

## Effects of Cooperative Learning Structures in Physical Education: A Systematic Review

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**Abstract:** One possibility of successfully dealing with the increasing heterogeneity of students is cooperative learning. However, this learning structure is still rarely used in physical education. To substantiate positive effects of cooperative learning in physical education and to support the commitment of pedagogical staff, the aim of this research was to evaluate physical, social, behavioral and psychological effects of interventions implementing cooperative learning structures in physical education lessons. The current systematic review was designed based on the PRISMA guidelines. Five databases were used to select articles that evaluated effects of cooperative learning in physical education of children and adolescents with an average age within the range of five to 19 years in August 2022. Studies had to report quantitative measured outcomes of cooperative learning. Two authors independently screened studies for eligibility and assessed risk of bias. Descriptive analyses were conducted to evaluate intervention effects. In total, 23 articles reporting 36 outcomes were included in the analysis with an overall sample size of 3699 children and adolescents aged between 6.5 and 17.5 years. Summarized 71% of all reported outcomes resulted in significant positive effects on cooperative learning compared to traditional teaching styles with most positive effects on social outcomes (92%). It is recommended to integrate different teaching styles, e.g. cooperative learning, to improve children's development and to engage them in lifelong physical activity. Furthermore, interdisciplinary cooperation (e.g. between researchers and pedagogical school staff) should be sought in order to develop pedagogical approaches that consider the needs and prerequisites of students.

**Keywords:** Teaching Styles, Healthy Development, Educational Technology, Collaboration

### About the Authors



**Carolin Schulze** works at the Technical University of Chemnitz in a post-doc position. Her main research interest is cooperative learning in different contexts (e.g. in physical education). In particular, she is interested in different effects of cooperative learning structures and in the quality of experience of teachers when cooperative learning is used.



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of school children.

### 1. Introduction

In recent decades, demands on teaching and learning have changed radically in our society. The constantly changing society with rapidly increasing knowledge, the breaking up of traditional family structures and the structural changes in the economic and working area require the development of key competences [1]. Key competences were defined as acquirable, general skills, attitudes and knowledge elements that are useful for solving problems and gaining new competences in as many content areas as possible. Consistent integration of cooperative learning structures is a prerequisite for developing and improving these key competences. In present school practice, structures that create homogeneous learning groups are most used. In contrast, the potential of alternative, internally differentiated, open, reform-oriented and student independent teaching methods

for successfully dealing with heterogeneity of students are emphasized [2].

Cooperative learning was developed in the 1970s based on concern that students have few opportunities to demonstrate their personal skills in traditional and competitive learning environments [3]. Combining social and academic learning, the structure of cooperative learning is a way to improve personal and social skills. Cooperative learning is characterized by students working in small groups to help each other to deal with learning materials [3]. As cooperative learning continues to be non-competitive, teachers have new opportunities to impart knowledge with the chances or necessity of mutual help [3]. It combined principles of various student-centered or experience- and problem-oriented approaches. The teacher acts in a subordinate role, i.e. he or she takes an accompanying function in order to educate the students to work independently. This enables students to solve problems standalone, develop learning strategies and use different concepts of learning. Using cooperative learning structures, five basic elements are required: positive interdependence, individual accountability, promoting interaction, social skills and group processing [4]. The promotion of students' interaction does not only serve the pure acquisition of knowledge but also strengthening of social skills.

Within physical education (PE), great potential by using the structure of cooperative learning exists. It enables the development of current movement and sports culture ('education for sport') as well as the development of personality and social skills ('education through sport', e.g. co-determination, self-determination, solidarity) [5]. The structure of cooperative learning is therefore appropriate in PE classes in order to satisfy the double task of PE, since both professional and social-psychological contents are integrated into the teaching process.

Over the last 20 years, few reviews and meta-analysis have been conducted on cooperative learning, but they have focused on curricular subjects like Mathematics or learning in general [6-8]. Reviews including cooperative learning in PE classes were limited to studies in the last five years and were related more to the didactic implementation of cooperative learning and did not measure quality of included studies or focused on only one outcome [5, 9-11]. For example, the study from Fernández-Espínola researched the effect of cooperative learning on intrinsic motivation in PE [11]. Furthermore, the reviews did not present a lucid summary of the effects

of cooperative learning. The aim of the current systematic review was to present physical, social, behavioral and psychological effects of cooperative learning in PE of children and adolescents and therefore aimed to show that cooperative learning can contribute to fulfill the two main goals of PE (education for and through sport). The knowledge gained can support the work of pedagogical staff and promote the implementation of cooperative learning in PE.

