09
		CG	3.76 ± .98	3.57 ± .96	.89	30	.38	.25; .63	0.20
Identified motivation	Total	IG	4.35 ± 1.19	4.55 ± 1.13	-1.58	95	.12	.44; .04	0.17
		CG	4.18 ± 1.03	4.19 ± .95	-.13	95	.89	.21; .19	0.01
	Girls	IG	4.12 ± 1.17	4.38 ± .90	-1.24	35	.22	.69; .17	0.25
		CG	4.12 ± .99	4.21 ± .96	-.86	64	.39	.30; .12	0.09
	Boys	IG	4.50 ± 1.19	4.66 ± 1.26	-1.02	59	.31	.47; .15	0.13
		CG	4.32 ± 1.12	4.17 ± .98	.65	30	.52	.32; .62	0.14

Variable	Group		T1 M ± SD	T2 M ± SD	T	df	p	95% CI	d
Intrinsic motivation	Total	IG	5.30 ± 1.20	5.39 ± 1.25	-.89	94	.37	.30; .11	0.07
		CG	5.17 ± 1.09	5.13 ±.98	.37	94	.71	.16; .24	0.04
	Girls	IG	5.28 ± 1.12	5.37 ± 1.21	-.55	34	.59	.45; .26	0.08
		CG	5.15 ± 1.22	5.16 ± 1.05	-.03	64	.98	.27; .26	0.00
	Boys	IG	5.32 ± 1.25	5.41 ± 1.29	-.70	59	.49	.36; .17	0.07
		CG	5.21 ± .77	5.08 ± .86	.78	29	.44	.22; .48	0.16
Enjoyment in PE	Total	IG	5.28 ± 1.51	5.11 ± 1.53	1.21	94	.22	.10; .44	0.11
		CG	5.40 ± 1.30	5.24 ± 1.23	1.26	94	.21	.09; .42	0.13
	Girls	IG	5.44 ± 1.53	5.69 ± 1.10	-1.30	35	.20	.64; .14	0.19
		CG	5.50 ± 1.20	5.62 ± 1.00	-.87	63	.39	.38; .15	0.10
	Boys	IG	5.19 ± 1.51	4.76 ± 1.65	2.33	58	**.02**[b]	.06; .79	0.27
		CG	5.21 ± 1.49	4.46 ± 1.31	2.81	30	**.01**[b]	.20; 1.29	0.53
Self-efficacy	Total	IG	4.43 ± 1.18	4.31 ± 1.29	.90	105	.37	.13; .36	0.10
		CG	4.31 ± 1.17	4.55 ± 1.23	-1.30	42	.19	.59; .12	0.20
	Girls	IG	4.51 ± 1.12	4.40 ± 1.15	.91	76	.37	.14; .36	0.10
		CG	4.19 ± 1.13	4.75 ± 1.14	-2.71	17	**.01**[a]	1.01; .12	0.50
	Boys	IG	4.27 ± 1.30	4.12 ± 1.54	.55	33	.59	.41; .72	0.11
		CG	4.41 ± 1.23	4.41 ± 1.31	.02	24	.98	.53; .55	0.00

[a] Intervention effect in favour of the IG.
[b] Intervention effect in favour of the CG.

Table 23 Middle-Term Within-Group Differences in Psychological Determinants of Physical Activity

Variable	Group		T1 M ± SD	T3 M ± SD	T	df	p	95% CI	d
Attitudes towards health effects of PA	Total	IG	5.78 ± .77	5.94 ± .85	-2.22	114	**.03**[a]	-.31; -.02	0.20
		CG	5.65 ± .10	5.74 ± .10	-1.08	53	.29	-.25; .08	0.90
	Girls	IG	5.76 ± .70	5.94 ± .78	-1.91	78	.06	-.37; .01	0.24
		CG	5.73 ± .74	5.72 ± .67	.08	24	.94	-.24; .26	0.01
	Boys	IG	5.82 ± .92	5.94 ± .99	-1.12	35	.27	-.36; .10	0.13
		CG	5.58 ± .75	5.75 ± .73	-1.59	28	.12	-.39; .05	0.23
Attitudes towards PE	Total	IG	5.53 ± 1.25	5.49 ± 1.31	.44	112	.66	-.15; .23	0.03
		CG	5.49 ± 1.42	5.67 ± 1.24	-1.83	53	.07	-.37; .02	0.14
	Girls	IG	5.50 ± 1.25	5.48 ± 1.36	.19	77	.85	-.21; .25	0.02
		CG	5.11 ± 1.66	5.31 ± 1.39	-1.44	24	.16	-.49; .09	0.13
	Boys	IG	5.61 ± 1.27	5.52 ± 1.22	.52	34	.61	-.26; .44	0.07
		CG	5.82 ± 1.10	5.98 ± 1.00	-1.15	28	.26	-.44; .12	0.15
Knowledge of PA health effects	Total	IG	4.83 ± 1.64	4.99 ± 1.57	-.95	111	.35	-.50; .18	0.10
		CG	4.64 ± 1.51	4.70 ± 1.82	-.22	52	.83	-.58; .47	0.04
	Girls	IG	4.89 ± 1.55	5.10 ± 1.46	-1.11	78	.27	-.60; .17	0.14
		CG	5.04 ± 1.34	4.92 ± 1.53	.35	24	.73	-.58; .82	0.08
	Boys	IG	4.70 ± 1.85	4.73 ± 1.82	-.09	32	.93	-.73; .66	0.02
		CG	4.29 ± 1.58	4.50 ± 2.06	-.55	27	.59	-1.02; .59	0.12
External motivation	Total	IG	3.55 ±1.15	3.48 ±1.04	.73	98	.47	-.13; .28	0.07
		CG	3.45 ±.95	3.43 ±.97	.19	97	.85	-.20; .24	0.02
	Girls	IG	3.38 ±1.08	3.11 ±.91	1.60	37	.12	-.07; .61	0.27
		CG	3.31 ±.94	3.46 ±1.03	-1.24	66	.22	-.38; .09	0.15
	Boys	IG	3.66 ±1.18	3.71 ±1.05	-.35	60	.73	-.30; .21	0.04
		CG	3.76 ±.92	3.38 ±.82	1.65	30	.11	-.09; .85	0.44
Identified motivation	Total	IG	4.40 ± 1.21	4.26 ± 1.15	1.10	94	.28	-.11; .38	0.12
		CG	4.20 ± .99	4.07 ± 1.06	1.19	97	.24	-.08; .34	0.13
	Girls	IG	4.15 ± 1.15	3.97 ± 1.00	.98	37	.33	-.19; .55	0.17
		CG	4.10 ± .98	4.06 ± 1.16	.33	66	.74	-.19; .27	0.04
	Boys	IG	4.57 ± 1.24	4.46 ± 1.21	.64	56	.53	-.23; .45	0.09
		CG	4.40 ± 1.00	4.08 ± .80	1.41	30	.17	-.14; .77	0.35
Intrinsic motivation	Total	IG	5.38 ± 1.16	5.21 ± 1.38	1.52	93	.13	-.05; .40	0.13
		CG	5.18 ± 1.07	4.93 ± 1.15	2. 25	96	**.03**[b]	.03; .48	0.23
	Girls	IG	5.30 ± 1.15	5.18 ± 1.36	.67	36	.51	-.25; .50	0.10

Variable	Group		T1 M ± SD	T3 M ± SD	T	df	p	95% CI	d
Enjoyment in PE	Boys	CG	5.15 ± 1.22	5.02 ± 1.14	.97	66	.34	-.14; .40	0.11
		IG	5.44 ± 1.18	5.23 ± 1.41	1.41	56	.16	-.09; .49	0.16
	Total	CG	5.25 ± .63	4.72 ± 1.16	2.68	29	**.01**[b]	.13; .94	0.57
		IG	5.37 ± 1.45	4.90 ± 1.46	3.25	97	**<.001**[b]	.18; .74	0.32
	Girls	CG	5.38 ± 1.30	4.98 ± 1.46	2.64	95	**.01**[b]	.10; .70	0.29
		IG	5.55 ± 1.47	5.10 ± 1.04	1.93	36	.06	-.02; .91	0.35
	Boys	CG	5.54 ± 1.17	5.36 ± 1.43	1.09	64	.28	-.15; .50	0.14
		IG	5.26 ± 1.44	4.78 ± 1.65	2.60	60	**.01**[b]	.11; .84	0.30
	Total	CG	5.05 ± 1.52	4.19 ± 1.21	2.82	30	**.01**[b]	.24; 1.48	0.63
		IG	4.43 ± 1.16	4.29 ± 1.46	1.00	107	.32	-.14; .43	0.11
Self-efficacy	Girls	CG	4.32 ± 1.28	4.72 ± 1.23	-1.93	51	.06	-.82; .02	0.32
		IG	4.53 ± 1.08	4.42 ± 1.33	.76	74	.45	-.17; .39	0.09
	Boys	CG	4.25 ± 1.29	4.82 ± 1.07	-2.54	23	**.02**[a]	-1.04; -.11	0.49
		IG	4.21 ± 1.32	3.99 ± 1.70	.66	32	.52	-.48; .94	0.15
	Total	CG	4.38 ± 1.29	4.64 ± 1.37	-.76	27	.45	-.95; .44	0.19

[a] Intervention effect in favour of the IG.
[b] Intervention effect in favour of the CG.

The analysis of the short- and middle-term within-group development of students' *attitudes towards the health effects of physical activity* (see Figure 12a) showed that IG girls had a significant short-term positive change in their attitudes (d = .34) whereas the CG girls remained on the same level. In the middle-term there were no significant changes in any of the groups. In boys, no significant changes on the attitudes towards the health effects of physical activity were observed. Nevertheless, in the short-term the IG decreased their positive attitudes slightly and remained stable in the middle term. CG boys showed a slight non-significant increase in the short- and middle-term. When examining the total group without separating the students by gender, short- (d = .21) and middle-term (d = .20) positive significant changes were observed only in the IG. The analysis of students' *attitudes towards PE* (see Figure 12b) did not reveal any short- or middle-term significant changes in girls of the IG and the CG. A significant reduction in the IG girls' attitudes towards PE was only observed in the follow-up timeframe (T2-T3). In boys, this analysis revealed a different picture: a short-term significant reduction of attitudes towards PE was measured in the IG boys (d = .36). No significant changes were measured in the CG boy and in the gender independent analysis.

The short- and middle-term within-group changes of students' *knowledge of the positive health effects of physical activity* are shown in figure 13a. Even though the IG girls increased their short-term knowledge, the changes were not significant. CG girls non-significantly decreased their knowledge in this timeframe slightly. Also in the middle-term, no significant changes could be observed in girls' knowledge. Boys in both groups, showed an increase in knowledge in the short- and middle-term but also here the changes were not significant. Only in the gender independent analysis a short-term positive significant change occurred in the IG (d = .23).

When looking at the development of students' self-efficacy levels towards regular physical activity, an opposite trend between students of the IG compared to the CG was revealed (see

Figure 13a). CG students showed an increase in self-efficacy levels whereas IG students' self-efficacy decreased over time. These changes in the self-efficacy levels were only significant in the CG girls in the short- (d = .50) and middle-term (d = .49).

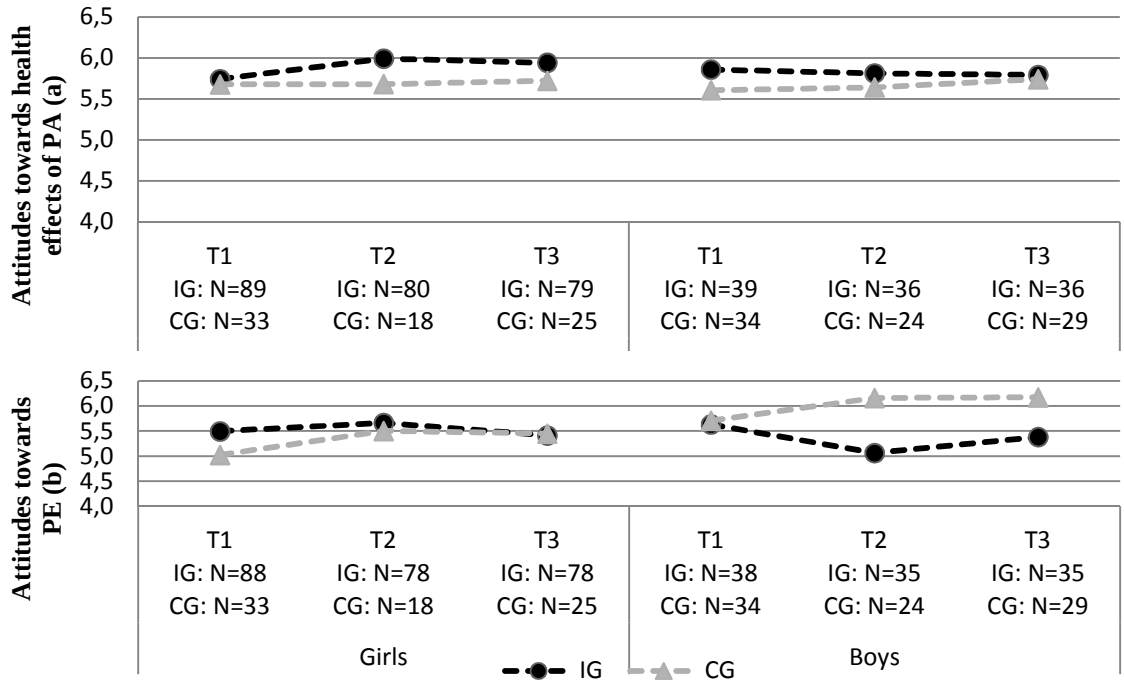

Figure 12 Short- and Middle-Term Developments of Attitudes Towards the Health Effects of PA (a) and on Attitudes Towards PE (b) in the IG and the CG Over the Five Month Investigation Period.

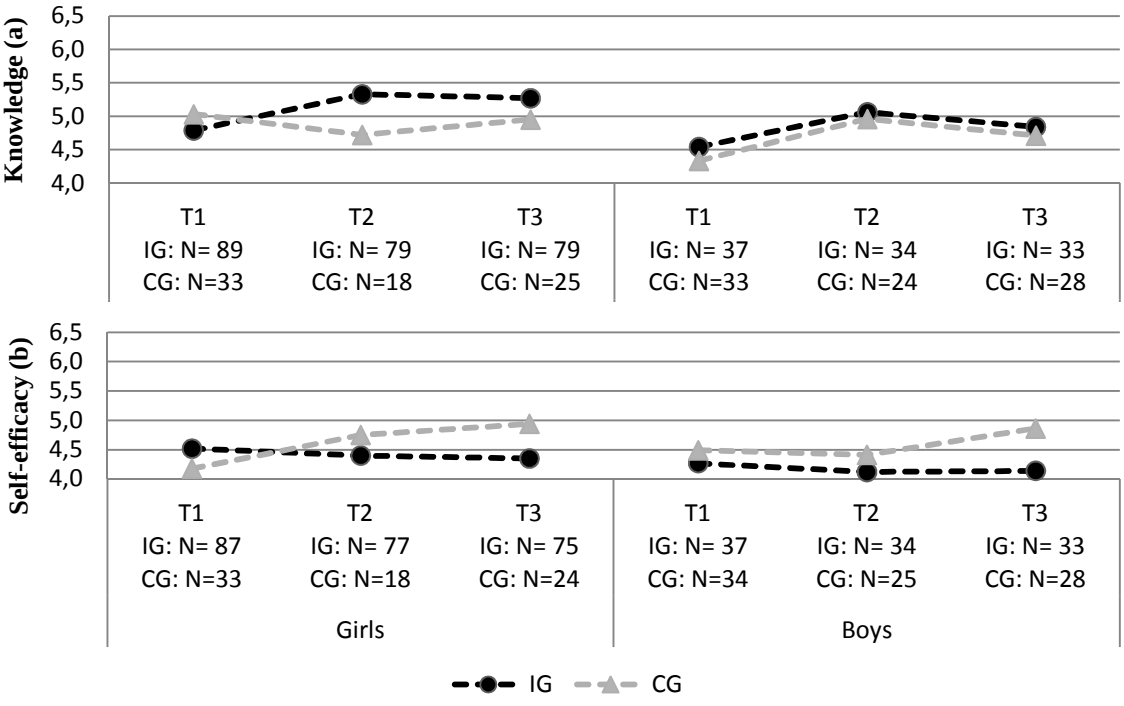

Figure 13 Short- and Middle-Term Developments of Knowledge and Self-Efficacy in the IG and the CG Over the Five Month Investigation Period.

The changes in students' *external, identified, and intrinsic motivation towards physical activity* based on the theory by Deci and Ryan (2004) as well as students' *enjoyment in PE* are described in the following (see Figure 14). The *external motivation* to participate in exercise did not significantly change in any of the groups either in the short- or in the middle-term. Interestingly, a slight decrease was observed in IG girls and CG boys whereas a slight increase was measured in CG girls and IG boys. No significant changes were measured in the gender independent analysis in the short- and middle-term, but a significant reduction in the IG was measured in the follow-up timeframe (T2-T3). Also concerning students' *identified motivation* to participate in physical activity, there were no significant differences during the short- and middle-term. Only during the follow-up (T2-T3), a significant reduction in IG girls and boys as well as for the entire IG was observed. The changes in students' *intrinsic motivation* to participate in physical activity showed no significant short- and middle-term changes in any of the groups except from a significant reduction in the CG boys in the middle-term ($d = .57$). During the follow-up (T2-T3), a significant reduction was observed in boys of the IG and in the entire IG. The gender independent analysis showed a significant reduction in the CG in the middle-term ($d = .23$).

In girls, the developments concerning *enjoyment of PE* were similar to the changes in intrinsic motivation towards physical activity. In the short- and milled-term, no significant changes occurred in girls. Only during the follow-up timeframe (T2-T3), both IG and CG girls showed a significant decreased in enjoyment of PE. In both IG and CG boys, a significant decrease in PE enjoyment was measured in the short-term ($d = .27$, $d = .53$ respectively) and in the middle-term (IG: $d = .30$, CG: $d = .63$). Finally, in the gender independent analysis, a significant reduction in PE enjoyment was measured in both groups in the middle-term (IG: $d = .32$, CG: $d = .29$).

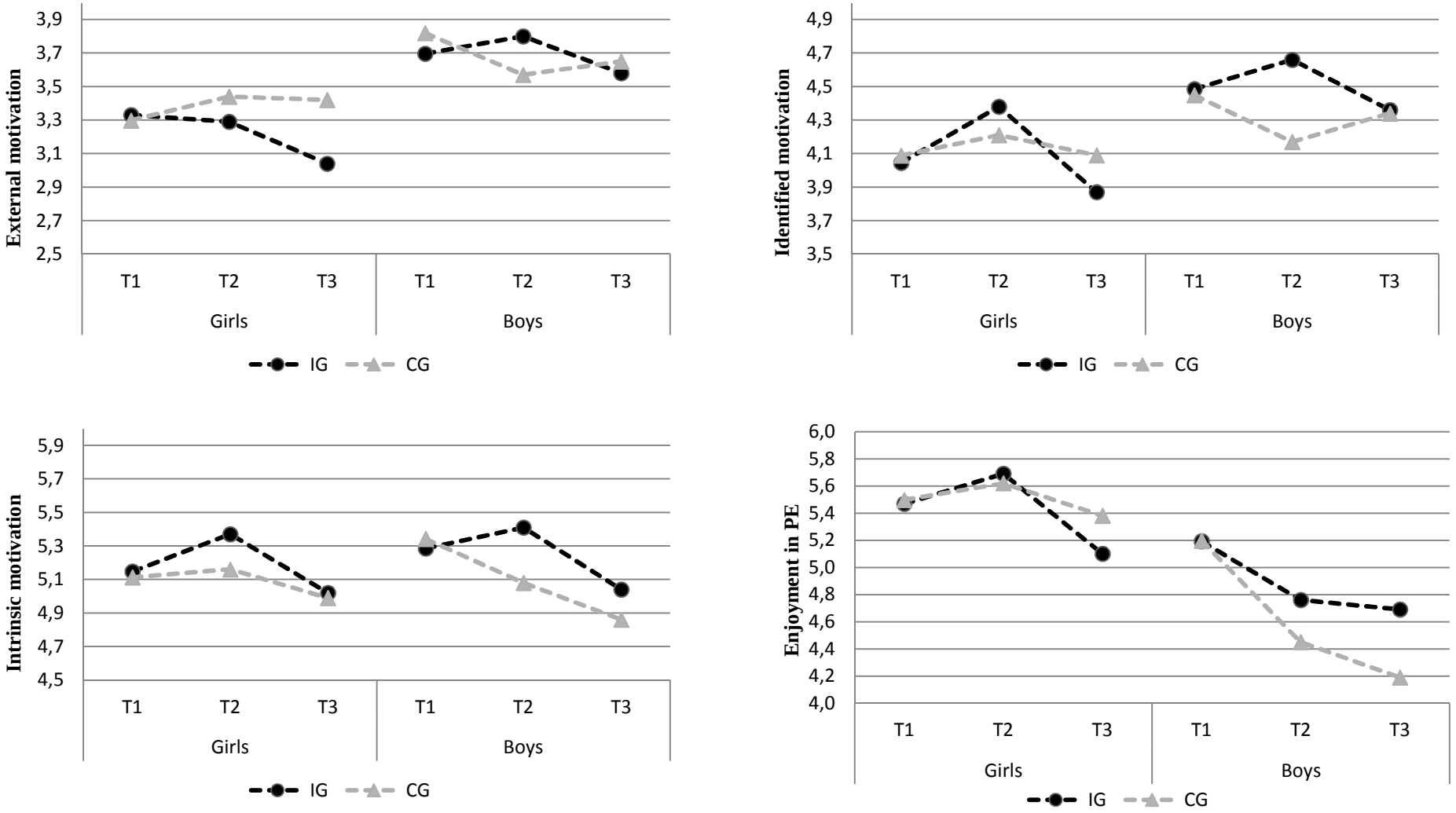

Figure 14 Short- and Middle-Term Developments of Motivation Towards Physical Activity and PE in the IG and the CG Over the Five Month Investigation Period (IG Girls: T1=41, T2=36, T3=37; CG Girls: T1=73, T2=64, T3=67) (IG Boys: T1=73, T2=59, T3=61; CG Boys: T1=36, T2=31, T3=30).