## 2. Material and Methods

This quantitative review was reported according to the PRISMA guidelines and focuses on quantitative reported outcomes of interventions including cooperative learning in PE lessons of children and adolescents aged between five and 19 years [12]. This systematic review was not registered previously and no review report was prepared.

### 2.1 Search strategy and eligibility criteria

For the current review, a comprehensive literature search was conducted using five electronic databases (Ovid Embase, EBSCO, Eric, SPORTDiscus, Clarivate Web of Science (Science Citation Index Expanded and Conference Proceeding Index Science, SPCI-S)) in August 2022. The descriptors 'Cooperative learning' and 'Physical Education' were used with the search operator AND. No filters were used.

Included intervention studies met the following criteria:

- (1) Participants: healthy children and adolescents with an average age within the range of five to 19 years.
- (2) Intervention: content of intervention was cooperative learning structures in PE based on Johnson [4]. This also included cooperative games which fulfill the five elements of cooperative learning [3].
- (3) Study design: studies with repeated measures (pre- and post-test design) with or without control group, with or without randomization.
- (4) Outcome: quantitative measurement of physical (e.g. motor skills learning), social (e.g. social interactions), behavioral (e.g. disturb others) or psychological (e.g. self-concept) effects of cooperative learning.
- (5) Publication: English language, peer-reviewed articles.

## 2.2 Study selection and data extraction

Study selection of the current systematic review was performed by two independent reviewers using Covidence systematic software (Veritas Health Innovation, Melbourne, Australia, available at [www.covidence.org](http://www.covidence.org)). After de-duplication, titles and abstracts were screened and articles of potential or indeterminate relevance were retrieved for full text screening against eligibility criteria. Conflicts were discussed by the two reviewers. For each study, details were extracted using piloted data extraction form. Data extraction covered information about general study characteristics (country, design), sample size of intervention and control group, sex/gender distribution as well as results of the intervention. For additional information, study protocols and supplementary materials were used and in case of missing information, the author(s) of the articles were contacted (maximum two contact attempts).

## 2.3 Quality assessment of risk of bias

Risk of bias was carried out independently by two reviewers using the revised Cochrane risk-of-bias-tool for randomized trials (RoB2) [13]. Using this tool different domains of bias, focusing on different aspects of trial design, conduct and reporting were assessed. Judgment of different items can be 'low' or 'high' risk of bias or can express 'some concerns'. Discrepancies of the two reviewers were resolved through discussion.

## 2.4 Data synthesis

We were unable to conduct meta-analysis due to heterogeneity (heterogeneous methodologies and outcome measurements) of studies. Because only a small subset of all included studies was homogeneous enough to consider meta-analysis, we chose not to combine data. A descriptive analysis was conducted to analyze the effects of cooperative learning structures in PE lessons on physical, social, behavioral or psychological variables. Some studies reported more than one outcome for cooperative learning structures (e.g. social and physical effects) with different effects. Thus, we conducted the analysis on the level of cooperative learning outcomes. Due to missing statistical data in one third of all included primary studies (e.g. only reporting interactions of time x group as not significant), analysis displayed only effects of time-by-group (intervention versus control

group) and therefore effects of cooperative learning compared to traditional learning structures. Outcomes were divided into four groups: physical, social, behavioral and psychological effects. For all four groups different outcomes of studies were included (e.g. social interaction as outcome for social effects). Because some studies reported more than one outcome for more than one effect and some outcomes were reported in more than one study, number of outcomes, number of studies and sum of number of outcomes that were reported by studies for this effect (=study outcomes) were included. For example: two different outcomes (e.g. ball control with hands and speed) were reported for physical effects in three studies. Overall, ball control was measured in three studies and speed was measured in two of these three studies. Then there were five study outcomes included which reported physical effects.

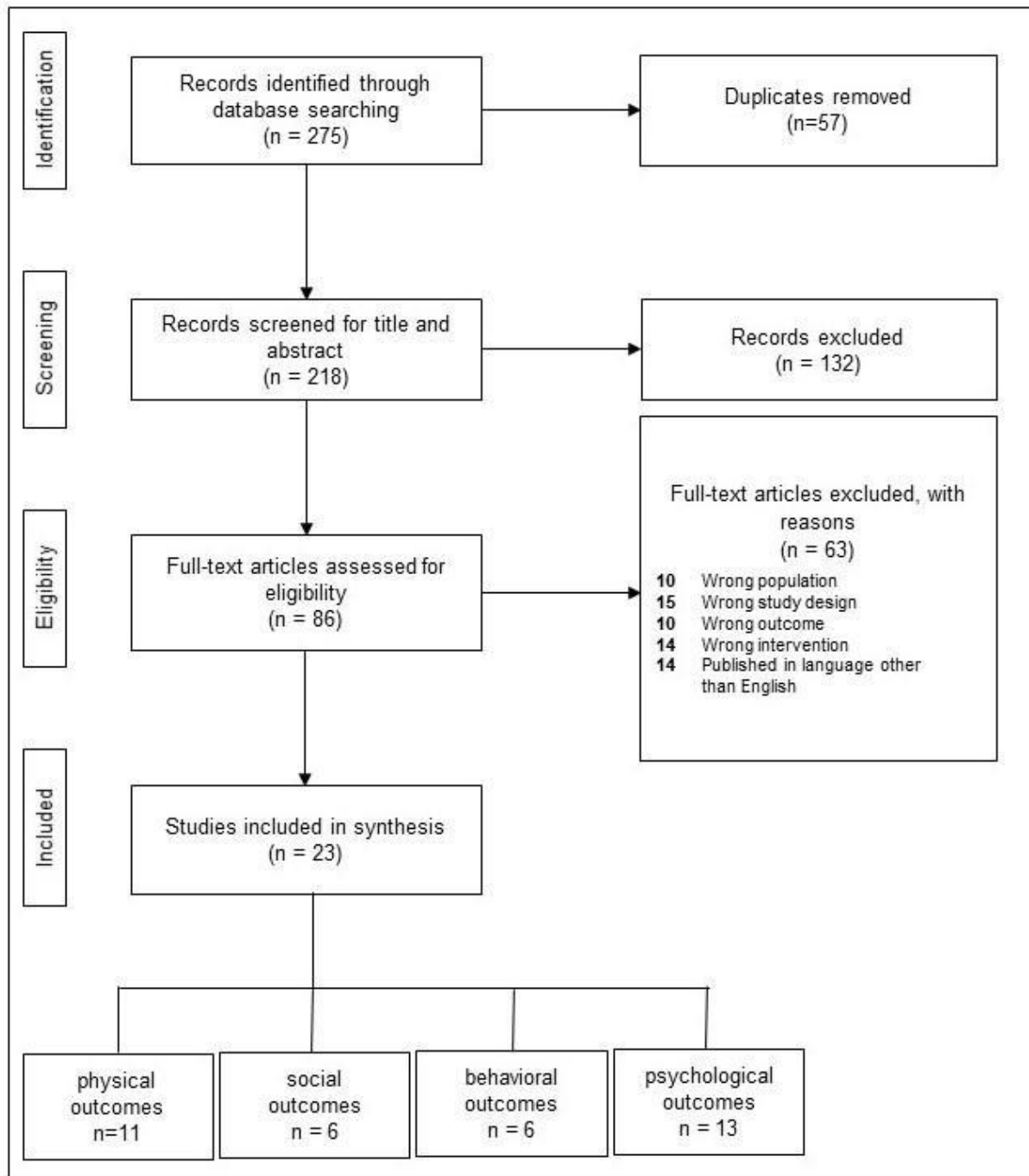
## 3. Results and Discussion

### 3.1 Study flow diagram

In total, 23 articles reporting 36 outcomes (66 study outcomes) implementing cooperative learning structures in PE were included in the analysis (Figure 1). Physical effects were reported by five studies (11 outcomes, 16 study outcomes), social effects were considered in ten studies (six outcomes, 13 study outcomes), behavioral effects have been considered by three studies (six outcomes, ten study outcomes) and psychological effects were measured by 14 studies (12 outcomes, 26 study outcomes).

### 3.2 Characteristics of included studies and study participants

A table including all relevant characteristics of included studies is available on request from the corresponding author. Studies were published between the years 2009 and 2022 with a maximum of publications in 2019 (five intervention studies). Duration of included studies ranged from two weeks to 28 weeks, with a mean duration of 11 weeks, excluding follow-up durations [14, 15]. Overall, 18 studies were published in Europe with a maximum of eight publications from Spain. Furthermore, four publications were conducted in Asia and one in Africa. Overall, 3699 children and adolescents participated in all included studies.



**Figure 1.** PRISMA Flow Diagram

Average sample-size was 160 students, ranging from 30 to 810 participants [15,16]. Mean age ranged from 6.5 to 17.5 years with an average of 12.5 years. Average percentage of male participants in included intervention studies was 45% with two studies only included girls [17, 18]. Control groups of all included studies received education lessons according to the curriculum (teacher-centered). Of the 23 included studies, 8 (35%) used randomized controlled designs, 13 (57%) were non-randomized trials and two (9%) studies used no control group.