Between-group differences

In a first step, the short- and middle-term intervention effects on the examined psychological determinants of physical activity based on the entire IG and CG were analysed (see Table 24). When considering the estimated means of the two groups it is shown that the IG had higher scores in the attitudes towards physical activity, in the external, identified, and intrinsic motivation as well as the enjoyment in PE. The results from the ANCOVA revealed only two significant differences between the IG and the CG: A short-term (T2) positive intervention effect on students' external motivation towards physical activity was revealed and in the middle-term (T3), a negative intervention effect was measured on students' self-efficacy levels.

In a second step, the same analysis was carried out separately for the two genders (see Table 25). Also here the estimated means reveal a positive picture of the effects of HealthyPEP on the students. IG girls have higher values on attitudes towards physical activity, in the identified and intrinsic motivation, the enjoyment in PE, and in knowledge. IG boys showed higher values compared to the CG boys in attitudes towards physical activity, in the external, identified, and intrinsic motivation, the enjoyment in PE, and in knowledge. Nevertheless, negative short- and middle-term significant intervention effects were found in IG girls self-efficacy levels. Additionally, short-term negative intervention effects were revealed in IG boys attitudes towards PE.

Table 24 Short- and Middle-Term Intervention Effects on Psychological Determinants of Physical Activity in the Total Group (Estimated Means (± SE), Controlled for T1-Values and Baseline BMI Values)

		IG		CG					
Variable	Time	N	M ± SE	N	M ± SE	F	p	η^2	d
Attitudes PA	T2	116	5.92 ± .06	42	5.71 ± .10	2.95	.09	.02	0.25
	T3	115	5.92 ± .06	54	5.79 ± .09	1.35	.25	.01	0.16
Attitudes PE	T2	113	5.50 ± .08	42	5.79 ± .13	3.51	.06	.02	0.22
	T3	113	5.48 ± .08	54	5.69 ± .12	2.14	.15	.01	0.16
Self-efficacy	T2	111	4.29 ± .11	43	4.60 ± .17	2.28	.13	.01	0.24
	T3	108	4.27 ± .13	52	4.75 ± .18	4.68	**.03**[b]	.03	0.34
External motivation	T2	96	4.52 ± .10	96	4.24 ± .10	4.28	**.04**[a]	.02	0.26
	T3	99	4.21 ± .10	98	4.11 ± .10	.48	.49	.00	0.08
Identified motivation	T2	96	5.36 ± .09	96	5.17 ± .09	2.01	.16	.01	0.17
	T3	99	5.11 ± .10	98	4.97 ± .11	1.03	.31	.01	0.11
Intrinsic motivation	T2	113	5.24 ± .14	42	4.88 ± .22	1.86	.18	.01	0.24
	T3	112	4.97 ± .15	53	4.75 ± .21	.73	.39	.00	0.13
Enjoyment in PE	T2	96	3.59 ± .09	96	3.50 ± .09	2.29	.13	.01	0.08
	T3	99	3.46 ± .09	98	3.45 ± .09	.96	.33	.00	0.00
Knowledge	T2	96	5.15 ± .12	96	5.21 ± .12	.12	.73	.00	0.04
	T3	99	4.91 ± .13	98	4.98 ± .13	.15	.70	.00	0.05

[a] Intervention effect in favour of the IG.
[b] Intervention effect in favour of the CG.

Table 25 Short- and Middle-Term Intervention Effects on Psychological Determinants of Physical Activity in Girls and Boys (Estimated Means (± SE), Controlled for T1-Values and Baseline BMI Values)

		Girls								Boys							
		IG		CG						IG		CG					
Variable	Time	N	M ± SE	N	M ± SE	F	p	η^2	d	N	M ± SE	N	M ± SE	F	p	η^2	d
Attitudes PA	T2	80	5.99 ± .07	18	5.69 ± .15	3.46	.07	0.04	.41	36	5.75 ± .12	24	5.73 ± .15	.01	.92	.00	0.02
	T3	79	5.94 ± .08	25	5.73 ± .14	1.71	.19	0.02	.27	36	5.86 ± .10	29	5.85 ± .11	.01	.94	.00	0.01
Attitudes PE	T2	78	5.63 ± .07	18	5.62 ± .15	.01	.94	0.00	.01	35	5.18 ± .18	24	5.97 ± .21	7.94	**.01**[b]	.12	0.58
	T3	78	5.41 ± .10	25	5.54 ± .18	.39	.53	0.00	-.09	35	5.58 ± .14	29	5.90 ± .15	2.46	.12	.04	0.29
Self-efficacy	T2	77	4.36 ± .11	18	4.90 ± .23	4.63	**.03**[b]	0.05	-.47	34	4.15 ± .23	25	4.37 ± .27	.40	.529	.007	0.15
	T3	75	4.38 ± .13	24	4.94 ± .23	4.70	**.03**[b]	0.05	-.44	33	4.00 ± .27	28	4.62 ± .29	2.45	.123	.041	0.40
External motivation	T2	36	3.29 ± .13	65	3.44 ± .10	.33	.57	0.00	-.15	60	3.81 ± .12	31	3.55 ± .16	2.48	.12	.03	0.22
	T3	38	3.09 ± .14	67	3.47 ± .10	.02	.89	0.00	-.34	61	3.72 ± .11	31	3.35 ± .16	2.97	.09	.03	0.27
Identified motivation	T2	36	4.38 ± .14	65	4.21 ± .10	.99	.32	0.01	.18	60	4.63 ± .14	31	4.22 ± .19	3.06	.08	.03	0.35
	T3	38	3.95 ± .15	67	4.07 ± .11	.43	.52	0.00	-.11	61	4.41 ± .13	31	4.11 ± .18	1.98	.16	.02	0.27
Intrinsic motivation	T2	36	5.33 ± .15	65	5.18 ± .11	.60	.44	0.01	.13	60	5.39 ± .12	31	5.13 ± .17	1.63	.21	.02	0.23
	T3	38	5.12 ± .17	67	5.05 ± .12	.12	.73	0.00	.06	61	5.12 ± .14	31	4.76 ± .19	2.33	.13	.03	0.27
Enjoyment in PE	T2	36	5.71 ± .14	65	5.61 ± .11	.34	.56	0.00	.10	60	4.77 ± .17	31	4.46 ± .23	1.20	.28	.01	0.20
	T3	38	5.10 ± .19	67	5.36 ± .14	1.19	.28	0.01	-.20	61	4.75 ± .17	31	4.26 ± .24	2.73	.10	.03	0.32
Knowledge	T2	79	5.33 ± .16	18	4.72 ± .33	2.84	.10	0.03	.43	34	5.05 ± .26	24	4.97 ± .31	.04	.85	.00	0.05
	T3	79	5.11 ± .16	25	4.88 ± .28	.52	.47	0.01	.16	33	4.64 ± .31	28	4.60 ± .34	.01	.93	.00	0.02

[a] Intervention effect in favour of the IG.
[b] Intervention effect in favour of the CG.

Summary

The results concerning the *within-group changes* of students' psychological determinants of physical activity revealed a mixed picture. Positive as well as negative significant short- and middle-term changes could be observed in the IG and in the CG. In the short-term, a significant increase in IG girls' attitudes towards the health effects of physical activity took place and a significant increase in knowledge when analysing the entire IG independent of gender. Girls in the CG significantly increased their self-efficacy beliefs during this timeframe. During the follow-up period (T2-T3), a significant reduction was observed in several variables in the IG: The entire IG decreased their positive attitudes towards PE as well as the external, identified (this reduction was significant also in the gender separated analysis), and intrinsic motivation. Additionally, girls and boys of the CG as well as boys of the IG showed a reduction of the enjoyment during PE. Finally, the analysis of the middle-term changes revealed a positive development of students' attitudes towards the health effects of physical activity as well as a reduction in the enjoyment of PE in the IG (gender independent analysis). The reduction of PE enjoyment was also significant in the IG boys in the gender separated analysis. The CG showed a reduction in the intrinsic motivation and the enjoyment in PE (gender independent analysis). This reduction in both variables was also significant in CG boys during the gender separated analysis. Finally, girls in the CG significantly increased their self-efficacy in the middle-term.

The short- and middle-term *intervention effects* comparing the IG with the CG revealed a rather negative influence of HealthyPEP lessons on the psychological determinants of physical activity. Except for an increase in the short-term external motivation in the entire IG only significant negative intervention effects were observed. The self-efficacy levels of the entire IG and the IG girls significantly decreased in the short- and middle-term and boys attitudes towards PE decreased in the short-term.

4.3.2.3.2 Physical activity behaviour

In the following section, the results on the students' physical activity behaviour (MVPA and exercise levels in and outside a sports club) are presented. First, the within-group changes are described and second, the specific intervention effects are stated. As already stated (see section 4.3.1.3.2), several problems occurred due to the low reliability values of the questionnaire. The consequences resulting from these low reliability values for the following results, are discussed in detail in section 4.3.3.

Within-group differences

The detailed results of the IG und the CG concerning the short- and middle term changes in MVPA and the minutes spent exercising in and outside a sports club are shown in table 26 and table 27.

Table 26 Short-Term Within-Group Differences in Physical Activity Levels

Variable			T1 M ± SD	T2 M ± SD	T	df	p	95% CI	d
MVPA	Total	IG	3.90 ± 1.63	4.07 ± 1.52	-1.33	109	.19	-.42; .08	0.10
		CG	3.79 ± 1.48	4.13 ± 1.45	-1.48	41	.15	-.82; .12	0.23
	Girls	IG	3.91 ± 1.56	3.86 ± 1.41	.31	75	.75	-.25; .34	0.03
		CG	3.67 ± 1.32	4.28 ± 1.40	-1.85	17	.08	-1.31; .08	0.46
	Boys	IG	3.90 ± 1.81	4.54 ± 1.68	-2.85	33	**.01**[a]	-1.11; -.19	0.36
		CG	3.88 ± 1.62	4.02 ± 1.51	-.45	23	.66	-.81; .52	0.09
Minutes spend in a sports club per week	Total	IG	214.63 ± 208.79	228.77 ± 206.76	-.81	80	.42	-49.08; 2.80	0.07
		CG	246.07 ± 202.96	273.82 ± 187.22	-.95	33	.35	-87.01; 31.51	0.14
	Girls	IG	209.54 ± 223.91	199.54 ± 163.68	.46	53	.65	-33.73; 53.73	0.04
		CG	187.35 ± 227.57	188.08 ± 144.22	-.02	12	.99	-93.33; 91.87	0.00
	Boys	IG	224.81 ± 178.27	287.22 ± 267.59	-2.25	26	**.03**[a]	-119.55; -5.27	0.35
		CG	282.43 ± 182.39	326.90 ± 193.96	-1.13	20	.27	-126.83; 37.87	0.24
Minutes spend outside a sports club per week	Total	IG	202.18 ± 168.65	177.22 ± 125.61	1.00	53	.32	-25.28; 75.19	0.15
		CG	213.50 ± 208.93	264.00 ± 179.07	-0.88	19	.39	-170.19; 69.19	0.24
	Girls	IG	190.45 ± 149.17	175.64 ± 107.40	0.55	38	.58	-39.44; 69.06	0.10
		CG	255.00 ± 210.88	207.50 ± 132.28	0.60	5	.58	-157.31; 252.31	0.23
	Boys	IG	232.67 ± 214.26	181.33 ± 168.52	0.88	14	.39	-73.95; 176.62	0.24
		CG	195.71 ± 213.45	288.21 ± 195.01	-1.27	13	.23	-250.22; 65.22	0.43

[a] Intervention effect in favour of the IG.
[b] Intervention effect in favour of the CG.

Table 27 Middle-Term Within-Group Differences in Physical Activity Levels

Variable			T1 M ± SD	T3 M ± SD	T	df	p	95% CI	d
MVPA	Total	IG	3.93 ± 1.64	4.24 ± 1.53	-2.12	109	**.04**[a]	-.60; -.02	0.19
		CG	3.55 ± 1.47	3.99 ± 1.30	-2.62	52	**.01**[a]	-.77; -.10	0.30
	Girls	IG	3.90 ± 1.59	4.19 ± 1.52	-1.62	76	.11	-.64; .07	0.18
		CG	3.37 ± 1.34	4.00 ± 1.27	-2.77	24	**.01**[a]	-1.10; -.16	0.47
	Boys	IG	4.00 ± 1.77	4.36 ± 1.56	-1.38	32	.18	-.90; .17	0.21
		CG	3.71 ± 1.58	3.98 ± 1.34	-1.11	27	.28	-.76; .23	0.17
Minutes spend in a sports club per week	Total	IG	209.61 ± 198.46	246.91 ±183.85	-1.87	75	.07	-77.01; 2.40	0.19
		CG	245.29 ± 213.93	243.62 ± 162.24	.06	39	.96	-57.78; 61.10	0.99
	Girls	IG	208.15 ± 224.29	228.80 ± 147.22	-1.02	53	.31	-61.15; 19.85	0.09
		CG	197.38 ± 258.24	174.41 ± 156.51	.66	16	.52	-51.02; 96.96	0.09
	Boys	IG	213.18 ± 116.96	291.36 ± 251.19	-1.64	21	.12	-177.11; 20.75	0.67
		CG	280.70 ± 171.89	294.78 ± 149.70	-.32	22	.75	-106.39; 78.22	0.08
Minutes spend outside a sports club per week	Total	IG	214.39 ± 178.99	244.72 ± 182.43	-1.06	52	.29	-87.66; 27.00	0.17
		CG	215.24 ± 240.90	159.05 ± 81.53	1.29	20	.21	-34.93; 147.31	0.23
	Girls	IG	191.51 ± 150.68	219.08 ± 158.33	-0.92	37	.36	-88.38; 33.25	0.18
		CG	194.29 ± 206.41	184.29 ± 81.57	0.17	6	.87	-131.63; 151.63	0.05
	Boys	IG	272.33 ± 232.34	309.67 ±225.95	-0.55	14	.59	-183.99; 109.32	0.16
		CG	225.71 ± 263.17	146.43 ± 81.49	1.34	13	.20	-48.66; 207.23	0.30

[a] Intervention effect in favour of the IG.
[b] Intervention effect in favour of the CG.

The short- and middle-term changes concerning the physical levels of the IG and the CG revealed mixed results. Regarding the MVPA levels the following changes were observed

(see Figure 15): In short-term, a significant increase occurred in IG boys (d = .36). In middle-term a significant increase was measured in both groups (IG: d = .19. CG: d = .30) in the gender independent analysis and in the CG girls (d = .47) during the gender separated examination. Additionally, in the follow-up period (T2-T3) a significant increase in IG girls was found.

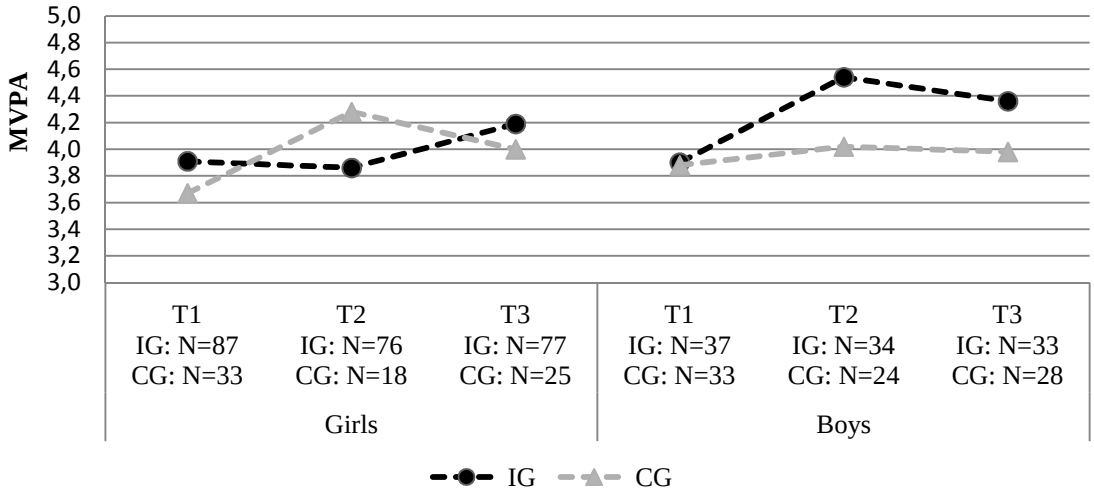

Figure 15 Short- and Middle-Term Within-Group Developments of MVPA Levels in the IG and the CG Over the Five Month Investigation Period.

The items assessing the amount of *exercise within a sports club* showed that the students participated in several different sports in the clubs. The majority of the students played football (29.9%) followed by gymnastics (14.9%), and tennis (14.2%). Handball and dance were each carried out by 12.7% of the students and swimming and track and field athletics were carried out by 9.7% and 9% respectively. Information concerning the frequency and the number of minutes with which each training session was carried out was also provided. These numbers were calculated to receive the total sum of minutes that students spent exercising in the sports club every week. The results in this analysis revealed only a significant a short-term increase in the number of minutes IG boys spent exercising in a sports club (see Figure 16a). No further significant changes could be observed. Overall, the number of minutes girls spent exercising in the sports club was similar in both groups: In the short-term the minutes remained stable. In the middle-term a small increase was observed in the IG whereas a decrease was measured in the CG girls. In boys, an increase in short- and middle term was observed in both groups.

The short- and middle-term within-group changes concerning the number of minutes students spent *exercising outside the sports club* are also shown in figure 16b. Regarding this domain, no short- and middle-term changes were observed. Nevertheless, based on the mean minutes measured, in girls a decrease in the short-time in both groups was observed. In the middle-term a decrease in the CG and an increase in the IG were revealed. In boys, the IG decreased

the minutes spent exercising outside the sports club in the short-term whereas they showed an increase in the middle-term. The opposite was found in the CG boys. Concerning this variable, only one significant change was observed in the follow-up timeframe (T2-T3): the total CG decreased the number of minutes they spent exercising outside the sports club.

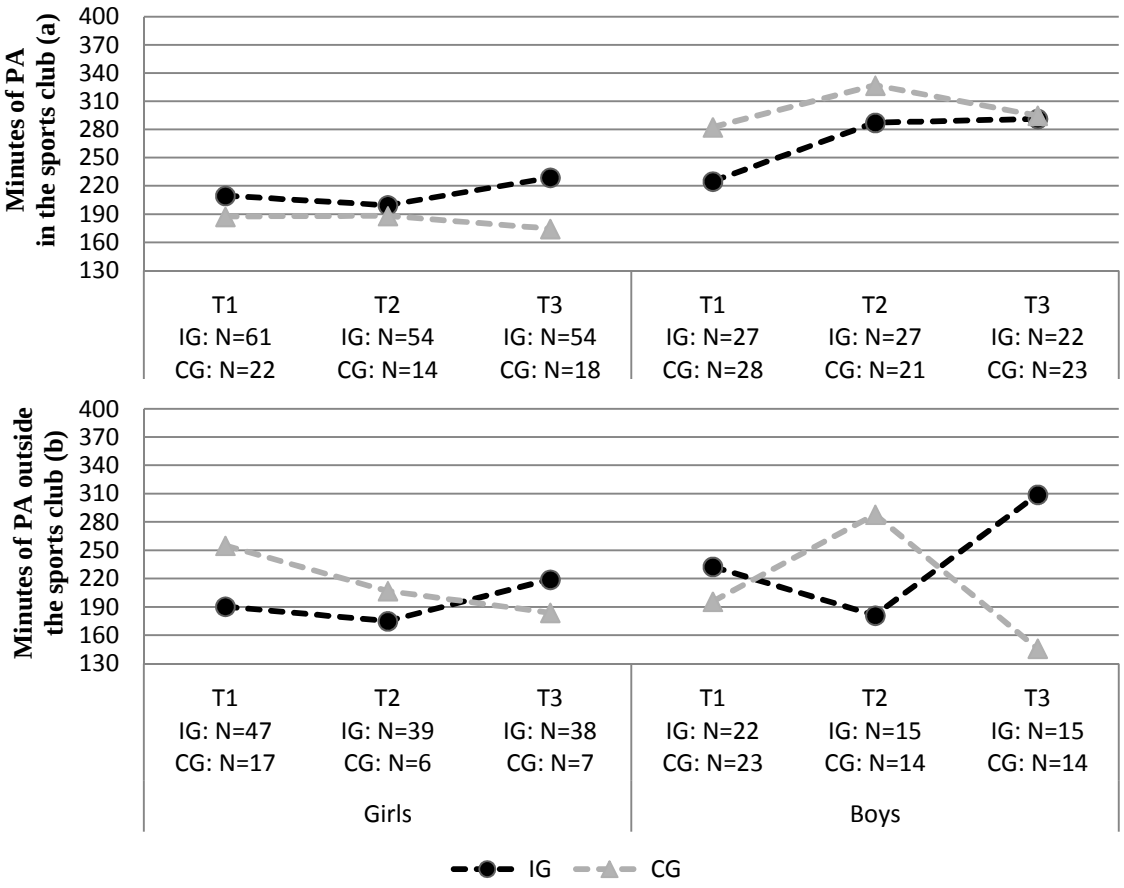

Figure 16 Short- and Middle-Term Within-Group Developments of Minutes Spent in and Outside the Sports Club in the IG and the CG Over the Five Month Investigation Period.

Between-group differences

The short- and middle-term intervention effects were examined (see Table 28). Based on the analysis of the entire study sample without differentiating on students' gender, negative short-term intervention results occurred on the number of minutes students spent outside of a sports club (d = .74) whereas on the same item positive intervention effects were observed in the middle-term (d = .97). On the other variables assessing students' physical activity levels no significant intervention could be observed. Also the observations based on the mean values do not bring out a clear picture concerning the tendencies of the intervention effects on students' physical activity levels. Even the more differentiated gender separated analysis of the intervention effects on students' physical activity could not provide clearer results. Only one positive middle-term intervention effect was revealed: IG boys spent a higher number of minutes outside a sports club.

Table 28 Short- and Middle-Term Intervention Effects on Physical Activity in the Total, Girls, and Boys Group (Estimated Means (± SE), Controlled for T1-Values and Baseline BMI Values)

Variable	Group	Time	IG N	IG M ± SE	CC N	CC M ± SE	F	p	η^2	d
MVPA	Total	T2	110	4.05 ± .11	42	4.18 ± .19	.34	.56	.00	0.01
		T3	110	4.18 ± .12	53	4.12 ± .17	.08	.79	.00	0.01
	Girls	T2	76	3.84 ± .13	18	4.39 ± .27	3.49	.07	.04	0.08
		T3	77	4.12 ± .14	25	4.20 ± .25	.08	.78	.00	0.01
	Boys	T2	34	4.54 ± .22	24	4.03 ± .26	2.30	.14	.04	0.09
		T3	33	4.29 ± .20	28	4.06 ± .22	.58	.45	.01	0.04
Minutes spend in a sports club per week	Total	T2	81	234.97 ± 16.33	34	259.03 ± 25.22	0.64	.43	.01	0.17
		T3	76	253.00 ± 16.74	40	232.06 ± 23.10	0.54	.47	.01	0.18
	Girls	T2	54	197.37 ± 15.56	13	197.09 ± 31.72	0.00	.99	.00	0.00
		T3	54	227.49 ± 12.63	17	178.55 ± 22.52	3.59	.06	.05	0.59
	Boys	T2	27	311.8 ± 31.56	21	295.31 ± 35.84	0.12	.73	.00	0.18
		T3	22	304.39 ± 43.29	23	282.33 ± 42.31	0.13	.72	.00	0.28
Minutes spend outside a sports club per week	Total	T2	54	177.71 ± 19.02	20	262.68 ± 31.25	5.39	**.02**[b]	.07	0.74
		T3	53	244.79 ± 20.79	21	158.87 ± 33.02	4.85	**.03**[a]	.06	0.97
	Girls	T2	39	177.01 ± 17.48	6	198.62 ± 44.88	.20	.66	.00	0.38
		T3	38	219.21 ± 23.34	7	183.59 ± 54.38	.36	.55	.01	0.53
	Boys	T2	15	178.15 ± 46.85	14	291.62 ± 48.50	2.82	.11	.10	1.56
		T3	15	303.98 ± 42.32	14	152.52 ± 43.81	6.15	**.02**[a]	.19	2.87

[a] Intervention effect in favour of the IG.
[b] Intervention effect in favour of the CG.

Summary

Concluding, the study results concerning students' physical activity levels show a rather mixed picture. Some of the assessed variables changed positively while other changed to a negative degree due to the intervention. As also shown by the retest-reliability results of the questionnaire, some of the items are not reliable and therefore the results based on them need to be interpreted with caution (see section 4.3.1.3.2).

4.3.2.3.3 Health and fitness outcomes

Within-group differences

The detailed short- and middle-term results of the IG and the CG within-group Differences in the motor performance test (total score and each individual test), BMI, and HRQOL (total score and the six sub-domains) are presented in the following (see Table 29 and Table 30).

Table 29 Short-Term Within-Group Differences in Motor Performance, BMI, and HRQOL

Variable			T1 M ± SD	T2 M ± SD	T	df	p	95% CI	d
Motor performance score	Total	IG	107.62 ± 5.99	111.19 ± 6.37	-13.89	205	**<.001**[a]	-4.07; -3.06	0.00
		CG	107 ± 6.43	110.69 ± 6.64	-12.17	154	**<.001**[a]	-3.89; -2.8	0.01
	Girls	IG	106.21 ± 5.97	110.54 ± 6.44	-11.66	99	**<.001**[a]	-5.06; -3.59	0.70
		CG	105.69 ± 6.42	109.56 ± 6.21	-11.36	87	**<.001**[a]	-4.55; -3.20	0.61
	Boys	IG	108.96 ± 5.72	111.82 ± 6.27	-8.31	105	**<.001**[a]	-3.55; -2.18	0.48
		CG	109.53 ± 5.79	112.19 ± 6.93	-6.04	66	**<.001**[a]	-3.54; -1.78	0.42
Sideways jumps	Total	IG	40.51 ± 5.46	45.58 ± 5.69	-13.27	202	**<.001**[a]	-5.82; -4.31	7.37
		CG	39.38 ± 6.26	42.45 ± 5.50	-7.84	154	**<.001**[a]	-3.85; -2.30	0.52
	Girls	IG	40.48 ± 5.09	45.73 ± 5.08	-11.33	97	**<.001**[a]	-6.17; -4.33	1.03

Variable			T1 M ± SD	T2 M ± SD	T	df	p	95% CI	d
Balance backwards	Boys	CG	39.23 ± 5.84	41.52 ± 4.44	-6.47	66	**<.001**[a]	-5.38; -2.84	0.44
		IG	40.54 ± 5.82	45.45 ± 6.24	-8.17	104	**<.001**[a]	-6.10; -3.71	0.81
	Total	CG	39.57 ± 6.83	43.69 ± 6.49	-6.47	66	**<.001**[a]	-5.38; -2.84	0.62
		IG	37.995 ± 8.29	40.09 ± 8.10	-3.94	205	**<.001**[a]	-3.15; -1.05	4.14
	Girls	CG	38.65 ± 7.97	40.14 ± 7.77	-2.71	154	**.01**[a]	-2.58; -.40	4.38
		IG	38.53 ± 7.71	41.85 ± 6.80	-4.50	99	**<.001**[a]	-4.78; -1.86	0.46
	Boys	CG	39.53 ± 6.96	41.20 ± 6.74	-2.51	87	**.01**[a]	-2.99; -.35	0.24
		IG	37.49 ± 8.82	38.44 ± 8.88	-1.27	105	.21	-2.44; .54	0.11
	Total	CG	37.49 ± 9.06	38.76 ± 8.81	-1.36	66	.18	-3.13; .60	0.14
		IG	3.7847 ±.29	3.7880 ±.28	-.189	186	.85	-.03; .03	0.01
20m sprint	Girls	CG	3.7485 ±.30	3.76 ±.33	-.568	137	.57	-.05; .02	0.04
		IG	3.84 ± .32	3.85 ± .30	-.27	86	.79	-.06; .05	0.02
	Boys	CG	3.80 ± .33	3.73 ± .35	-2.99	66	**<.001**[a]	-.16; -.03	0.20
		IG	3.74 ± .27	3.74 ± .25	.00	99	1.0	-.05; .05	0.00
	Total	CG	3.69 ± .27	3.79 ± .33	2.93	70	**<.001**[b]	.02; .12	0.32
		IG	1079.73 ± 128.76	1068.48 ± 12.96	2.00	184	**.04**[b]	.155; 22.34	0.12
6-min run	Girls	CG	1074.15 ± 133.44	1063.99 ± 124.80	1.48	149	.14	-3.41; 23.73	0.08
		IG	1037.84 ± 110.84	1030.09 ± 98.76	1.07	89	.29	-6.61; 22.11	0.07
	Boys	CG	1028.16 ± 112.33	1020.25 ± 112.30	.90	86	.37	-9.51; 25.32	0.07
		IG	1119.43 ± 132.48	1104.87 ± 129.07	1.70	94	.09	-2.45; 31.58	0.11
	Total	CG	1137.67 ± 135.01	1124.40 ± 116.38	1.20	62	.24	-8.89; 35.41	0.11
		IG	.31 ± 7.85	1.58 ± 8.11	-5.13	204	**<.001**[a]	-1.76; -.783	0.16
Stand and reach flexibility	Girls	CG	1.25 ± 7.74	2.46 ± 8.07	-3.01	153	**<.001**[a]	-2.00; -.41	0.15
		IG	3.15 ± 7.67	5.25 ± 7.27	-5.40	99	**<.001**[a]	-2.86; -1.33	0.28
	Boys	CG	3.49 ± 7.05	5.07 ± 7.00	-4.50	99	**<.001**[a]	-4.78; -1.86	0.23
		IG	-2.38 ± 7.07	-1.90 ± 7.33	-1.66	104	.10	-1.07; .09	0.07
	Total	CG	-1.64 ± 7.70	-.91 ± 8.18	-.92	66	.36	-2.34; .86	0.09
		IG	22.76 ± 4.85	25.34 ± 4.87	-8.83	204	**<.001**[a]	-3.15; -2.00	0.53
Sit-ups	Girls	CG	22.36 ± 5.30	25.95 ± 5.47	-11.79	152	**<.001**[a]	-4.19; -2.99	0.67
		IG	21.22 ± 4.35	24.48 ± 4.69	-7.54	98	**<.001**[a]	-4.12; -2.40	0.72
	Boys	CG	20.47 ± 5.06	24.47 ± 5.26	-6.35	65	**<.001**[a]	-4.02; -2.10	0.77
		IG	24.19 ± 4.89	26.13 ± 4.92	-5.03	105	**<.001**[a]	-2.71; -1.18	0.40
	Total	CG	24.85 ± 4.56	27.91 ± 5.16	-10.30	86	**<.001**[a]	-4.77; -3.23	0.63
		IG	16.52 ± 3.10	19.68 ± 3.17	-16.60	204	**<.001**[a]	-3.53; -2.78	1.01
Press-ups	Girls	CG	16.26 ± 3.38	19.39 ± 3.43	-12.32	154	**<.001**[a]	-3.63; -2.62	0.92
		IG	15.25 ± 2.65	19.02 ± 2.54	-14.54	98	**<.001**[a]	-4.28; -3.25	1.45
	Boys	CG	15.27 ± 3.15	18.90 ± 2.80	-5.47	66	**<.001**[a]	-3.38; -1.57	1.22
		IG	17.71 ± 3.05	20.30 ± 3.57	-9.72	105	**<.001**[a]	-3.12; -2.06	0.78
	Total	CG	17.57 ± 3.26	20.04 ± 4.05	-13.16	87	**<.001**[a]	-4.17; -3.08	0.67
		IG	159.57 ± 19.43	159.85 ± 19.98	-.36	204	.72	-1.80; 1.25	0.01
Standing long jump	Girls	CG	157.79 ± 2.77	162.73 ± 23.78	-4.10	153	**<.001**[a]	-7.32; -2.56	0.29
		IG	155.77 ± 19.28	155.34 ± 20.41	.38	98	.71	-1.82; 2.66	0.02
	Boys	CG	150.52 ± 18.91	155.00 ± 20.28	-2.62	65	**.01**[a]	-9.80; -1.32	0.23
		IG	163.13 ± 18.98	164.07 ± 18.71	-.88	105	.38	-3.04; 1.17	0.05
	Total	CG	167.48 ± 19.24	173.05 ± 24.35	-2.62	65	**.01**[a]	-9.80; -1.32	0.25
		IG	18.24 ± 2.60	18.38 ± 2.55	-3.61	204	**<.001**	-.22; -.06	0.05
BMI	Girls	CG	18.39 ± 3.00	18.76 ± 3.05	-9.00	154	**<.001**	-.44; -.28	0.12
		IG	17.92 ± 2.50	18.08 ± 2.45	-2.81	98	**.01**	-.27; -.05	0.06
	Boys	CG	18.76 ± 3.21	19.16 ± 3.28	-7.49	87	**<.001**	-.51; -.29	0.12
		IG	18.54 ± 2.67	18.68 ± 2.63	-2.32	105	**.02**	-.25; -.02	0.05
	Total	CG	17.92 ± 2.66	18.23 ± 2.68	-5.11	66	**<.001**	-.44; -.19	0.12
		IG	95.76 ± 1.96	94.01 ± 11.83	1.627	88	.11	-.39; 3.88	0.17
Score	Girls	CG	95.03 ± 1.89	93.77 ± 10.25	1.265	85	.21	-.72; 3.24	0.12
		IG	97.89 ± 10.12	96.28 ± 11.29	.75	31	.46	-2.74; 5.95	0.16
	Boys	CG	95.60 ± 10.71	95.12 ± 10.00	.40	56	.69	-1.87; 2.82	0.04
		IG	94.57 ± 11.32	92.74 ± 12.04	1.53	56	.13	-.56; 4.22	0.16
	Total	CG	93.91 ± 11.35	91.10 ± 10.37	1.52	28	.14	-.98; 6.59	0.25
Physical wellbeing		IG	15.68 ± 2.62	14.98 ± 2.77	2.078	92	**.04**[b]	.03; 1.37	0.27
		CG	15.38 ± 3.00	14.83 ± 2.66	1.624	92	.11	-.12; 1.22	0.18

Variable			T1 M ± SD	T2 M ± SD	T	df	p	95% CI	d
	Girls	IG	15.47 ± 3.21	15.09 ± 2.72	.58	33	.57	-.96; 1.73	0.12
		CG	15.21 ± 3.23	14.97 ± 2.29	.60	62	.55	-.56; 1.03	0.07
	Boys	IG	15.80 ± 2.23	14.92 ± 2.81	2.37	58	**.02**[b]	.14; 1.62	0.39
		CG	15.73 ± 2.46	14.53 ± 3.33	1.92	29	.07	-.08; 2.48	0.49
	Total	IG	17.11 ± 2.32	16.58 ± 2.81	1.597	95	.11	-.13; 1.18	0.23
		CG	17.09 ± 2.22	16.96 ± 2.16	.579	93	.56	-.31; .57	0.06
Psychological wellbeing	Girls	IG	17.75 ± 2.20	16.97 ± 2.84	1.34	35	.19	-.40 1.95	0.35
		CG	17.33 ± 2.04	17.25 ± 1.93	.28	63	.78	-.49; .65	0.04
	Boys	IG	16.73 ± 2.32	16.35 ± 2.79	.94	59	.35	-.43; 1.18	0.16
		CG	16.57 ± 2.51	16.33 ± 2.52	.69	29	.50	-.46; .92	0.09
	Total	IG	13.97 ± 3.37	14.31 ± 3.37	-.948	93	.34	-1.05; .37	0.10
		CG	14.14 ± 2.89	14.20 ± 2.85	-.235	94	.82	-.60; .47	0.02
Self-worth	Girls	IG	14.35 ± 2.86	14.51 ± 3.52	-.24	34	.81	-1.53; 1.20	0.06
		CG	14.05 ± 3.07	14.45 ± 3.04	-1.22	64	.23	-1.05; .25	0.13
	Boys	IG	13.74 ± 3.64	14.19 ± 3.30	-1.08	58	.29	-1.28; .38	0.12
		CG	14.33 ± 2.50	13.67 ± 2.35	1.49	29	.15	-.25; 1.58	0.27
	Total	IG	17.94 ± 2.42	17.68 ± 2.70	.991	92	.32	-.26; .78	0.11
		CG	17.65 ± 2.77	17.57 ± 2.70	.253	92	.80	-.51; .67	0.03
Family	Girls	IG	18.06 ± 2.60	18.03 ± 2.91	.08	33	.94	-.76; .82	0.01
		CG	18.00 ± 2.10	17.87 ± 2.56	.46	61	.64	-.43; .69	0.06
	Boys	IG	17.86 ± 2.33	17.47 ± 2.57	1.13	58	.26	-.30; 1.08	0.17
		CG	16.94 ± 3.71	16.97 ± 2.90	-.05	30	.96	-1.47; 1.41	0.01
	Total	IG	15.39 ± 2.97	15.47 ± 2.59	-.297	91	.77	-.61; .45	0.03
		CG	16.17 ± 2.65	15.78 ± 2.75	1.466	92	.15	-.14; .90	0.14
Friends	Girls	IG	16.26 ± 2.80	15.82 ± 2.38	1.01	32	.32	-.45; 1.34	0.16
		CG	16.22 ± 2.68	15.84 ± 2.71	1.13	61	.26	-.29; 1.06	0.14
	Boys	IG	14.90 ± 2.98	15.27 ± 2.70	-1.11	58	.27	-1.04; .30	0.13
		CG	16.06 ± 2.62	15.68 ± 2.87	.95	30	.35	-.45; 1.22	0.15
	Total	IG	15.26 ± 2.47	15.31 ± 2.68	-.202	95	.84	-.56; .46	0.02
		CG	14.88 ± 2.62	15.02 ± 2.33	-.665	95	.51	-.57; .28	0.05
School	Girls	IG	15.50 ± 2.26	15.86 ± 2.33	-.87	35	.39	-1.20; .48	0.16
		CG	15.12 ± 2.65	15.31 ± 2.34	-.70	64	.48	-.71; .34	0.07
	Boys	IG	15.12 ± 2.60	14.98 ± 2.83	.40	59	.69	-.53; .79	0.05
		CG	14.37 ± 2.52	14.42 ± 2.22	-.14	30	.89	-.82; .71	0.02

[a] Intervention effect in favour of the IG.
[b] Intervention effect in favour of the CG.

Table 30 Middle-Term Within-Group Differences in Motor Performance, BMI, and HRQOL

Variable			T1 M ± SD	T3 M ± SD	T	df	p	95% CI	d
Motor performance score	Total	IG	107.81 ± 5.96	112.92 ± 5.64	-19.63	215	**<.001**[a]	-5.62; -4.59	0.88
		CG	107.31 ± 6.28	112.10 ± 6.89	-14.23	143	**<.001**[a]	-5.44; -4.12	0.73
	Girls	IG	106.27 ± 5.97	112.30 ± 5.40	-17.26	110	**<.001**[a]	-6.72; -5.34	1.06
		CG	106.15 ± 6.49	110.47 ± 6.71	-9.62	84	**<.001**[a]	-5.22; -3.43	0.66
	Boys	IG	109.44 ± 5.54	113.58 ± 5.86	-11.31	104	**<.001**[a]	-4.87; -3.42	0.73
		CG	109.01 ± 5.62	114.46 ± 6.52	-11.00	58	**<.001**[a]	-6.44; -4.46	0.90
Sideways jumps	Total	IG	40.62 ± 5.49	45.67 ± 5.22	-15.41	210	**<.001**[a]	-5.69; -4.40	0.94
		CG	39.67 ± 6.47	44.55 ± 6.28	-9.57	141	**<.001**[a]	-5.88; -3.87	0.76
	Girls	IG	40.41 ± 5.12	46.29 ± 5.77	-14.53	108	**<.001**[a]	-6.68; -5.08	1.08
		CG	39.64 ± 6.13	42.93 ± 6.29	-5.18	82	**<.001**[a]	-4.55; -2.02	0.53
	Boys	IG	40.85 ± 5.87	45.01 ± 4.49	-8.17	101	**<.001**[a]	-5.17; -3.15	0.80
		CG	39.71 ± 6.97	46.82 ± 5.55	-9.41	58	**<.001**[a]	-8.62; -5.60	1.13
Balance backwards	Total	IG	38.30 ± 7.81	40.87 ± 6.56	-4.80	214	**<.001**[a]	-3.61; -1.51	0.36
		CG	38.34 ± 8.14	40.27 ± 7.25	-3.34	141	**<.001**[a]	-3.07; -.79	0.25
	Girls	IG	38.59 ± 7.42	41.18 ± 6.57	-3.34	110	**<.001**[a]	-4.14; -1.05	0.37
		CG	39.56 ± 7.20	40.20 ± 7.00	-.84	83	.40	-2.16; .87	0.09
	Boys	IG	38.00 ± 8.24	40.53 ± 6.58	-3.46	103	**<.001**[a]	-3.98; -1.08	0.34
		CG	36.57 ± 9.12	40.36 ± 7.66	-4.54	57	**<.001**[a]	-5.47; -2.12	0.45
20m sprint	Total	IG	3.79 ± .30	3.70 ± .27	4.53	197	**<.001**[a]	.05; .12	0.30