### 3.3 Risk of bias

Overall, 65% of included studies were judged to be at high risk of bias for at least one domain (Figure 2). The domains rated as having the lowest risk of bias were missing outcome data, measurement of outcomes and selection of the reported results with 80% of studies at low risk. Deviations from intended interventions were assessed to be at low risk of bias in 30% of included studies. The risk of bias domain that was judged to have the largest number of high risk was the randomization process (55%).

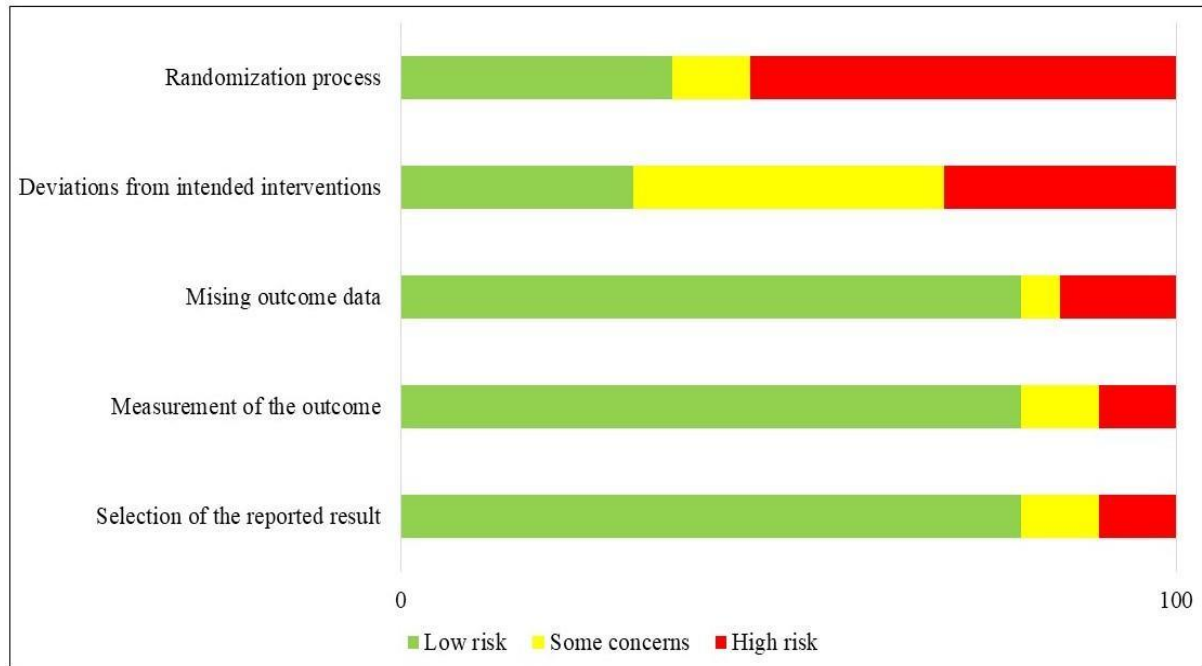


Figure 2. Risk of bias of included studies.

Table 1. Physical effects of cooperative learning in physical education.

Outcome	Number of studies	Effect of cooperative learning vs. control
Ball controlling	4	++
	1	--
Coordination	1	+
Agility	2	++
Balance	1	++
Flexibility	1	0
Speed	1	0
Endurance capacity	1	++
Strength	1	++
Jumping	1	0
BMI	1	0
FMS	1	++
Summary	Effect	Number of study outcomes (%)
	++	10 (63)
	+	1 (6)
	0	4 (25)
	--	1 (6)

++ significant positive effect, + positive non-significant effect, 0 no effect



### 3.4 Intervention effects

Overall, five studies reported 11 different outcomes (16 study outcomes) on physical effects were included in the systematic review (Table 1). Summarized 63% of study outcomes showed positive effects, 6% revealed non-significant positive effects and 25% reported no effects. One study (6 %) reported negative effects of cooperative learning on ball control with significantly better results of the control group compared to the intervention group [19].

Overall, ten studies reported six different outcomes (13 study outcomes) on social effects were included in this systematic review (Table 2). Summarized 92% of study outcomes showed significant positive effects and 8% reported no effects.

Overall, three studies reported six outcomes (ten study outcomes) on behavioral effects were included in this systematic review (Table 3). Summarized 80% of study outcomes showed positive effects and 20% reported no effects of cooperative learning in PE.