Variable			T1 M ± SD	T3 M ± SD	T	df	p	95% CI	d
6-min run	Girls	CG	3.75 ± .29	3.73 ± .29	.90	140	.367	-.02; .06	0.07
		IG	3.84 ± .31	3.71 ± .29	4.49	97	**<.001**[a]	.07; .18	0.41
	Boys	CG	3.78 ± .32	3.74 ± .27	1.49	81	.14	-.01; .10	0.14
		IG	3.74 ± .28	3.69 ± .25	1.88	99	.06	.00; .10	0.18
	Total	CG	3.71 ± .25	3.72 ± .32	-.31	58	.76	-.08; .06	0.04
		IG	1078.06 ± 126.66	1071.93 ± 132.65	.86	192	.39	-7.96; 2.24	0.05
		CG	1080.17 ± 125.60	1058.64 ± 133.26	2.79	125	**<.001**[b]	6.25; 36.80	0.17
	Girls	IG	1030.30 ± 103.14	1044.78 ± 103.01	-1.57	96	.12	-32.77; 3.81	0.14
		CG	1030.74 ± 109.88	1014.78 ± 110.84	1.47	72	.15	-5.72; 37.63	0.14
	Boys	IG	1126.32 ± 130.35	1099.35 ± 152.73	2.55	95	**.01**[b]	5.97; 47.97	0.19
		CG	1148.25 ± 114.24	1119.06 ± 138.78	2.74	52	**.01**[b]	7.85; 50.53	0.23
Stand and reach flexibility	Total	IG	.53 ± 7.81	1.96 ± 8.27	-4.13	214	**<.001**[a]	-2.12; -.75	0.18
		CG	1.00 ± 7.90	1.41 ± 8.41	-1.01	141	.316	-1.22; .40	0.05
	Girls	IG	3.27 ± 7.80	5.82 ± 7.55	-5.13	110	**<.001**[a]	-3.53-1.56	0.33
		CG	3.35 ± 7.40	3.98 ± 7.35	-1.53	82	.13	-1.44; .19	0.08
	Boys	IG	-2.40 ± 6.71	-2.15 ± 6.93	-.54	103	.59	-1.16; .66	0.04
		CG	-2.31 ± 7.42	-2.20 ± 8.53	-.14	58	.89	-1.71; 1.49	0.01
Sit-ups	Total	IG	22.89 ± 4.76	27.69 ± 4.97	-16.01	211	**<.001**[a]	-5.39; -4.21	0.99
		CG	22.26 ± 5.10	27.28 ± 4.88	-13.48	140	**<.001**[a]	-5.76; -4.28	1.01
	Girls	IG	21.38 ± 4.23	26.57 ± 4.38	-12.22	109	**<.001**[a]	-6.03; -4.35	1.20
		CG	20.67 ± 4.97	26.04 ± 4.28	-12.57	82	**<.001**[a]	-6.21; -4.51	1.16
	Boys	IG	24.52 ± 4.78	28.89 ± 5.29	-10.41	101	**<.001**[a]	-5.21; -3.54	0.87
		CG	24.52 ± 4.42	29.05 ± 5.17	-6.79	57	**<.001**[a]	-5.87; -3.20	0.94
Press-ups	Total	IG	16.51 ± 3.03	20.34 ± 3.36	-17.33	211	**<.001**[a]	-4.27; -3.40	1.20
		CG	16.27 ± 3.13	20.98 ± 3.33	-16.48	139	**<.001**[a]	-5.27; -4.14	1.46
	Girls	IG	15.31 ± 2.65	19.39 ± 3.03	-13.39	108	**<.001**[a]	-4.68; -3.47	1.43
		CG	15.59 ± 2.90	19.98 ± 3.12	-12.51	81	**<.001**[a]	-5.09; -3.69	1.46
	Boys	IG	17.78 ± 2.90	21.36 ± 3.40	-11.13	102	**<.001**[a]	-4.22; -2.94	1.13
		CG	17.24 ± 3.22	22.40 ± 3.13	-10.83	57	**<.001**[a]	-6.11; -4.20	1.62
Standing long jump	Total	IG	159.76 ± 19.66	163.67 ± 2.48	-4.18	212	**<.001**[a]	-5.75; -2.07	0.19
		CG	158.05 ± 18.73	161.90 ± 18.43	-3.49	140	**<.001**[a]	-6.01; -1.67	0.26
	Girls	IG	155.98 ± 19.49	159.53 ± 19.59	-2.80	109	**.01**[a]	-6.06; -1.04	0.18
		CG	152.37 ± 18.57	156.70 ± 16.94	-3.29	83	**<.001**[a]	-6.95; -1.71	0.24
	Boys	IG	163.80 ± 19.12	168.11 ± 20.59	-3.11	102	**<.001**[a]	-7.06; -1.56	0.22
		CG	166.44 ± 15.68	169.56 ± 17.99	-1.63	56	.11	-6.96; .71	0.19
BMI	Total	IG	18.15 ± 2.49	18.41 ± 2.40	-5.16	214	**<.001**	-.36; -.16	0.11
		CG	18.33 ± 2.97	18.84 ± 2.96	-8.32	142	**<.001**	-.63; -.39	0.17
	Girls	IG	17.87 ± 2.43	18.17 ± 2.33	-4.22	110	**<.001**	-.44; -.16	0.13
		CG	18.81 ± 3.16	19.23 ± 3.10	-5.09	83	**<.001**	-.58; -.25	0.13
	Boys	IG	18.44 ± 2.53	18.66 ± 2.46	-3.04	103	**<.001**	-.35; -.07	0.09
		CG	17.65 ± 2.55	18.29 ± 2.67	-7.13	58	**<.001**	-.82; -.46	0.25
Score	Total	IG	96.65 ± 9.88	93.58 ± 13.43	2.67	88	**.01**[b]	.79; 5.36	0.31
		CG	94.77 ± 10.49	93.45 ± 10.49	1.11	83	.27	-1.04; 3.69	0.13
	Girls	IG	97.91 ± 9.81	95.85 ± 11.07	1.12	33	.27	-1.68; 5.80	0.21
		CG	95.30 ± 10.28	94.97 ± 10.95	.24	54	.81	-2.40; 3.07	0.03
	Boys	IG	95.87 ± 9.94	92.17 ± 14.63	2.50	54	**.02**[b]	.73; 6.66	0.37
		CG	93.77 ± 10.98	90.57 ± 9.04	1.41	28	.17	-1.46; 7.85	0.29
Physical wellbeing	Total	IG	15.58 ± 2.68	14.93 ± 3.31	1.87	94	.06	-.04; 1.35	0.24
		CG	15.38 ± 2.93	14.55 ± 3.03	2.01	93	**.05**[b]	.01; 1.65	0.28
	Girls	IG	15.44 ± 3.16	15.44 ± 2.86	.00	35	1.00	-1.11; 1.11	0.00
		CG	15.28 ± 3.16	14.64 ± 3.03	1.27	63	.21	-.37; 1.65	0.20
	Boys	IG	15.66 ± 2.37	14.61 ± 3.54	2.35	58	**.02**[b]	.16; 1.95	0.44
		CG	15.60 ± 2.39	14.37 ± 3.08	1.73	29	.09	-.23; 2.69	0.52
Psychological wellbeing	Total	IG	17.29 ± 2.24	16.47 ± 2.65	2.76	96	**.01**[b]	.23; 1.40	0.36
		CG	17.05 ± 2.17	17.00 ± 2.21	.20	96	.84	-.47; .57	0.02
	Girls	IG	17.76 ± 2.14	17.05 ± 2.69	1.38	37	.18	-.33; 1.75	0.33
		CG	17.27 ± 1.98	17.37 ± 2.19	-.37	66	.71	-.66; .45	0.05
	Boys	IG	16.98 ± 2.26	16.10 ± 2.58	2.46	58	**.02**[b]	.16; 1.59	0.39
		CG	16.57 ± 2.51	16.17 ± 2.07	.69	29	.49	-.78; 1.58	0.16

Variable			T1 M ± SD	T3 M ± SD	T	df	p	95% CI	d
Self-worth	Total	IG	13.99 ± 3.03	14.33 ± 3.44	-1.09	95	.28	-.97; .28	0.11
		CG	14.28 ± 2.81	14.36 ± 2.74	-.27	95	.79	-.67; .51	0.03
	Girls	IG	14.32 ± 2.81	14.68 ± 2.75	-.72	36	.48	-1.38; .65	0.13
		CG	14.28 ± 3.01	14.45 ± 2.90	-.49	65	.62	-.89; .54	0.06
	Boys	IG	13.77 ± 3.16	14.11 ± 3.81	-.81	58	.42	-1.16; .49	0.11
		CG	14.30 ± 2.37	14.17 ± 2.38	.24	29	.81	-.99; 1.25	0.06
Family	Total	IG	18.14 ± 2.15	17.43 ± 3.06	2.56	92	**.01**[b]	.16; 1.26	0.33
		CG	17.65 ± 2.72	17.35 ± 2.48	1.00	93	.32	-.29; .89	0.11
	Girls	IG	18.31 ± 2.01	17.78 ± 2.52	1.41	35	.17	-.23; 1.29	0.26
		CG	18.00 ± 2.07	17.65 ± 2.29	1.00	62	.32	-.35; 1.05	0.17
	Boys	IG	18.04 ± 2.25	17.21 ± 3.36	2.13	56	**.04**[b]	.05; 1.60	0.37
		CG	16.94 ± 3.65	16.74 ± 2.77	.34	30	.74	-.97; 1.36	0.05
Friends	Total	IG	15.54 ± 2.88	15.32 ± 2.63	.70	93	.49	-.41; .85	0.08
		CG	16.12 ± 2.58	15.81 ± 2.20	1.12	93	.27	-.24; .86	0.12
	Girls	IG	16.36 ± 2.66	15.76 ± 2.19	1.17	34	.25	-.44; 1.64	0.23
		CG	16.14 ± 2.62	16.09 ± 2.02	.14	62	.89	-.62; .71	0.02
	Boys	IG	15.05 ± 2.91	15.05 ± 2.84	-.01	58	.99	-.81; .80	0.00
		CG	16.10 ± 2.56	15.25 ± 2.46	1.69	30	.10	-.17; 1.87	0.33
School	Total	IG	15.42 ± 2.38	14.92 ± 2.91	1.86	98	.07	-.03; 1.04	0.21
		CG	14.86 ± 2.62	14.41 ± 2.68	1.82	97	.07	-.04; .95	0.17
	Girls	IG	15.58 ± 2.32	15.03 ± 2.54	1.26	37	.21	-.33; 1.44	0.24
		CG	15.09 ± 2.66	14.73 ± 2.81	1.41	66	.16	-.15; .87	0.13
	Boys	IG	15.33 ± 2.43	14.85 ± 3.14	1.37	60	.18	-.22; 1.17	0.20
		CG	14.37 ± 2.51	13.71 ± 2.25	1.15	30	.26	-.50; 1.82	0.26

[a] Intervention effect in favour of the IG.
[b] Intervention effect in favour of the CG.

Overall, positive changes were revealed on students *motor performance score* (see Figure 17a). In girls, a significant increase in both examined groups were measured in the short- (IG: d = .70, CG: d = .61) and the middle-term (IG: d = 1.06, CG: d = .66). Also in boys, significant positive changes were measured in the short- (IG: d = .48, CG: d = .42) and the middle-term (IG: d = .73, CG: d = .90). Additionally, significant positive changes were shown in both groups in the follow-up timeframe (T2-T3). Similarly, also concerning *BMI* significant changes were observed (see Figure 17b). In the short-term girls in both groups (IG: d = .06, CG: d = .12) and boys (IG: d = .05, CG: d = .12) increased their BMI levels. These developments were also measured in the middle-term for girls (IG: d = .13, CG: d = .13) and boys (IG: d = .09, CG: d = .25). Finally, also during the follow-up timeframe (T2-T3), both groups in the gender independent analysis as well as IG girls and CG boys significantly increased in BMI. On the contrary, the results in overall *HRQOL score* revealed a different picture (see Figure 17c). No significant changes were measured in the short-term. In the middle-term only two significant negative developments were observed: in the entire IG (d = .31 and in the IG boys (d = .37).

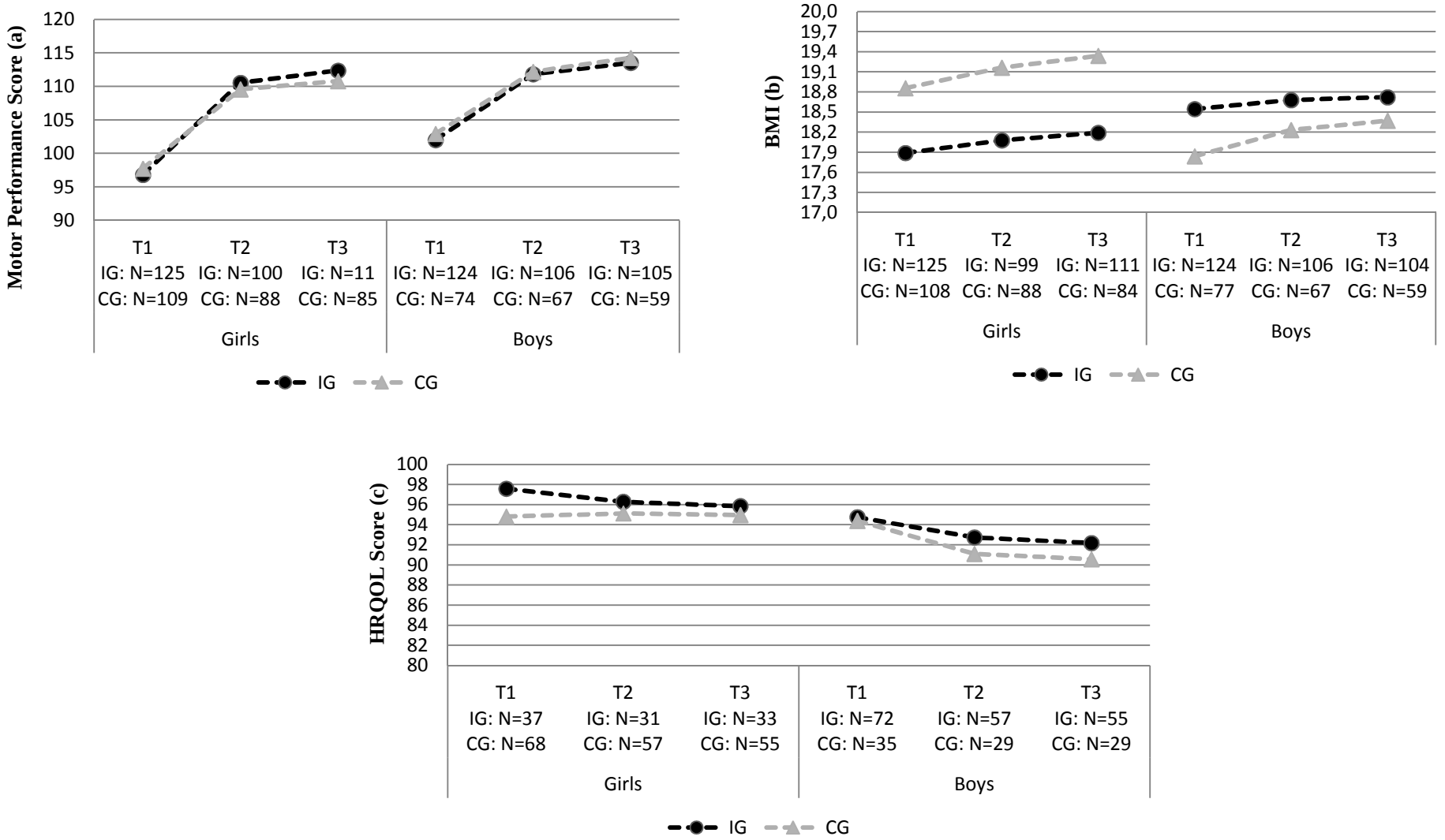

Figure 17 Short- and Middle-Term Within-Group Developments of the Three Measures on the Health and Fitness Target Level (Motor Performance Score, BMI, and HRQOL Score) in the IG and the CG Over the Five Month Investigation Period.

Students' *coordination* was assessed using the balance backwards test and the sideways jumps. In the *balance backwards* test (see Figure 18a), significant short-term positive developments were observed in girls (IG: d = .46, CG: d = .24). In the middle-term, significant positive changes were measured in the IG girls (d = .37) and in both groups in boys (IG: d = .34, CG: d = .45). During the follow-up, only boys in both groups significantly improved in this test. When looking at the changes in the *sideways jumps* test (see Figure 18b), it becomes clear that in the short-term significant positive developments occurred in girls (IG: d = 1.03, CG: d = .44) and boys (IG: d = .81, CG: d = .62). These positive significant changes were also measured in the middle-term in girls (IG: d = 1.08, CG: d = .53) and boys (IG: d = .80, CG: d = 1.13). During the follow-up (T2-T3), only the CG significantly improved in this test in the gender independent and the gender separated analysis.

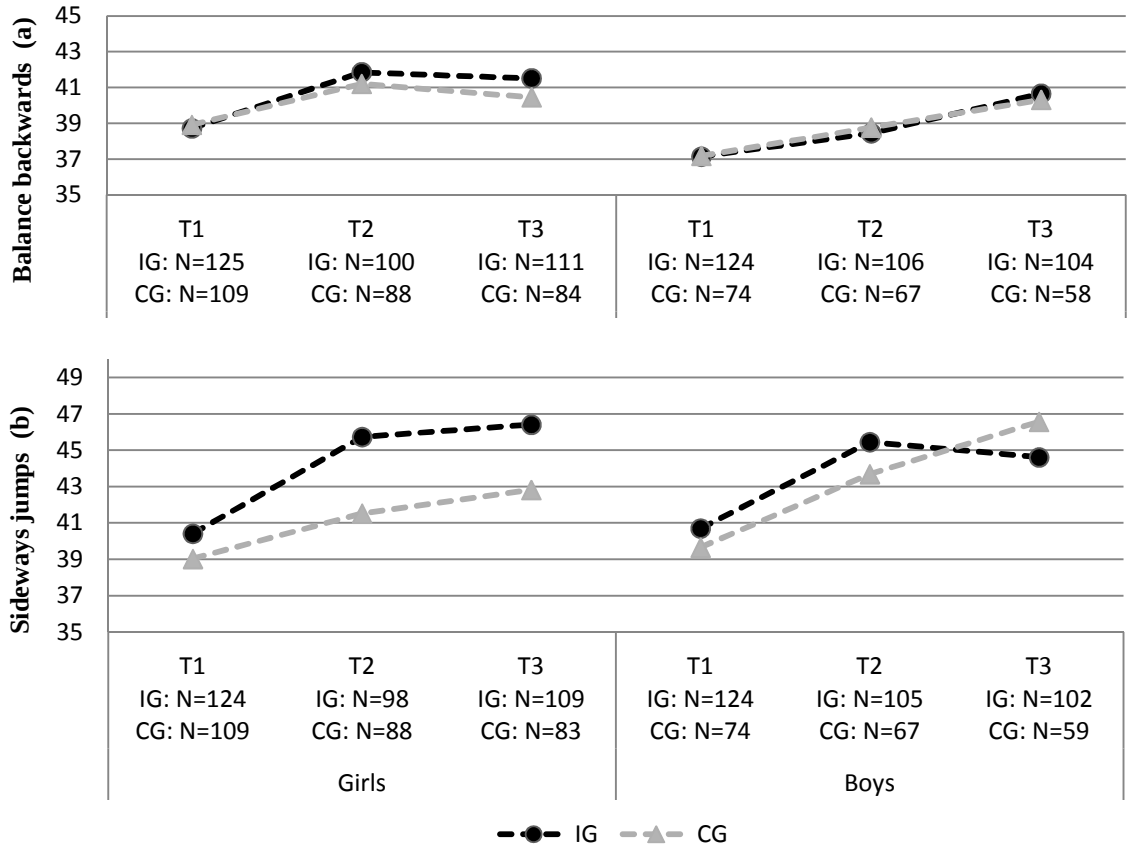

Figure 18 Short- and Middle-Term Within-Group Developments of Coordination (Balance Backwards and Sideways Jumps) in the IG and the CG Over the Five Month Investigation Period.

For the assessment of students' speed, the *20m sprint* was used. In this test, short-term significant changes were only measured in the CG (see Figure 19): Girls improved in the 20m sprint (d = .20) whereas boys showed negative changes (d = .32). In the middle-term IG girls (d = .41) and the entire IG (d = .30) showed significant positive changes. During the follow-up (T2-T3), girls in the IG and boys in the CG significantly improved their speed.

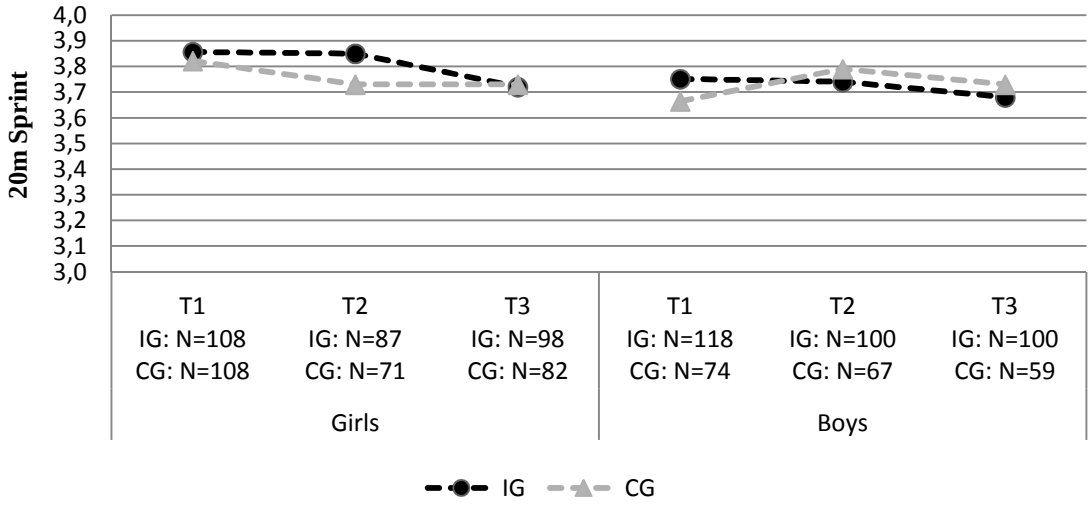

Figure 19 Short- and Middle-Term Within-Group Developments of Speed in the IG and the CG Over the Five Month Investigation Period.

To assess students' *endurance* levels over the intervention timeframe, the *6-min run* was used. Overall, negative developments were observed in this test (see Figure 20). In the short-term, only one significant change was observed in which the entire IG significantly decreased in the 6-min run (d = .12). In the middle-term, in boys both groups revealed a significant decrease in endurance (IG: d = .19, CG: d = .23). Additionally, a significant decrease was measured in the entire CG (d = .17).

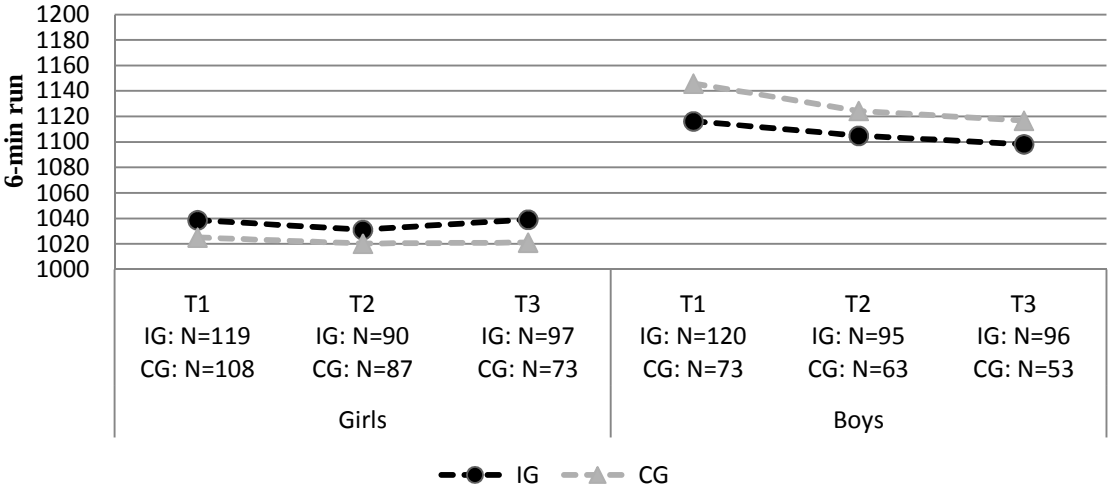

Figure 20 Short- and Middle-Term Within-Group Developments of Endurance in the IG and the CG Over the Five Month Investigation Period.

For the measurement of students' *flexibility*, the *stand and reach flexibility* test was used. Overall, positive changes were revealed in this test (see Figure 21). In the short-term, significant improvements took place in IG and CG girls (IG: d = .28, CG: d = .23) and in the gender independent analysis in both groups (IG: d = .16, CG: d = .15). In the middle-term, only the IG girls (d = .33) and the entire IG (d = .18) showed positive significant changes in

this test. Finally, during follow-up (T2-T3), a significant reduction was measured in the CG girls and the entire CG.

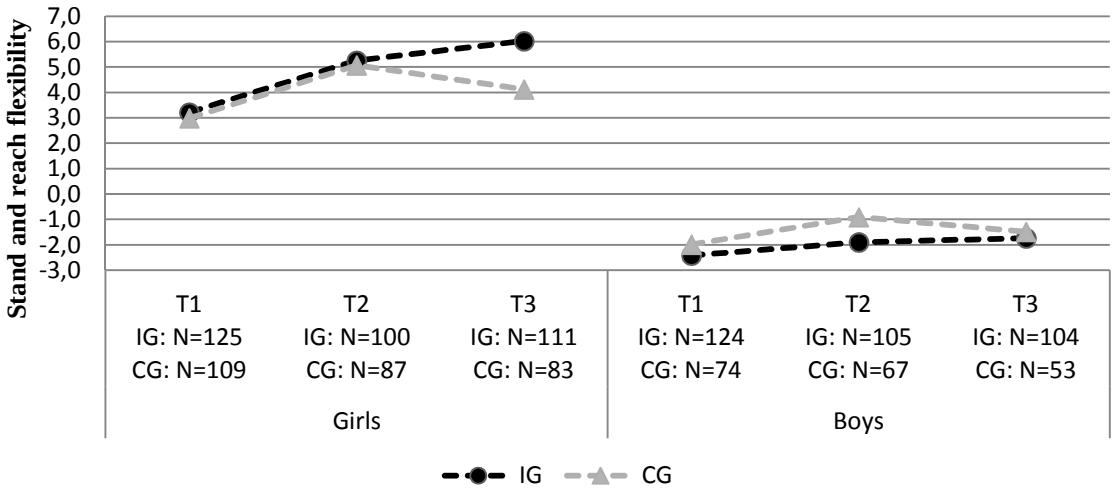

Figure 21 Short- and Middle-Term Within-Group Developments of Flexibility in the IG and the CG Over the Five Month Investigation Period.

For the assessment of students' *strength*, the tests sit-ups, press-ups, and standing long jump were used. The changes of the students participating in the intervention study were overall positive (see Figure 22). Concerning *sit-ups* and *press-ups*, significant positive changes were observed in the short-term in girls (sit-ups IG: d = .72, CG: d = .77; press-ups IG: d = 1.45, CG: d = 1.22) and boys (sit-ups IG: d = .40, CG: d = .63; press-ups IG: d = .78, CG: d = .67). Also in the middle-term the changes measured were significantly positive for girls (sit-ups IG: d = 1.20, CG: d = 1.16; press-ups IG: d = 1.43, CG: d = 1.46) and boys (sit-ups IG: d = .87, CG: d = .94; press-ups IG: d = 1.13, CG: d = 1.62). Additionally, also in the follow-up timeframe all changes were significantly positive. Regarding the *standing long jump*, mostly positive within-group changes were measured. In the short-term, significant positive changes were revealed only in CG girls (d = .23) and in CG boys (d = .26). In the middle-term, significant positive changes were observed in girls (IG: d = .18, CG: d = .24) and significant negative changes IG boys (d = .22). During the follow-up (T2-T3), significant positive changes existed only in the IG.

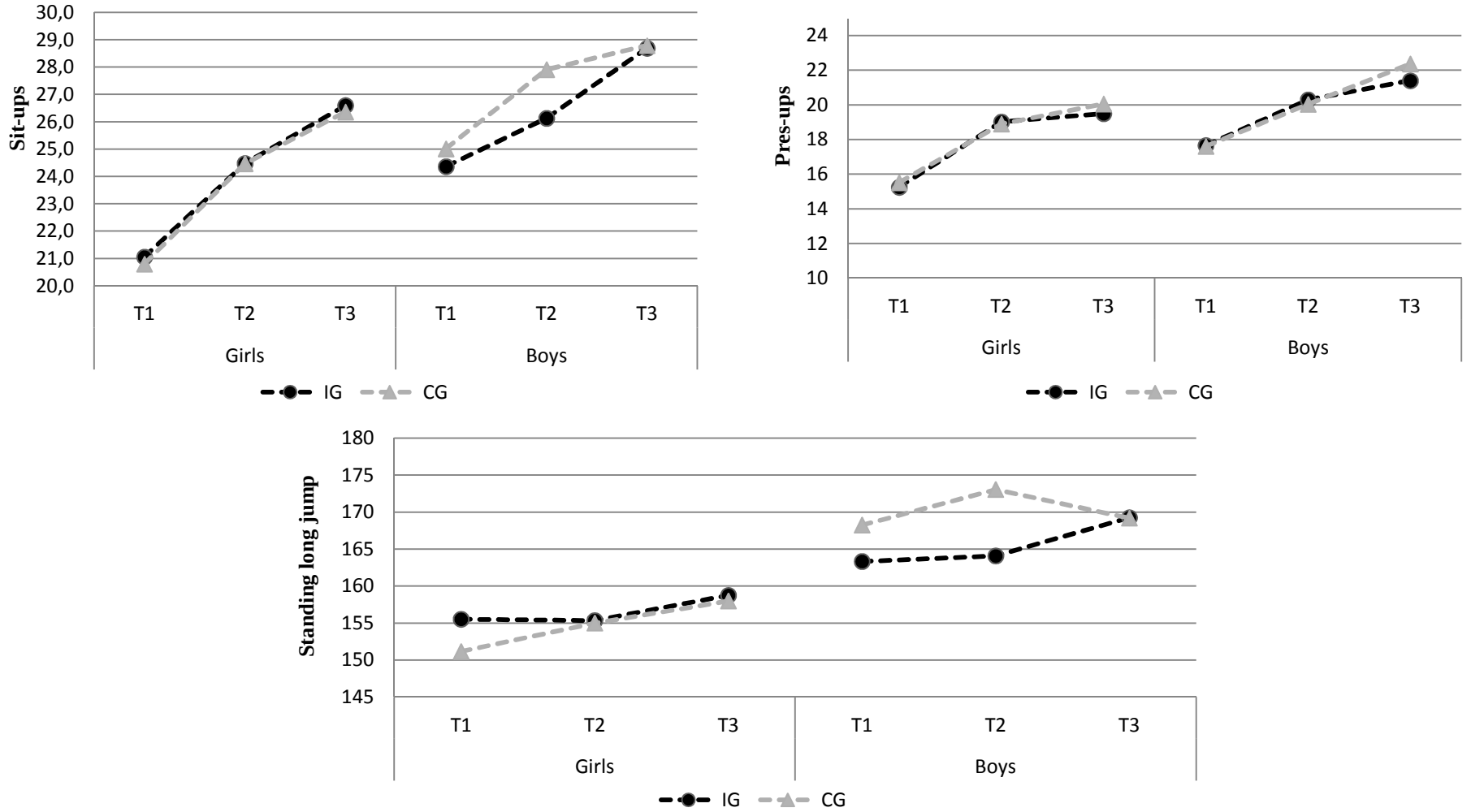

Figure 22 Short- and Middle-Term Within-Group Developments of Strength (Sit-Ups, Press-Ups, and Standing Long Jump) in the IG and the CG Over the Five Month Investigation Period (IG Girls: T1=125, T2=99, T3=110; CG Girls: T1=109, T2=87, T3=83) (IG Boys: T1=124, T2=106, T3=102; CG Boys: T1=74, T2=66, T3=58).

In a more detailed analysis of each dimension of students' *HRQOL*, the following results were observed. In the short-term, significant negative changes were found only on the physical wellbeing in IG boys (d = .39) as well as in the entire IG (d = .27) in the gender independent analysis. In the middle-term, only negative changes in the various dimensions of HRQOL were found. IG boys decrease in physical wellbeing (d = .44), in psychological wellbeing (d = .39) and in the dimension family (d = .37). Also the entire IG decreased in the dimensions in psychological wellbeing (d = .36) and family (d = .33). Finally, the entire CG (d = .28) decreased in the physical wellbeing dimension. During follow-up, significant negative changes existed in IG boys' psychological wellbeing as well as in the school dimension in the entire IG, CG, and IG girls. CG boys also increased significantly in the dimension self-worth.

Between-group differences

In the next step, the intervention effects on the health and fitness variables were examined. First, the analysis was carried out without separating the two genders (see Table 31). Concerning *motor performance*, short-term negative intervention effects were revealed in two out of the three tests measuring strength: These were the sit-ups (d = .18) and the standing long jump (d = .21). Additionally, positive intervention effects were measured on the sideways jumps. In the middle-term, negative intervention effects were measured on press-ups (d = .24). Concerning *BMI* levels, positive short- (d = .08) and middle-term effects (d = .10) were revealed. The examination of the intervention effects of students' *HRQOL* revealed no significant short- or middle-term differences.

Table 31 Short- and Middle-Term Intervention Effects on Motor Performance (MP) and BMI in the Total Group (Estimated Means (± SE), Controlled for T1-Values and Baseline BMI Values)

		IG		CG					
Variable	Time	N	M ± SE	N	M ± SE	F	p	η^2	d
MP Score	T2	206	111.08±0.24	155	110.86±0.27	0.35	.55	.00	0.03
	T3	216	112.75±0.25	144	112.37±0.31	0.95	.33	.00	0.06
Balance backwards	T2	206	40.22±0.44	155	39.98±0.51	0.13	.72	.00	0.03
	T3	215	40.84±0.40	142	40.30±0.49	0.73	.39	.00	0.08
Sideways jumps	T2	203	45.30±0.32	155	42.83±0.36	25.79	**<.001**[a]	.07	0.44
	T3	211	45.45±0.32	142	44.88±0.39	1.28	.26	.00	0.10
20m sprint	T2	187	3.78±0.02	138	3.77±0.02	0.03	.87	.00	0.01
	T3	198	3.70±0.02	141	3.74±0.02	3.72	.05	.01	0.17
6-min run	T2	185	1066.16±5.28	150	1066.87±5.87	0.01	.93	.00	0.01
	T3	193	1072.18±6.40	126	1058.25±7.92	1.87	.17	.01	0.10
Stand and reach flexibility	T2	205	1.95±0.29	154	1.99±0.34	0.01	.92	.00	0.01
	T3	215	2.12±0.33	142	1.17±0.41	3.25	.07	.01	0.11
Sit-ups	T2	205	25.20±0.25	153	26.13±0.29	5.75	**.02**[b]	.02	0.18
	T3	212	27.53±0.27	141	27.52±0.33	0.00	.98	.00	0.00
Press-ups	T2	205	19.61±0.18	155	19.49±0.21	0.17	.68	.00	0.03
	T3	212	20.28±0.20	140	21.07±0.25	6.17	**.01**[b]	.02	0.24
Standing long jump	T2	205	159.15±0.88	154	163.67±1.01	11.36	**<.001**[b]	.03	0.21
	T3	213	163.13±0.87	141	162.73±1.07	0.09	.77	.00	0.02
BMI	T2	205	18.45 ± .04	155	18.67 ± .04	14.47	**<.001**[a]	.04	0.08
	T3	215	18.47 ± .05	143	18.74 ± .06	11.50	**<.001**[a]	.03	0.10

Variable	Time	IG N	IG M ± SE	CG N	CG M ± SE	F	p	η^2	d
HRQOL Score	T2	27	94.85± 1.77	53	95.89±1.26	.23	.63	.00	0.10
	T3	29	95.13±1.74	50	95.35±1.32	.01	.92	.00	0.02
Physical wellbeing	T2	30	14.87±.43	58	14.96±.31	.03	.86	.00	0.04
	T3	32	15.17±.51	58	14.58±.38	.84	.36	.01	0.20
Psychological wellbeing	T2	30	16.89±.43	59	17.19±.30	.33	.57	.00	0.13
	T3	33	16.80±.42	61	17.39±.30	1.32	.25	.01	0.24
Self-worth	T2	30	14.48±.52	60	14.63±.37	.06	.81	.00	0.05
	T3	33	14.75±.43	60	14.45±.32	.31	.58	.00	0.11
Family	T2	29	18.19±.39	58	18.04±.27	.09	.76	.00	0.06
	T3	32	17.67±.38	58	17.81±.28	.09	.77	.00	0.06
Friends	T2	28	15.98±.43	57	15.98±.30	.00	1.00	.00	0.00
	T3	31	15.82±.36	57	16.03±.27	.22	.64	.00	0.10
School	T2	30	15.64±.36	60	15.45±.26	.19	.66	.00	0.08
	T3	33	14.92±.39	61	14.93±.28	.00	.99	.00	0.00

[a] Intervention effect in favour of the IG.
[b] Intervention effect in favour of the CG.

Additionally, the intervention effects were analysed for girls and boys separately. The results revealed that HealthyPEP had different effects on the sexes (see Table 32). Results showed that girls benefited from participating in the intervention. When looking at each motor performance test separately, it was revealed that in the short-term girls in the IG were significantly better in sideways jumps (d = .73) whereas the girls in the CG were significantly better in 20m sprints (d = .29) and standing long jumps (d = .24). In the middle-term, the girls in the IG achieved significantly better results in the motor performance score (d = .27), sideways jumps (d = .47) and stand-and-reach flexibility (d = .25) compared to the CG. In addition, the IG girls showed marginally significant better results in the 6-min run (d = .24). In boys, in the short-term, the IG reached significantly higher values in the 20m sprints (d = .32) and marginally significant better results in sideways jumps (d = .23). The CG boys were significantly better in the standing long jump (d = .24) and marginally better in the situps (d = .22). In the middle-term, boys in the CG performed significantly better in their press-ups (d = .33) and sideways jumps (d = .45) compared to the IG. Concerning *BMI*, the girls in the IG had significantly lower BMIs compared to the CG in the short-term (d = .09), which developed into a marginally significant difference in the middle-term (d = .07). Similarly, IG boys had a marginally significant lower BMI than the CG boys in the short-term (d = .06) and a significantly lower BMI in the middle-term (d = .15). The examination of the intervention effects of students' *HRQOL* revealed no significant short- or middle-term differences also in the gender separated analysis.

Table 32 Short- and Middle-Term Intervention Effects on Motor Performance (MP), BMI, and HRQOL in Girls and Boys ((Estimated Means (± SE), Controlled for T1-Values and Baseline BMI Values) (Höner & Demetriou, 2012a)

		Girls								Boys							
Variable	Time	IG		CG						IG		CG					
		N	M ± SE	N	M ± SE	F	p	η^2	d	N	M ± SE	N	M ± SE	F	p	η^2	d
MP Score	T2	100	110.21 ± .33	88	109.93 ± .35	.32	.57	.00	0.04	106	112.10 ± .34	67	111.75 ± .43	.39	.53	.00	0.05
	T3	111	112.21 ± .35	85	110.60 ± .40	9.24	**<.01**[a]	.05	0.27	105	113.57 ± .35	59	114.48 ± .47	2.37	.13	.01	0.15
Balancing backwards	T2	100	41.89 ± .57	88	41.16 ± .60	.78	.38	.00	0.11	106	38.54 ± .67	67	38.61 ± .84	.00	.95	.00	0.01
	T3	111	41.21 ± .59	84	40.16 ± .68	1.33	.25	.01	0.15	104	40.47 ± .53	58	40.47 ± .72	.00	1.00	.00	0.00
Sideways jumps	T2	98	45.40 ± .39	88	41.89 ± .41	38.18	**<.001**[a]	.17	0.73	105	45.32 ± .50	67	43.88 ± .63	3.19	.08	.02	0.23
	T3	109	46.06 ± .45	83	43.23 ± .52	16.89	**<.001**[a]	.08	0.47	102	44.86 ± .41	59	47.08 ± .54	10.68	**<.001**[b]	.06	0.45
20 m sprint	T2	87	3.84 ± .02	71	3.74 ± .03	7.50	**.01**[b]	.05	0.29	100	3.72 ± .02	67	3.81 ± .03	6.77	**.01**[a]	.04	0.32
	T3	98	3.70 ± .02	82	3.76 ± .02	2.52	.11	.01	0.19	100	3.68 ± .02	59	3.74 ± .03	2.69	.10	.02	0.22
6 min run	T2	90	1024.56 ± 7.16	87	1025.98 ± 7.29	.02	.89	.00	0.01	95	1111.61 ± 7.72	63	1114.24 ± 9.49	.05	.83	.00	0.02
	T3	97	1042.78 ± 8.37	73	1017.44 ± 9.67	3.87	.05	.02	0.24	96	1107.49 ± 9.67	53	1104.32 ± 13.05	.04	.85	.00	0.02
Stand-and-reach flexibility	T2	100	5.36 ± .35	87	4.94 ± .37	.69	.41	.00	0.06	105	-1.68 ± .45	67	-1.25 ± .56	.35	.56	.00	0.06
	T3	111	5.84 ± .42	83	3.95 ± .49	8.48	**<.01**[a]	.04	0.25	104	-2.15 ± .50	59	-2.22 ± .67	.01	.93	.00	0.01
Sit-ups	T2	99	24.14 ± .37	87	24.86 ± .40	1.72	.19	.01	0.14	106	26.40 ± .35	66	27.48 ± .44	3.64	.06	.02	0.22
	T3	110	26.39 ± .35	83	26.28 ± .40	.04	.83	.00	0.03	102	28.97 ± .42	58	28.91 ± .56	.01	.93	.00	0.01
Press-ups	T2	99	18.96 ± .22	88	18.96 ± .23	.00	1.00	.00	0.00	106	20.30 ± .29	67	20.05 ± .37	.28	.60	.00	0.07
	T3	109	19.38 ± .27	82	19.98 ± .31	2.10	.15	.01	0.20	103	21.33 ± .29	58	22.44 ± .39	5.02	**.03**[b]	.03	0.33
Standing long jump	T2	99	152.93 ± 1.19	88	157.71 ± 1.26	7.50	**.01**[b]	.04	0.24	106	165.58 ± 1.31	66	170.62 ± 1.66	5.64	**.02**[b]	.03	0.24
	T3	110	158.26 ± 1.14	84	158.36 ± 1.31	.00	.96	.00	0.01	103	169.03 ± 1.36	57	167.90 ± 1.83	.24	.63	.00	0.06
BMI	T2	99	18.47 ± .05	88	18.72 ± .06	1.27	**<.001**[a]	.05	0.09	106	18.44 ± .05	67	18.60 ± .07	3.40	.07	.02	0.06
	T3	111	18.55 ± .07	84	18.73 ± .08	2.85	**.**09	.02	0.07	104	18.38 ± .07	59	18.77 ± .09	11.70	**<.001**[a]	.07	0.15
HRQOL Score	T2	27	94.85 ± 1.77	53	95.89 ± 1.26	.23	.63	.00	0.10	55	93.13 ± 1.15	29	90.09 ± 1.61	2.25	.14	.03	0.26
	T3	29	95.13 ± 1.74	50	95.35 ± 1.32	.01	.92	.00	0.02	52	91.92 ± 1.53	28	91.08 ± 2.11	.10	.75	.00	0.06
Physical wellbeing	T2	30	14.87 ± .43	58	14.96 ± .31	.03	.86	.00	0.04	57	14.96 ± .38	30	14.44 ± .53	.63	.43	.01	0.17
	T3	32	15.17 ± .51	58	14.58 ± .38	.84	.36	.01	0.20	56	14.70 ± .44	29	14.20 ± .61	.44	.51	.01	0.15
Psychological wellbeing	T2	30	16.89 ±.43	59	17.19 ± .30	.33	.57	.00	0.13	58	16.44 ± .32	30	16.15 ± .45	.25	.62	.00	0.10
	T3	33	16.80 ± .42	61	17.39 ± .30	1.32	.25	.01	0.24	56	16.11 ± .32	29	16.23 ± .45	.05	.83	.00	0.05
Self-worth	T2	30	14.48 ± .52	60	14.63 ± .37	.06	.81	.00	0.05	57	14.33 ± .34	30	13.28 ± .47	3.21	.08	.04	0.35
	T3	33	14.75 ± .43	60	14.45 ± .32	.31	.58	.00	0.11	56	14.19 ± .40	29	13.78 ± .56	.34	.56	.00	0.12
Family	T2	29	18.19 ± .39	58	18.04 ± .27	.09	.76	.00	0.06	57	17.51 ± .33	31	16.93 ± .45	1.07	.30	.01	0.22
	T3	32	17.67 ± .38	58	17.81 ± .28	.09	.77	.00	0.06	54	17.12 ± .38	30	17.04 ± .51	.02	.90	.00	0.02
Friends	T2	28	15.98 ± .43	57	15.98 ± .30	.00	1.00	.00	0.00	57	15.60 ± .30	31	15.09 ± .41	.96	.33	.01	0.18
	T3	31	15.82 ± .36	57	16.03 ± .27	.22	.64	.00	0.10	56	15.23 ± .34	30	14.93 ± .47	.26	.61	.00	0.11
School	T2	30	15.64 ± .36	60	15.45 ± .26	.19	.66	.00	0.08	58	14.91 ± .28	31	14.42 ± .38	1.03	.31	.01	0.18
	T3	33	14.92 ± .39	61	14.93 ± .28	.00	.99	.00	0.00	58	14.70 ± .32	30	13.97 ± .45	1.69	.20	.02	0.26

[a] Intervention effect in favour of the IG.
[b] Intervention effect in favour of the CC.

Summary

On the health and fitness level, from a first glance on the overriding variables motor performance score, BMI, and HRQOL the following developments can be summarised (see Figure 23): On the one hand, in both examined groups a significant short- and middle-term improvement in the motor *performance score* as well as a significant increase in *BMI* levels were revealed. On the other hand, a reduction in the overall *HRQOL* score which was significant for the IG and not significant for the CG.

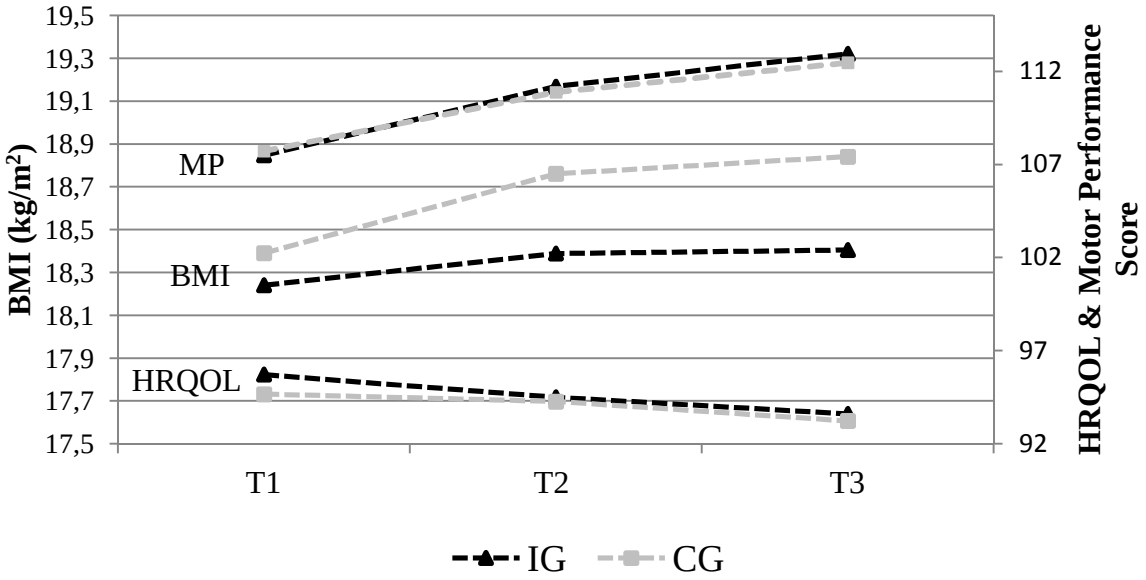

Figure 23 Development of Motor Performance (MP), BMI, and HRQOL in the IG and the CG Over the Five Month Investigation Period (Höner & Demetriou, 2012a).

In more detail, when looking at each *motor performance* test separately the following developments over the investigation timeframe were revealed: Concerning students' coordination mostly positive significant short- and middle-term changes were observed in the tests balance backwards and sideways jumps. Students' speed was measured with the 20m sprint in which the short- and middle-term changes varied between the groups. Students' endurance, measured with the 6-min run, revealed mostly negative developments during the investigation timeframe. These were significant in the IG in the short-term and in boys and the entire CG in the middle-term. Also the stand and reach flexibility test revealed mostly positive developments both in short- and middle-term. Finally, the changes in students' strength levels were positive in the short- and middle-term in all groups concerning the sit-ups and the press-ups. Also, regarding the standing long jump test mostly positive within-group changes were measured. Nevertheless, in the short-term, these were only significantly positive in the CG whereas in the middle-term, significant positive changes were observed only in the IG. Concluding in can be emphasised that on motor performance, overall positive changes were measured in both groups over the entire investigation timeframe. Concerning *BMI*, a significant increase was observed in the short- and the middle-term in girls and boys in both

examined groups. Finally, the results on the within-group changes in *HRQOL* showed short-term significant negative changes on IG boys physical wellbeing. Additionally, in the middle-term, only negative changes especially in the IG boys were found in several dimensions of HRQOL.

It became clear that the intervention programme had different effects on the sexes. Girls were particularly able to benefit from the intervention programme, whereas boys experienced some negative effects from the treatment. When focusing on the overall *motor performance* score a positive intervention effect was found only in girls in the middle-term. This was mainly a result of the improvement in strength-endurance (sideways jumps) and partly due to the positive development in endurance (6-min-run). In boys, there were no significant differences in the short- or middle-term between the groups. Concerning *BMI*, an increase in students' values over the entire investigation timeframe was measured and clear intervention effects on both girls and boys compared to the CG were found. Finally, concerning *HRQOL* students in both groups experienced a decrease during sixth grade and HealthyPEP did not lead to positive intervention effects.

4.3.2.4 Additional analysis

In the following section, further analyses were carried out to determine the effects of HealthyPEP. First, it was examined whether the intervention programme led to unwanted negative *side effects*. Since not all of the targets PE aims to influence could be measured in the course of this study, students' cooperation was chosen to examine in an exemplary fashion the side effects of HealthyPEP. The statistical analysis was carried out similarly as in the previously described outcome variables.

Second, further analyses were carried out on motor performance and BMI, which were the variables on the health and fitness level, on which positive intervention effects were achieved (see section 4.3.2.3.3). These analyses were not carried out on the psychological determinants and the behaviour level because no significant intervention effects were found[4]. First, it was examined whether an interaction existed between the moderating variables (class composition, initial BMI, and initial motor performance) and the main significant outcome variables. Second, a more detailed moderator analysis was carried out by analysing the short- and middle-term intervention effects on several sub-groups. These sub-groups were the following: a) co-educative classes, only girls classes, and only boys classes, b) underweight, normal weight, and overweight students' at baseline, and c) low, medium, and high motor performance levels at baseline (see section 4.3.2.1.2).

[4] No further examination was carried out on physical activity levels as well as the psychological determinants because of the small sample size. A division of the two groups into further smaller groups in order to examine the influence of the initial values of each psychological determinant led to groups partly existing only out of six participants. Therefore, a statistical analysis to examine the moderator effects was not possible.

Additionally, because in the quasi-experimental design chosen for this study the students were allocated into IG or CG on school level, clustering effects might occur. It is assumed that students within a school are more similar to each other compared to students in different schools. Therefore, it was important to examine differences between the schools in order to gain a picture on the extent of the influence of the school clustering on the significant intervention effects (see section 4.3.2.1.3).

4.3.2.4.1 Intervention's side effects: Students' cooperation

The within-group changes on students' cooperation revealed no significant short- or middle-term changes (see Table 33 and Table 34). Based on the mean values, it was evident that particularly IG girls' cooperation increased in the short-term and both IG and CG girls increased their values on cooperation in the middle-term. In the short-term, boys in both groups decreased in cooperation and in the middle-term IG showed a decrease whereas CG boys revealed an increase in cooperation (see Figure 24).

Table 33 Short-Term Within-Group Differences in Cooperation

Variable	Group		T1 M ± SD	T2 M ± SD	T	df	p	95% CI	d
Cooperation	Total	IG	22.92 ± 4.48	22.97 ± 5.49	-.11	95	.91	-.97; .86	0.01
		CG	22.33 ± 5.13	22.38 ± 4.66	-.08	95	.94	-1.09; 1.01	0.01
	Girls	IG	24.53 ± 3.73	25.44 ± 3.73	-1.56	35	.13	-2.11; .28	0.25
		CG	23.08 ± 5.01	23.48 ± 4.71	-.60	64	.55	-1.72; .92	0.08
	Boys	IG	21.95 ± 4.64	21.48 ± 5.85	.73	59	.47	-.82; 1.75	0.09
		CG	20.77 ± 5.10	20.06 ± 3.62	.82	30	.42	-1.07; 2.49	0.16

Table 34 Middle-Term Within-Group Differences in Cooperation

Variable	Group		T1 M ± SD	T3 M ± SD	T	df	p	95% CI	d
Cooperation	Total	IG	23.26 ± 4.32	22.75 ± 6.30	.99	98	.32	-.51; 1.54	0.10
		CG	22.38 ± 5.09	23.37 ± 4.12	-1.96	97	.05	-1.99; .01	0.21
	Girls	IG	24.87 ± 3.71	25.39 ± 4.40	-.67	37	.50	-2.11; 1.06	0.13
		CG	23.12 ± 4.95	24.36 ± 4.00	-2.04	66	.05	-2.45; -.03	0.28
	Boys	IG	22.26 ± 4.40	21.10 ± 6.76	1.71	60	.09	-.19; 2.52	0.20
		CG	20.77 ± 5.10	21.23 ± 3.58	-.49	30	.62	-2.32; 1.41	0.10

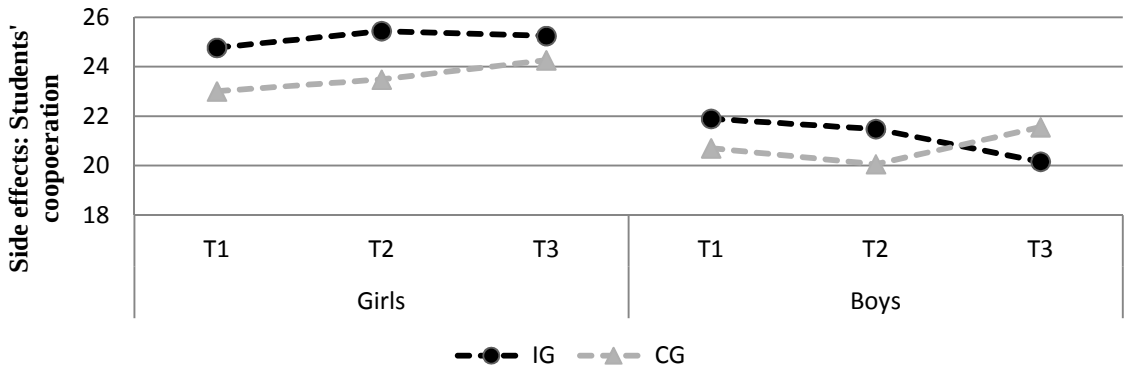

Figure 24 Development of Treatment side effects over the investigation timeframe.

The analysis of the intervention effects on students' cooperation also revealed no significant differences between the groups (see Table 35). HealthyPEP indicates that no negative effects on other domains should be expected, even when focusing PE on health promotion over a middle-term of eight weeks.

Table 35 Short- and Middle-Term Intervention Effects on Cooperation in the Total, Girls, and Boys Group (Estimated Means (± SE), Controlled for T1-Values)

Variable	Group	Time	Total							
			IG		CG					
			N	M ± SE	N	M ± SE	F	p	η^2	d
Cooperation	Total	T2	96	22.81 ± .45	96	22.54 ± .45	.19	.67	.00	0.05
		T3	99	22.50 ± .47	98	23.62 ± .47	2.81	.10	.01	0.21
	Girls	T2	36	25.06 ± .67	65	23.69 ± .49	2.67	.11	.03	0.31
		T3	38	25.02 ± .64	67	24.57 ± .48	.32	.57	.00	0.11
	Boys	T2	60	21.26 ± .58	31	20.50 ± .81	.58	.45	.01	0.15
		T3	61	20.76 ± .65	31	21.89 ± .91	1.00	.32	.01	0.19

4.3.2.4.1 Moderating effects

In a first step, it was examined whether significant interactions existed between the chosen moderator variables (class composition, initial BMI levels, and initial motor performance levels) and the main variables, motor performance and BMI levels, on which significant intervention effects were found. Here, a significant interaction existed only between motor performance and the class composition in the short- ($F(2, 361)=11.87$, $p<.001$, $\eta^2=.06$) and in the middle-term ($F(2, 358)=17.40$, $p<.001$, $\eta^2=.09$). No further significant interactions were revealed. In the following, a more detailed analysis was carried out to examine the moderating effects of the different categories of the moderating variables.

Concerning *motor performance* (see Table 36), the significant moderating influence of the *class composition* already found in the previous analysis was confirmed. In the gender mixed classes, short- and middle-term positive intervention effects were measured in both girls (T2: d = .62, T3: d = .71) and boys (T2: d = .38, T3: d = .42). The opposite picture was revealed in the gender separated classes in which mostly negative tendencies were measured (except of girls at T3). Nevertheless, these effects were only significant in the total group in the short-term (d = .38) and in boys in the middle term (d = .45).

When examining the moderating influence of the *initial BMI levels* on the effects of HealthyPEP on motor performance, it can be confirmed that this variable had no significant moderating influence on the intervention effects. Even though only a significant influence on BMI on motor performance was revealed in normal weight girls at T3 (d = .30), eleven out of the 18 analyses carried out showed a positive tendency in the way that the IG had higher values in motor performance compared to the CG independent on their initial BMI levels.

Similar findings were revealed concerning students' *initial motor performance* levels. Eleven out of the 18 examinations found that the IG had higher motor performance levels compared

to the CG. Nevertheless, only in the IG girls in the middle-term (T3) this difference was significant (d = .74).

Table 36 Moderating Variables on the Short- and Middle-Term Intervention Effects on Motor Performance in Girls and Boys (Estimated Means (± SE), Controlled for T1-Values)

Variable	Group		Motor Performance								
				IG		CG					
			Time	N	M ± SE	N	M ± SE	F	p	η^2	d
Class composition	Mixed	Total	T2	80	113.16 ± .32	36	110.25 ± .47	26.05	**<.001**[a]	.19	0.48
			T3	81	113.93 ± .37	33	110.76 ± .57	21.61	**<.001**[a]	.16	0.53
		Girls	T2	35	113.11 ± .43	13	109.28 ± .70	21.71	**<.001**[a]	.33	0.62
			T3	40	114.16 ± .47	14	109.85 ± .80	21.42	**<.001**[a]	.30	0.71
		Boys	T2	45	113.16 ± .46	23	110.86 ± .64	8.42	**.01**[a]	.12	0.38
			T3	41	113.78 ± .56	19	111.27 ± .83	6.10	**.02**[a]	.10	0.42
	Separated	Total	T2	126	109.89 ± .31	119	110.90 ± .32	5.05	**.02**[b]	.02	0.15
			T3	133	112.11 ± .32	111	112.72 ± .35	1.60	.20	.00	0.10
		Girls	T2	65	108.95 ± .42	75	109.78 ± .39	2.01	.16	.01	0.13
			T3	69	111.38 ± .46	71	110.40 ± .46	2.21	.14	.02	0.16
		Boys	T2	61	111.29 ± .46	44	112.26 ± .54	1.83	.18	.02	0.14
			T3	64	113.36 ± .42	40	116.12 ± .53	16.11	**<.001**[b]	.14	0.45
BMI	Underweight (BMI≤16.5)	Total	T2	51	113.13 ± .49	54	112.22 ± .47	1.78	.19	.02	0.16
			T3	55	114.05 ± .52	50	114.49 ± .54	.34	.56	.00	0.08
		Girls	T2	27	112.44 ± .57	28	111.49 ± .56	1.28	.26	.02	0.18
			T3	31	113.39 ± .68	25	112.28 ± .77	1.09	.30	.02	0.22
		Boys	T2	24	114.01 ± .84	26	112.91 ± .80	.89	.35	.02	0.19
			T3	24	114.79 ± .79	25	116.79 ± .77	3.25	.08	.07	0.39
	Normal weight (16.5<BMI≤20)	Total	T2	107	112.05 ± .32	55	112.47 ± .45	.57	.45	.00	0.07
			T3	113	113.70 ± .34	53	112.79 ± .50	2.23	.14	.01	0.15
		Girls	T2	51	110.98 ± .49	29	111.12 ± .65	.03	.87	.00	0.02
			T3	55	112.94 ± .52	31	111.06 ± .69	4.79	**.03**[a]	.06	0.30
		Boys	T2	56	113.12 ± .42	26	113.76 ± .62	.72	.40	.01	0.11
			T3	58	114.60 ± .43	22	114.74 ± .71	.03	.87	.00	0.02
	Overweight (BMI>20)	Total	T2	48	107.19 ± .50	46	106.88 ± .51	.19	.67	.00	0.05
			T3	48	109.35 ± .54	41	108.86 ± .58	.37	.54	.00	0.08
		Girls	T2	22	107.02 ± .78	31	106.47 ± .64	.28	.60	.01	0.09
			T3	25	109.64 ± .71	29	108.21 ± .65	2.01	.16	.04	0.26
		Boys	T2	26	107.83 ± .67	15	106.83 ± .88	.82	.37	.02	0.14
			T3	23	109.10 ± .83	12	110.32 ± 1.16	.72	.40	.02	0.17
Motor performance level	Low (MP≤105)	Total	T2	69	104.47 ± .46	50	104.51 ± .54	.00	.96	.00	0.01
			T3	70	107.06 ± .48	45	106.15 ± .60	1.41	.24	.01	0.18
		Girls	T2	43	104.66 ± .58	36	104.79 ± .63	.02	.88	.00	0.03
			T3	47	107.45 ± .57	32	105.73 ± .70	3.54	.06	.05	0.35
		Boys	T2	26	104.24 ± .75	14	103.66 ± 1.03	.20	.65	.01	0.11
			T3	23	106.53 ± .81	13	106.69 ± 1.09	.01	.91	.00	0.03
	Medium (105<MP≤ 110)	Total	T2	61	111.57 ± .39	49	111.04 ± .44	.79	.38	.01	0.15
			T3	67	113.42 ± .41	49	112.42 ± .49	2.41	.12	.02	0.27
		Girls	T2	28	111.78 ± .50	30	111.78 ± .48	.00	.99	.00	0.00
			T3	33	114.05 ± .53	30	111.72 ± .55	9.03	**<.001**[a]	.13	0.74
		Boys	T2	33	111.38 ± .60	19	109.91 ± .79	2.17	.15	.04	0.37
			T3	34	112.85 ± .64	19	113.42 ± .86	.28	.60	.01	0.14
	High (MP>110)	Total	T2	76	116.65 ± .38	56	116.41 ± .44	.18	.68	.00	0.06
			T3	79	117.25 ± .41	50	117.87 ± .52	.86	.36	.01	0.15
		Girls	T2	29	117.02 ± .61	22	115.72 ± .70	1.94	.17	.04	0.35
			T3	31	117.02 ± .73	23	116.48 ± .85	.23	.63	.00	0.12
		Boys	T2	47	116.40 ± .49	34	116.88 ± .58	.39	.53	.01	0.12
			T3	48	117.45 ± .49	27	118.96 ± .67	3.20	.08	.04	0.40

[a] Intervention effect in favour of the IG.
[b] Intervention effect in favour of the CG.
Note. MP=motor performance

The detailed analysis concerning moderating effects on *BMI* confirmed the picture already shown in the analysis of the intervention effects (see Table 37). Irrespective of the moderating variable examined, the effects of HealthyPEP were positive on students' BMI levels in both the short- and the middle-term. Nevertheless, these results were not always significant. Concerning the *class composition*, the total IG group revealed significantly lower BMI levels in the short- (d = .08) and middle-term (d = .10) when being taught in gender separated PE classes. These differences were also found in IG girls in the short-term (d = .08) and IG boys in the middle-term (d = .18).

Concerning the moderating effects of the initial BMI levels, significant short- and middle-term intervention effects were found in the category "normal weight" in IG boys (T2: d = .16, T3: d = .37) as well as the total IG group (T2: d = .18, T3: d = .27). Furthermore, positive short-term intervention effects on BMI were also observed in the total IG group in the category "overweight" (d = .19).

Finally, when examining the moderating effects of the *initial motor performance* levels on BMI the following significant intervention effects were revealed: In the category of "low" initial motor performance, short- (d = .11) and middle-term (d = .11) significant effects were found in the total IG. Girls and boys revealed lower BMI levels at T2 (d = .13) and T3 (d = .17) respectively. Furthermore, the total group had significantly lower BMI values when having "medium" motor performance levels at baseline (d = .08) and boys experienced positive intervention effects on BMI when having high motor performance levels at baseline (d = .22).

Table 37 Moderating Variables on the Short- and Middle-Term Intervention Effects on BMI in Girls and Boys (Estimated Means (± SE), Controlled for T1-Values)

Variable	Group		BMI								
				IG		CG					
			Time	N	M ± SE	N	M ± SE	F	p	η^2	d
Class composition	Mixed	Total	T2	80	18.22 ± .06	36	18.39 ± .09	2.44	.12	.02	0.06
			T3	81	18.50 ± .07	33	18.80 ± .11	4.43	.04	.04	0.10
		Girls	T2	35	17.91 ± .08	13	18.13 ± .13	2.18	.15	.05	0.09
			T3	40	18.45 ± .10	14	18.67 ± .17	1.27	.27	.02	0.08
		Boys	T2	45	18.44 ± .09	23	18.58 ± .12	.89	.35	.01	0.05
			T3	41	18.56 ± .10	19	18.88 ± .16	2.98	.09	.05	0.12
	Separated	Total	T2	125	18.57 ± .05	119	18.79 ± .05	9.65	**<.01**[a]	.04	0.08
			T3	132	18.46 ± .06	110	18.74 ± .07	8.50	**<.01**[a]	.03	0.11
		Girls	T2	64	18.67 ± .07	75	18.91 ± .07	6.29	**.01**[a]	.04	0.08
			T3	69	18.59 ± .09	70	18.80 ± .09	2.74	.10	.02	0.08
		Boys	T2	61	18.45 ± .07	44	18.61 ± .08	2.20	.14	.02	0.06
			T3	63	18.28 ± .09	40	18.71 ± .12	8.45	**<.001**[a]	.08	0.18
BMI	Underweight (BMI≤16.5)	Total	T2	51	15.67 ± .05	54	15.78 ± .05	2.04	.16	.02	0.11
			T3	55	15.89 ± .07	50	16.05 ± .08	2.20	.14	.02	0.16
		Girls	T2	27	15.47 ± .07	28	15.65 ± .07	3.02	.09	.05	0.18
			T3	31	15.75 ± .11	25	15.93 ± .12	1.12	.29	.02	0.17
		Boys	T2	24	15.89 ± .08	26	15.91 ± .08	.04	.84	.00	0.03
			T3	24	16.03 ± .10	25	16.21 ± .10	1.68	.20	.04	0.19
	Normal weight (16.5<BMI≤20)	Total	T2	106	18.16 ± .05	55	18.35 ± .07	5.03	**.03**[a]	.03	0.18
			T3	112	18.24 ± .07	52	18.55 ± .10	7.35	**.01**[a]	.04	0.27

Variable	Group			BMI						
				IG		CG				
			Time	N	M ± SE	N	M ± SE	F	p	η^2	d
Motor performance level	Overweight (BMI>20)	Girls	T2	50	18.19 ± .07	29	18.39 ± .09	3.11	.08	.04	0.19
			T3	55	18.28 ± .09	30	18.47 ± .12	1.71	.20	.02	0.17
		Boys	T2	56	18.12 ± .07	26	18.31 ± .11	.15	**.03**[a]	2.08	0.16
			T3	57	18.20 ± .10	22	18.66 ± .16	6.09	**.02**[a]	.07	0.37
		Total	T2	48	22.09 ± .10	46	22.45 ± .11	5.91	**.02**[a]	.06	0.19
			T3	48	21.98 ± .13	41	22.26 ± .15	1.91	.17	.02	0.15
	Low (MP≤105)	Girls	T2	22	22.03 ± .15	31	22.33 ± .13	2.16	.15	.04	0.15
			T3	25	21.91 ± .20	29	22.01 ± .18	.12	.73	.00	0.05
		Boys	T2	26	22.24 ± .14	15	22.51 ± .19	1.35	.25	.03	0.17
			T3	23	22.14 ± .18	12	22.70 ± .25	3.22	.08	.09	0.35
		Total	T2	68	19.19 ± .07	50	19.52 ± .08	10.22	**<.001**[a]	.08	0.11
			T3	70	19.05 ± .09	44	19.38 ± .11	5.55	**.02**[a]	.05	0.11
	Medium (105<MP≤ 110)	Girls	T2	42	18.87 ± .08	36	19.28 ± .09	11.08	**<.001**[a]	.13	0.13
			T3	47	18.81 ± .11	31	19.11 ± .14	2.82	.10	.04	0.10
		Boys	T2	26	19.81 ± .12	14	19.97 ± .16	.63	.43	.02	0.05
			T3	23	19.54 ± .12	13	20.03 ± .17	5.36	**.03**[a]	.14	0.17
		Total	T2	61	18.48 ± .07	49	18.73 ± .07	6.37	**.01**[a]	.06	0.08
			T3	67	18.54 ± .08	49	18.69 ± .09	1.55	.22	.01	0.05
	High (MP>110)	Girls	T2	28	18.35 ± .11	30	18.65 ± .10	3.93	.05	.07	0.10
			T3	33	18.44 ± .11	30	18.59 ± .12	.79	.38	.01	0.05
		Boys	T2	33	18.63 ± .08	19	18.79 ± .10	1.45	.24	.03	0.05
			T3	34	18.63 ± .11	19	18.85 ± .15	1.43	.24	.03	0.08
		Total	T2	76	17.78 ± .06	56	17.86 ± .07	.75	.39	.01	0.04
			T3	78	17.92 ± .09	50	18.19 ± .11	3.90	.05	.03	0.14
		Girls	T2	29	17.99 ± .08	22	17.93 ± .10	.19	.67	.00	0.03
			T3	31	18.32 ± .14	23	18.33 ± .16	.00	.98	.00	0.00
		Boys	T2	47	17.65 ± .09	34	17.80 ± .10	1.16	.28	.01	0.08
			T3	47	17.66 ± .11	27	18.07 ± .15	4.78	**.03**	.06	0.22

[a] Intervention effect in favour of the IG.
[b] Intervention effect in favour of the CG.
Note. MP=motor performance

Summary

In conclusion, it can be said that only the class composition seems to have a moderating influence of the effects of HealthyPEP. Concerning motor performance, girls and boys taught in gender mixed classes profited more from HealthyPEP in the short- and the long-term. The influence of the class composition on BMI was not significant. Nevertheless, a tendency was observed that students who were taught in gender separated classes gained more from HealthyPEP concerning BMI. The moderating analysis of the influence of the initial BMI and motor performance levels showed no significant differences of the effects of HealthyPEP. Instead, it was confirmed that HealthyPEP had positive effects on the IG students and these positive effects were independent of their initial BMI and motor performance levels.

4.3.2.4.2 School clustering effects

Because students were allocated into IG or CG on school level, school clustering effects might occur. Therefore, the positive intervention effects on the main variables (girls motor performance score at T3 and BMI at T2 and T3) were further analysed for possible school clustering effects. ANCOVAs revealed within the IG no significant school factor in girls'

motor performance score at T3 (F(2, 106)=.59, p=.554) and in BMI at T3 (F(2, 210)=2.20, p=.113), but school clustering effects were observed in BMI at T2 (F(2, 202)=4.13, p=.017, η^2=.04). Within the CG a significant school factor was found for girls' motor performance score at T3 (F(3, 81)=9.07, p<.001, η^2=.26) and BMI at T3 (F(3, 139)=9.61, p<.001, η^2=.17), but not for BMI at T2 (F(3, 151)=1.88, p=.136). Figure 25 shows the adjusted means of these ANCOVAs for the IG and CG schools. With only two exceptions – CG4 on motor performance and CG3 on BMI at T3 – the IG schools on the one hand and the CG schools on the other hand are grouped together indicating that the significant intervention effects are mainly caused by the affiliation to the IG or CG and only partly by school clustering effects.

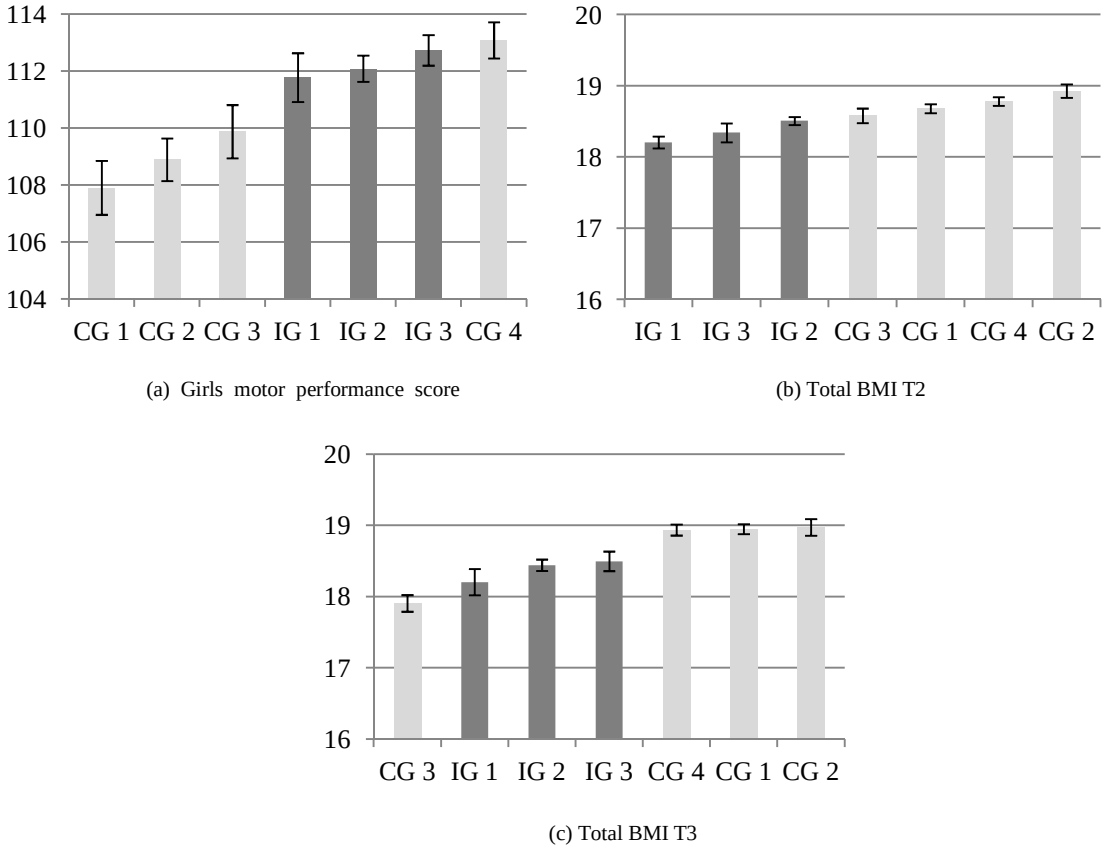

Figure 25 Adjusted Means of the Four CG Schools (NCG1=36, N CG2=24, N CG3=15, N CG4=80) and the Three IG Schools (NIG1=36, NIG2=89, NIG3=80) Concerning (a) Girls' Motor Performance Score at T3, (b) Total BMI at T2, and (c) Total BMI at T3.

4.3.3 Interpretation and discussion

Methodological considerations

Limitations on the intervention study results occurred because of the chosen study design and the measurement instruments used. One limitation of the *study design* was the quasi-experimental design used, in which the assignment of the 18 participating classes (N=516) into the IG or the CG was carried out at the school level in order to prevent contamination of the regular PE lessons within each school. A *randomisation* of schools or classes was not

possible as the teachers needed to be informed about HealthyPEP and their willingness to participate had to be arranged before the beginning of HealthyPEP. Additionally, with a relatively small number of schools participating (due to economic reasons), an equal distribution was not likely to be achieved by randomisation. Therefore, the classes were equally distributed into the IG and the CG according to their composition (mixed gender or gender-segregated classes, respectively). Nevertheless, it was not possible to recruit enough classes to guarantee an *equal number of classes participating in each school*. This led to the result that some schools were represented by four classes, while other schools only included one participating class.

In school-based intervention studies, in which the study sample is assigned to the IG and the CG on the school level, it is important to consider possible *school clustering effects* when interpreting the study results. Nevertheless, based on the design and the analysis carried out in this study, it was not possible to estimate the exact variance in the outcome measures caused by the factors of either group or school. When looking at the adjusted means of the IG schools the validity of the intervention effects was strengthened but the influence of the fact that students were clustered into schools remained unclear. As the factors group and school confound to a certain extent, their explained variance cannot be strictly separated from each other.

Further limitations concerning the analysis of the study results occurred because of the *size of the study sample*. According to the principles of a comprehensive evaluation, process and outcome variables on three target levels were assessed (Mittag, 2006). This resulted into a relatively long questionnaire that students were assigned to answer three times during the entire investigation timeframe. The preliminary examinations before the beginning of HealthyPEP made clear that sixth grade students were not able to answer the entire questionnaire accurately. A reduction in students' motivation and concentration during the filling out of the questionnaire was observed and therefore, it was decided to split the questionnaire into two parts and to restrict the length so that the students would not need more than 15 minute to fill them out. Consequently, only half of the study sample answered the variables concerning the psychological determinants of physical activity, physical activity itself, HRQOL, and the evaluation of HealthyPEP. This resulted into a relatively small study sample especially in the gender separated analysis and thus, a decreased statistical power of the statistical tests.

The *internal validity* of HealthyPEP might be biased by factors that were not controlled during the study such as the teachers' personality and motivation and group-dynamic processes between the students of a class. During the communication with the teachers before the beginning of HealthyPEP, it became clear that the *teachers' motivation* to participate in HealthyPEP differed and that different motives were hidden behind their interest. It was revealed that some teachers were especially motivated to participate because they believed

that their preparation time for PE would decrease because of the provided materials. Furthermore, during the data assessment process, it was obvious that the teachers motivated their students to a different degree. This became especially evident through the extent to which the teachers encouraged their students to use the booklets provided to them. The teachers' personality plays a tremendous role on the students' development during a school year and thus, also during the intervention period. A further aspect that might influence the intervention effects were *group-dynamic processes within the class*, which are also influenced by the personality of the teachers. During the data assessment, it was observed that the students in different classes showed a different amount and degree of cohesion between them. This became obvious during the assessment of the motor performance data and especially in the 6-min run.

Generic *measurement instruments* were used to evaluate the intervention effects on students' motor performance (DMT 6-18), weight status (BMI), physical activity (MoMo-AFB), and HRQOL (KINDL-R). Even though these instruments have already been used in many previous studies, during this study they showed weak *retest-reliability* values in some of their sub-dimensions. For example, in the DMT 6-18 the sideways jumps had only a weak retest-reliability ($r = .52$) and also the dimension "school" of the KINDL-R questionnaire revealed weak reliability levels ($r = .46$). Especially the retest-reliability of the MoMo-AFB questionnaire, to assess students' physical activity levels was problematic (Woll et al., 2007). Even though only some items of the overall questionnaire that revealed high reliability values in the reference sample were chosen, in the current study some of these items were still problematic reaching reliability values between $r = .20$ and $r = .74$. In the two items asking about the minutes students spent exercising in a sports club and outside of the sports club, the observation stated by Kahlert and Brand (2011) that children tend to overestimate their physical activity levels was confirmed. Especially the item asking about students' physical activity outside of a sports club was not answered adequately by the students. Many children reported exercising more than 17 hours per week. These are very high estimations and it can be highly questionable whether they represent the true time children spent exercising outside the sports club. Additionally, it must be stated that only few students provided an answer to this item referring to their activity levels outside the sports club. This is a further indication that the students faced difficulties when answering this part of the questionnaire. Thus, the results gained here must be interpreted with a lot of caution. Nevertheless, BMI and the overall scores in motor performance and HRQOL revealed high reliability warranting reliable conclusions on the main outcome variables.

An overall problem is the fact that *child- or adolescent-specific* questionnaires rarely exist for the measurement of psychological variables at this age. In many cases, models or variables assumed to be appropriate in adults are also adapted for the use with children (see section 2.2.3). The wording is usually slightly changed to accommodate differences in reading levels but the instruments rarely consider other developmental differences between children and

adults such as the fact that children have difficulties in abstract thought patterns (Stone et al., 1998). Although special attention was paid to this during the construction and the choosing of the questionnaires to assess students' psychological determinants, physical activity levels, and HRQOL, this aspect still remains problematic. Especially the SSA-Scale to assess students' self-efficacy levels was originally designed for the use among adults. Similar scales also existed for children but the wording hardly differed. Therefore, it was decided to use the existing questionnaire in the German language, which proved to be reliable in the adult reference sample as well as in the current study. Still, the results gained from this questionnaire need to be considered with caution because children might not be fully able to estimate their behaviour concerning this abstract concept.

The use of the German *motor performance test* made clear that examining intervention effects of students' motor performance is a challenging target. High learning effects occurred and students' motivation to participate in these tests decreased a lot. The loss of motivation to perform well during the DMT 6-18 was especially obvious in the 6-min run. On average, all students participating in the intervention study decreased their performance in this endurance test. A decrease in endurance during this age group is not expected, which leads to the conclusion that this test is not valid for the assessment of intervention effects on endurance in sixth grade students over a timeframe of five months. An alternative way to test students' endurance could be the lactic acid test, for example, where children do not necessarily need to reach full exhaustion. Unfortunately, this test is difficult to be carried out in a school setting (Faude, Kindermann, & Meyer, 2009).

The *validity of BMI* as an indicator of weight status in children and adolescents is also discussed controversially in the literature (Burkhauser & Cawley, 2008). It is criticised that a formula based on height and weight might make too simplistic assumptions about distribution of muscle and bone mass. Nevertheless, BMI is the method used most frequently to assess the degree of under-, normal-, and overweight in all age groups (Demetriou & Höner, 2012). Even though other measures exist to measure overweight and obesity such as sagittal abdominal diameter, waist circumference, and waist-to-hip ratio, also these measures are associated with problems (Lauer & Kelly, 2008). Especially the measure of the waist-to-hip ratio is not reliable (Nordhamn et al., 2000). Therefore, an alternative method with higher quality criteria compared to the BMI that can be used to assess the weight status in a large study sample of school-aged children does not exist.

The extent to which it can be expected that intervention studies in PE can reach large *effect sizes* should to be discussed. HealthyPEP was compared with the regular PE lessons that were carried out in the same frequency but differed in their content. Hager (2000) emphasises that in this kind of evaluations, in which two similar programmes are compared, the expectations on the effect sizes should not be very high. Additionally, aspects such as the duration and the intensity of a programme play an important role on the size of the intervention effects.

HealthyPEP lasted eight weeks, which was the maximum time the PE teachers were willing to participate at the study. Therefore, it can be questioned whether large effect sizes can be created on health variables over such a limited timeframe.

In the future, physical activity intervention studies in the school setting should take the following methodological considerations into account:

- Studies should assess an equal *number of classes* from each school participating in the study. In this way, bias resulting from the school effects can be reduced.
- A larger *number of schools* should participate in the intervention study in order to estimate the precise school influence on the intervention effects.
- A study sample should be chosen that will guarantee sufficient statistical power for the statistical analysis, even after a dropout rate of 30%. Therefore, it might be preferable to reduce the number of assessed variables and thus keep the questionnaire short so that all students can provide answers on all variables.
- Aspects of the teachers' personality and of group-dynamic processes should be controlled. This would result into an increased internal validity of the study results.
- Improved measurement instruments for the assessment of psychological determinants of physical activity, physical activity behaviour, and motor performance levels in young people should be developed.

Process measures

In the course of the comprehensive evaluation of HealthyPEP, several process measures were carried out to evaluate its implementation. The *lesson observations* in the IG showed that the IG teachers implemented HealthyPEP to a satisfactory degree and that changes were made to the lesson content only when necessary, in order to carry out the lesson with that specific class. The observations of the regular PE lessons carried out in the CG classes, showed that the content of the CG lessons differed to a great extent from HealthyPEP. During the lessons of the CG the traditional sports were taught such as gymnastics, swimming, volleyball, handball, and basketball and emphasis was given to the teaching of the technical aspects of each discipline. These lessons were mostly characterised by a content focusing on teaching the students basic sports techniques and emphasised only to a smaller degree the endurance and strength of students. A limitation in the process measures concerns the observations carried out in the CG. Unfortunately, only eight double regular PE lessons were observed during this timeframe. Although a picture of the regular PE lessons was gained, it would have been desirable to be able to refer to a larger amount of observed CG lessons. Unfortunately, this was not possible because only limited financial and time resources were available. Based on the lesson observations, it can be concluded that the IG teachers carried out HealthyPEP well and that the content of PE differed between HealthyPEP and the regular PE lessons.

The *teachers' evaluation* of HealthyPEP that was based on structured interviews, revealed a positive picture concerning the degree of implementation of HealthyPEP and the satisfaction of the teachers with the intervention study with only some limitations. The teachers concluded that the motivation of the students was very high at the beginning of the programme but decreased during its course. They also emphasised that the lack of ball games was a handicap of the programme. Nevertheless, it became clear that the teachers were satisfied with the content of HealthyPEP and with the material provided. The teachers concluded that HealthyPEP was successful, that in the future they would adopt parts of these lessons, and that they were optimistic that positive intervention effects would occur.

IG students evaluated HealthyPEP positive as they said that it was more strenuous, varying, motivating to do sports in the afternoon (only boys), and that they learned a lot during this period (boys). The gender separated analysis is especially interesting because it reveals that boys tended to evaluate HealthyPEP in a more positive manner compared to girls. This is a contradiction to the outcome results, which showed that girls profited to a larger extent from HealthyPEP.

Based on the results of the process measures, it can be concluded that HealthyPEP was successfully implemented in the IG classes. As stated in the systematic review (see section 3.2), it is important to take the degree of the treatment integrity into account in order to increase the interval validity of the study and in this way contribute to high evidence based results.

Outcome measures

HealthyPEP targets to influence students' health, which is one of the central perspectives of PE in sixth grade (Kurz, 2008a). To consider a wide spectrum of health, the intervention effects were measured on the three target levels: a) psychological determinants of physical activity, b) physical activity, and c), health and fitness. Additionally, in the course of the comprehensive evaluation of HealthyPEP (Mittag, 2006), students' cooperation with each other was measured as one possible side-effect. No differences between the IG and the CG on their cooperation levels were revealed since they showed similar changes in this variable during the investigation timeframe. These results support the hypothesis that HealthyPEP did not lead to negative side-effects.

The outcome variables used to measure the effects of HealthyPEP on the physical activity behaviour as well as the health and fitness level, were assessed with standardised measurement instruments. For these, reference samples exist that are used to classify the baseline values as well as the changes found in this study sample over the intervention period of five months. No reference data exist concerning the psychological determinants of physical activity, since the questionnaires used in this study were modified either on the basis of already existing scales or where specifically designed for this study.

Concerning *motor performance* diagnosed by the DMT 6-18, this study sample (M=106.10) was fitter compared to the children of a German reference group (M=100) and students in both samples showed an increase in motor performance over several months (Bös, 2009). The observed *BMI* values of this study sample were within the average of the worldwide BMI-reference data (WHO, 2011). Nevertheless, it needs to be considered that the comparison of the BMI levels of this sample with the reference group data is problematic. BMI values of the reference group were based on the self-reports provided by the young people and a large number of missing data existed (Currie et al., 2008). Thus, it is very likely that the reported BMI levels of the reference group do not represent the real picture and therefore a comparison with the data of this study must be viewed with caution. As shown in the reference sample, also this study sample could confirm the BMI increase in this age group (de Onis & Lobstein, 2010; WHO, 2011). Regarding *HRQOL*, the students of this study showed much higher values (M=95.18 points) compared to the reference group of the German health survey (KiGGS) (M=74.6 points). Nevertheless, similar to the reference group also this study sample decreased in HRQOL during the investigation timeframe (Ravens-Sieberer et al., 2007).

Students' *physical activity* levels assessed with the MoMo-AFB questionnaire were compared with the reference groups measured by Romahn (2008), but the changes of this study sample do not always reflect the changes in the reference group. In respect to the MVPA results, it can be said that the students of the current study showed average activity levels. They stated being more than 60 minutes physically active per day on 3.8 days per week compared to the students of the reference sample that reported being more than 60 minutes physically active on 3.6 and 3.7 days per week in the age group of the 11- and the 12-year-olds respectively. A reduction in MVPA was noted over a year in the reference group whereas this study sample increased their MVPA levels during the investigation timeframe. Concerning the number of minutes students spent exercising in the sports club, the study sample of this intervention programme was above average (M=230, SD=205) compared to the reference values of the 11-year-olds (M=173, SD=131) and the 12-year-olds (M=206, SD=147). Similar to the reference group there was an increase over time in the number of minutes students spent exercising in the sports club. An opposite picture was revealed on the time students spent exercising outside of the sports club. The sample of the current study showed an average of 203 minutes (SD=188) and the reference group had an average of 280 minutes (SD=151) in the age group of the 11-year-olds and an average of 283 minutes (SD=189) in the 12-year-olds. The students of the reference group did not show any changes when comparing the data from the 11- and 12-year-olds. The students of this intervention study increased the number of minutes they spent exercising outside of the sports club in the short-term but then again the number of minutes spent exercising decreased in the middle-term.

The systematic review of school-based physical activity intervention studies, revealed that only a small amount of the studies analysing the *psychological determinants of physical activity* influenced these determinants positively (see chapter 3) (Demetriou & Höner, 2012).

Also the current study was not able to strengthen these findings and the results could not confirm the hypotheses set at the beginning of the examination. On this level, an increase in the short-term external motivation in the entire IG was observed. Additionally, positive tendencies on the psychological determinants of physical activity were found in girls on their attitudes towards PA and knowledge and in boys on the various aspects of motivation. Nevertheless, the analysis of the short- and the middle-term intervention effects, revealed a rather negative influence of HealthyPEP on the psychological determinants of physical activity and also the fact that students' external motivation increased can be partly viewed as a negative intervention effect. Negative short- and middle-term intervention effects were observed on girls' self-efficacy and on boys' attitudes towards PE, which were also found in 12.5% of the studies examining attitudes in the systematic review. These negative effects can be partly explained using the assessed process measures. Here, both girls and boys of the IG expressed that HealthyPEP was more strenuous than regular PE. This might be the reason why especially IG girls had lower self-efficacy levels in the short-term. It needs to be considered though that in the middle-term, girls did not evaluate PE to be more strenuous compared to the CG and still their self-efficacy levels were significantly lower compared to the CG. These results might provide support for a decrease in short- and middle-term self-efficacy levels in girls after experiencing a strenuous PE programme. Because of the tiring experiences in PE, girls might not see themselves in a position to be regularly physically active in their free time. Nevertheless, these findings on self-efficacy need to be interpreted with caution because as previously stated young people might not be able to adequately estimate their ability to be physically active in the near future since this is an abstract construct. The fact that IG boys showed a decrease in their positive attitudes towards PE in the short-term is surprising. Especially when comparing this result with the findings from the students' evaluation of HealthyPEP, in which IG boys evaluated HealthyPEP positively. Nevertheless, this result might reflect measurement bias because the increase of this item in the CG boys can also not be explained since they carried out the unchanged regular PE lessons during the entire investigation timeframe.

The systematic review of school-based physical activity intervention studies, revealed that only 56.8% of the studies were able to positively influence students' *physical activity levels* and additionally 6.8% of the studies even led to a negative effect on young people's physical activity levels (see chapter 3). The intervention effects of this study on students' *physical activity levels*, showed a mixed picture. Positive and negative significant intervention effects were observed on the variable "minutes spent exercising outside of the sports club" in the short- and the middle-term, respectively. The findings on this item need to be interpreted with caution because of the very low retest-reliability results and the few students providing answers in this part of the questionnaire. At this point, it seems to be more reliable to restrict the interpretation attempts of students' physical activity levels on the basis of the internationally recognised items used to assess students MVPA levels. Concerning these

items, no significant intervention effects were observed which strengthens the results of the systematic review that emphasise that more work needs to be done to design suitable measures of physical activity and to create more effective programmes to promote young people's physical activity levels. At this point it needs to be questioned whether it can be expected that an intervention such as HealthyPEP can influence students' physical activity levels beyond PE. Due to the PE homework it was expected that the overall MVPA levels would increase because of HealthyPEP. Nevertheless, it seems unrealistic to expect an increase in students' physical activity in the sports club since no elements in HealthyPEP specifically targeted these. It is surprising that students' MVPA did not change since this was specifically targeted by HealthyPEP. Here, the question arises whether possible intervention effects on physical activity remained uncovered because of the insensitive MVPA items. Unfortunately, based on the data gained during this study, this question remains unanswered.

On the *health and fitness level*, in this study, no significant intervention effects were revealed on *HRQOL*. The observed HRQOL reduction was consistent with the changes in the reference values, which emphasise that a reduction in HRQOL is an overall phenomenon in this age group. The effects of a school-based physical activity programme on HRQOL were also examined by Hartmann, Zahner, Pühse, Puder, and Kriemler (2010). The results showed no general positive effects on HRQOL. Additionally, a reduction in HRQOL also appears in other settings and age groups after a health-promotion physical activity intervention programme (e.g., for a physical activity programme in cardiac rehabilitation, Sudeck & Höner, 2011). It seems that an intervention programme over a timeframe of eight weeks is not in a position to counteract the negative development of HRQOL in this age group. It is assumed that more intense and longer lasting programmes are needed in order to positively influence such a global construct.

The findings of HealthyPEP on *motor performance* complement the existing knowledge on the effectiveness of school-based physical activity interventions revealed in the systematic review (see chapter 3). The systematic review showed that nearly 70% of the studies were successful in promoting motor performance. In this intervention study, when analysing the intervention effects on motor performance separately for the two genders, it became clear that HealthyPEP had different effects on the sexes. Girls were particularly able to benefit from it. When focusing on the overall motor performance score a positive intervention effect was found only in girls in the middle-term. This is mainly a result of the improvement in strength-endurance and coordination (sideways jumps) and partly due to the positive development in endurance (6-min-run). In boys, there were no significant differences in the short- or middle-term between the groups. At this point, only assumptions can be made to explain these findings. First, during the interviews some teachers noted observing a decrease in students' motivation towards PE during the study. Additionally, they reported that especially boys complained about the lack of ball games. In contrast, boys expressed an increased motivation to participate in afternoon sports. It is difficult to explain this contradiction based in these

data. Second, the results in boys' motor performance might reflect their reduced motivation to participate in PE and the motor performance tests (e.g., the 6-min-run). A reduction in endurance is not expected in healthy boys at this age, it has to be assumed that this development was due to decreased motivation to strive for maximum performance in the 6-min-run. The analysis of the influence of the *moderator variables* (initial BMI and motor performance levels) confirmed the overall positive effects of HealthyPEP on girls' motor performance. It could not be shown that a particular group of girls profited more from HealthyPEP. Instead, the moderator analysis confirms that the intervention effects applied to girls independent of their initial BMI or motor performance levels. Additionally, the analysis of the school clustering effects based on the adjusted means of the IG and the CG schools, showed that the IG school on the one hand and the CG schools were grouped together indicating that the significant intervention effects were mainly caused by the HealthyPEP.

The systematic review showed that approximately 30% of the interventions were able to positively influence students' *BMI* (see chapter 3). In this study, short- and middle-term significant intervention effects were revealed on students' BMI levels, which were further strengthened by the high reliability values of the BMI measure and by the moderator analysis. Even though some significant moderating effects were found, the intervention effects did not significantly vary by the class composition, the initial BMI and motor performance levels of the students (see section 4.3.2.1.2). This is a further indication of the overall positive intervention effects of HealthyPEP on students' BMI levels. Furthermore, the effects on BMI were not caused by a school clustering effect as shown by the adjusted means of each school (see Figure 25), even though the exact effect of the school and HealthyPEP cannot be completely determined. The study results concerning BMI emphasise the positive effect of this treatment on students. The smaller increase in BMI in the IG is assumed to result from the more intense content of HealthyPEP aiming to keep students more active during PE and the physical activity homework that were mainly based on activities with greater energy expenditure.

Finally, the findings from the moderation analysis showed that the class composition seems to have an influence on the effects of HealthyPEP. Girls and boys being taught in gender mixed classes profited from HealthyPEP in the short- and long-term concerning motor performance. In contrast to the clear influence of the class composition on the HealthyPEP effects on motor performance, concerning BMI, these effects were smaller and in the opposite direction. Here, IG girls and boys revealed short- and middle-term lower BMI levels when being taught in gender separated PE classes. Since the effects of the class composition were not consistent concerning motor performance and BMI further research is urgently needed to clarify the effects of PE in gender separated and gender mixed classes. This topic is often discussed in the sport pedagogical field and different arguments are provided that strengthen both positions (Derry, 2002; Lirgg & Feltz, 1997; Tietjens & Potthoff, 2006).

In the future, when designing school-based intervention studies for students' health promotion, the following aspects should be taken into account:

- Intervention programmes should be designed with the target to influence students' health in an indirect way, by providing them the competency to adopt a physically active lifestyle outside of the school setting. This can be partly achieved by influencing students' psychological determinants of physical activity.
- The moderating effects of co-educative and gender-separated PE on the intervention effects on students' health and fitness variables should be further examined.
- Tailored interventions should be designed in order to individually promote students' sports preferences and thus establish long-term higher physical activity levels.
- Possibilities to achieve *larger intervention effects* on students' health through PE must be explored. For example, the effects of short-term intensive health promotion PE blocks spread over the entire school year. Another example would be the promotion of the participation in sport activities in sport clubs beyond the school hours.

5 Summary and Perspectives

The most frequent diseases in young people are chronic and the causes for these diseases are suspected to lie in their lifestyle and in the environment of the industrialized countries. Therefore, it is important to develop suitable programmes to promote a healthy lifestyle already in young age. This research project aims to contribute to the research needed in the field of health-promotion through physical activity in young people in the school setting and consists of mainly three consecutive steps targeting to provide theory-based empirical findings on a high evidence level.

In the first step (*see chapter 2*), the current state of young people's health and fitness status as well as their physical activity levels was discussed. Recent findings from the international HBSC and the German KiGGS survey as well as several other systematic reviews and meta-analyses revealed a mixed picture on the current status of young people's health and health behaviour. Data on children's and adolescents BMI levels have shown that overweight and obesity have reached epidemic proportions and are still rising in these age groups (Kurth & Schaffrath Rosario, 2007; Lobstein et al., 2004). Bös (2003) concludes that based on the data gathered from a meta-analysis in recent years, a decrease in young people's physical fitness levels of about 10% can be observed. The results from the HBSC survey on young people's HRQOL report that 11% to 20% of the 11- to 15-year-olds rate their health as fair or poor and both physical and emotional symptoms are reported more often in the older age groups. Also the results on young people's physical activity levels showed that actions need to be taken in order to encourage this health behaviour. The data have shown that young people's physical activity levels start decreasing already during adolescence. According to the HBSC data, less than half of the young people surveyed satisfied the current existing recommendations for physical activity levels. The existing systematic reviews and meta-analyses conclude that the current research shows a promising picture on the positive health effects of fitness and physical activity on several health aspects in young people. Physical activity and fitness are directly related to a high quality of life and the prevention of premature death and must be given the same attention as other important public health practices such as sound nutrition and the prevention of the adverse health effects of tobacco (U.S. Department of Health and Human Services, 1996).

The school is an important setting with great possibilities and with the obligation to encourage a healthy lifestyle already from a young age. Health promotion in the school setting is discussed from the perspective of sport psychology, sport pedagogy, and training science, which are three relevant disciplines of sport science concerning this topic. Each of these disciplines highlights a different facet of the education of young people towards regular physical activity and the question arises on how health effects can be achieved in the school setting. From the perspective of sport pedagogy, the reasons of why the school setting is ideal

for the education of young people to develop the competence to lead a physically active and healthy lifestyle was discussed. Health promotion is a part of the PE curriculum even though the extent of the direct and the indirect health promotion that can be accomplished through PE remains unanswered (Kurz, 2008a). From the perspective of training science, the question on which training guidelines must be considered and which methods should be implemented in order to achieve optimal effects on students' fitness levels in the restricted time during PE was analysed. It was concluded that a precise preparation and planning of an adequate training in PE concerning content, equipment and material, methods, and structure of the lessons taking training science and pedagogical principles into account has to be done (Frey & Hildenbrandt, 1995; Steinmann, 2004). Finally, from the perspective of sport psychology it was analysed which psychological factors determine physical activity and therefore consequently need to be addressed in the course of school-based physical activity intervention programmes. Up to now mostly the theories and models used for the explanation of behaviour change in adults are used also for children (Biddle & Nigg, 2000). Nevertheless, the theoretical considerations and the empirical findings indicate that attitudes, motivation, self-efficacy, and knowledge can be important psychological determinants of physical activity and need to be targeted in health promotion intervention programmes (Bandura, 1997; Deci & Ryan, 2004; Hagger et al., 1997; Keating et al., 2009).

In the second part of this work (*see chapter 3*), a comprehensive systematic review on the effects of school-based physical activity intervention studies on young people's psychological determinants of physical activity, the behaviour physical activity itself, and finally, health and fitness variables was carried out. This systematic review filled the existing research gap since up to now no systematic review existed that summarised all original studies in this field (Demetriou & Höner, 2012). The review provided insights to which concepts where especially effective and efficient in affecting these variables positively and which areas in this research field have already been sufficiently examined and which still require further research. Furthermore, it helps to establish known theoretical ideas and to expand theoretical models. The findings of the systematic review revealed an optimistic picture of the magnitude of school-based physical activity interventions of young people's health. A large amount of the considered studies positively influenced students' knowledge (87.5%), motor performance levels (69.7%), and physical activity levels (56.8%). A smaller amount of studies were in a position to have a positive impact on students' attitudes (43.8%), self-concept (30%), and BMI levels (28%). To complete the picture of the results of current intervention programmes, a more detailed literature search was carried out to find additional studies carried out in German language countries, which were not detected with the strict inclusion criteria of the main systematic review. These studies strengthened the positive picture of the results presented in the previously described systematic review and especially provided evidence concerning the possibility to achieve positive intervention effects on students' motor

performance when this was specifically addressed by the programme. The systematic review of existing studies in this field provides the basis for the design and evaluation of HealthyPEP

In the third part of the research project (*see chapter 4*), the design and implementation of HealthyPEP was described. The *design of HealthyPEP* was developed based on the sports science considerations in sport pedagogy, sport psychology, and training science as well as on the findings of the systematic review. The lessons aimed to address students' health in a theoretical and in a practical way. Therefore, they consisted of a combination of age-appropriate practical training, theoretical elements, and some additional components such as PE homework and bonus points for various assignments. By using specific behaviour change techniques (Michie et al., 2009), in was targeted to provide students the opportunity to experience the effects of regular training and to experience mastery. Additionally, it was aimed to raise students' awareness for the relationship between regular physical activity and health.

The *evaluation of HealthyPEP* was carried out with a total study sample of 18 sixth-grade high school classes (N=516) in the federal state of Baden-Württemberg. These classes were assigned to either the IG or the CG on the school level. The IG classes carried out HealthyPEP and the CG continued the regular PE lessons. A comprehensive evaluation of HealthyPEP was carried out using process measures to examine the degree to which HealthyPEP was successfully implemented, outcome measures to analyse the intervention effects on: a) the psychological determinants of physical activity level (students' motivation towards physical activity and PE, attitudes towards physical activity and PE, self-efficacy, and knowledge on the relationship between physical activity and health), b) the behaviour of physical activity level, and c) the health and fitness level (motor performance, BMI, and HRQOL) were assessed. Finally, students' cooperation with each other was measured to examine possible side effects of HealthyPEP.

The *process measures* revealed a positive picture concerning the implementation of HealthyPEP and its evaluation by the participating teachers and the students. The observation of HealthyPEP and of the regular PE showed that the lessons differed in their content. HealthyPEP emphasised to a larger extent students' endurance and strength as well as the theoretical aspects of health whereas the regular PE lessons focused on the teaching of the traditional sports. The interviews with the IG teachers revealed the overall satisfaction with HealthyPEP with only some limitations concerning the long period of the treatment and the lack of ball games. Finally, the direct evaluation of PE by the students revealed that students in both groups tended toward a negative evaluation of PE during the investigation timeframe. Additionally, the results showed a positive evaluation on behalf of the IG students as they estimated HealthyPEP to be more strenuous, varying, motivating to sports in the afternoon (only boys), and that they learned a lot during this period (boys).

The results on the *outcome variables* of the study revealed that HealthyPEP was mostly in a position to positively influence the IG students' health and fitness variables and did not reveal any negative side effects. Overall, this study showed small to medium intervention effects ($\eta^2 = .03$ and $\eta^2 = .04$) on the main variables BMI and girls' motor performance ($\eta^2 = .05$), which are consistent with previous studies and were further strengthened by the moderator analysis and the examination of the school clustering effects. Specifically, girls benefitted the most on their motor performance levels and both genders profited more concerning BMI. This intervention programme could not positively influence students' HRQOL, psychological determinants of physical activity or their physical activity behaviour itself. Several methodological problems concerning the study design and the measurement instruments used need to be taken into account when interpreting these findings. This leads to the conclusion that positive effects could only be achieved through the direct influence of HealthyPEP that was more intense and energy consuming compared to the regular PE lessons. A positive influence on variables that are related to intrinsic motivation and physical activity carried out beyond the PE lessons was not achieved.

Concluding it can be said that the *current study* (Höner & Demetriou, 2012a) is one of few in Germany (e.g., Graf et al., 2008; Steinmann, 2004) reporting the effects of a time-limited programme in PE focussing on the pedagogical perspective of health (Kurz, 2008b). Overall it becomes clear that intervention effects could be achieved on the health and fitness target level and specifically on motor performance and BMI. These findings contribute to the controversial discussion on whether PE can lead to direct positive health effects on students (Balz & Neumann, 2007; Neumann, 2004). This study confirmed very clearly that by implementing a more intense and more energy consuming programme with a frequency of two PE hours per week, such as HealthyPEP, direct positive health effects on students can be achieved in the school setting.

Questions remain unanswered on how indirect health effects can be achieved through PE. A positive influence on variables that are related to an intrinsically motivated and independent physical activity behaviour was not achieved by HealthyPEP. Additionally, the relationship between the three examined levels and specifically the examination of mediating effects needs to be further investigated and remains a high challenging task. Although, the IG students in this intervention study experienced negative intervention effects on their self-efficacy levels and no improvements in MVPA levels, they still increased in motor performance and showed a decrease in BMI levels. At this point, it is difficult to determine which elements of HealthyPEP led to these positive and negative intervention effects. Since all IG classes carried out the same programme and no second IG existed that took part in only for example the practical elements of HealthyPEP, it is difficult to locate the exact elements of HealthyPEP that led to the intervention effects.

In the future, it is essential to improve the measurement instruments on all three levels considered in HealthyPEP (psychological determinants, physical activity levels, and health and fitness outcomes) in order to be able to measure reliable and valid intervention effects. For future research, it seems promising to consider general conditions under which higher intervention effects can be expected. This could be perhaps by creating possibilities for students to adopt the sports that correspond to their interests (Sudeck & Conzelmann, 2010) and by including supplementary components in extension to the main intervention programme. These could be for example, creating school environments conducive to physical activity, including further motivational boosts after the end of the intervention or the involvement of the parents in the programme (as previously shown to be effective in the CATCH study, see Hoelscher et al., 2004). Additionally, as concluded from the findings of the process measures higher intervention effects might result especially in boys when including more ball games into the intervention programme. Up to now little is known about the effects of gender-specific tailored interventions on students' motor performance levels (Demetriou & Höner, 2012). Key findings from the HBSC report also suggest gender specific initiatives (Parry-Langdon & Roberts, 2004). One the one hand, the different intervention effects on boys and girls strongly suggest the need of gender independent programmes and also the need to teach students already in sixth grade high school in gender separated classes. On the other hand, the results from the analysis of moderating factors support the opposite hypotheses. Here, it was shown that both girls and boys being taught in gender mixed classes profited from HealthyPEP the most. Based on these study results this appears to be a highly promising possibility to increase intervention effects and should be further examined in future.

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Appendix