**Table 2.** Social effects of cooperative learning in physical education.

Outcome	Number of studies	Effect of cooperative learning vs. control
Social interactions	2	++
Social relatedness	4	++
	1	0
Social sensitivity	1	++
Social empathy	3	++
Tolerance	1	++
Cooperative skills	1	++
Summary	Effect	Number of study outcomes (%)
	++	12 (92)
	0	1 (8)

++ significant positive effect, 0 no effect

**Table 3.** Behavioral effects of cooperative learning in physical education.

Outcome	Number of studies	Effect of cooperative learning vs. control
Disobedience	2	++
Disturb others	3	++
Quick-temperedness	1	++
Engagement	1	0
Irresponsible behavior	1	++
Aggressiveness	1	++
	1	0
Summary	Effect	Number of study outcomes (%)
	++	8 (80)
	0	2 (20)

++ significant positive effect, 0 no effect

**Table 4.** Psychological effects of cooperative learning in physical education.

Outcome	Number of studies	Effect of cooperative learning vs. control
Motivation	7	++
Enjoyment	1	+
	1	0
	1	++
Self-concept	1	+
	2	++
Stress coping skills	1	++
Flow	1	0
Problem solving skills	2	++
Pleasure	1	0
Perceived autonomy	1	0
	1	++
Self-control	1	0
	1	++
Self-management	1	0
Emotional sensitivity	1	0
Emotional control	2	++
Self-efficacy	1	0
Summary	Effect	Number of study outcomes (%)
	++	17 (63)
	+	2 (7)
	0	8 (30)

Overall, 14 studies reported 13 different outcomes (26 study outcomes) on psychological effects were included in this systematic review (Table 4). Summarized 63% of study outcomes showed significant positive effects, 7% reported non-significant positive effects and 30% revealed no effects of cooperative learning in PE.

Overall, 47 (71%) of reported study outcomes showed significant positive effects after implementing cooperative learning structures in PE classes. Further three (5%) study outcomes showed positive but non-significant effects and 15 study outcomes (23%) resulted in no effects. One of the reported study

outcomes (2%) revealed negative effects of cooperative learning structures in PE.

### 3.5 Discussion

The aim of this systematic review was to evaluate the effects of interventions implementing structures of cooperative learning in PE lessons. This review included 23 studies with 36 outcomes measuring a wide range of quantitative outcomes. Results showed a great variety of curricular contents implementing cooperative learning such as soccer, handball and table tennis as well as cooperative games and contents related to health and basic motor skills. The results suggest positive effects of cooperative

learning in different domains (i.e. physical, social, behavioral and psychological). Overall, 71% of all reported study outcomes resulted in significant positive effects. Lowest effects were shown for physical and psychological outcomes (63%). For physical outcomes the study from Iserbyt et al., showed better effects for ball control of the control group compared to the intervention group [19]. Nevertheless, this study had a short intervention time (seven weeks), was not randomized and had a small number of subjects (n=55). Therefore, results should be interpreted cautiously. Furthermore, no group differences were found for forehead rate and error rate in this study. As expected, the largest number of positive effects were found for social outcomes (92%).

The only study that evaluated and found gender differences was that of Nicolosi et al. [20]. The authors found significant interaction effects only for a subscale of the physical self-description questionnaire. Positive effects of cooperative learning for this subscale were exclusively found for boys and not for girls. This might be due the content of intervention in which boys found the opportunity to express their skills through physical performance. The authors suggested a combination of interdisciplinary PE and cooperative learning structures to enhance teaching and learning progress [20].

The results suggest that cooperative learning compared to traditional learning showed positive effects for both motor learning and psycho-social development. Thus, cooperative learning is suitable to fulfill the double task of PE (education for and through sport). Using the increased heterogeneity of students in an effective way and not just seeing it as a burden, cooperative learning is a structure that enables both slow and strong learners to participate effectively in class and ensure that children with learning difficulties are accepted by their classmates [21].

The fact that just 23 studies with only eight of them using randomized controlled designs have been published in the context of cooperative learning in PE seemed to indicate the need to translate the theory into educational practice. It is necessary to promote consistent research with high quality of planning and implementing interventions to generate knowledge about effects of cooperative learning in PE. For further intervention studies, we recommend to describe intervention programs as detailed as possible and to identify and analyze potential moderators such as sex/gender or previous experiences of teachers regarding cooperative learning structures. Furthermore,

cooperative learning should be implemented for more than seven lessons to allow learning to progress beyond an elementary level [22]. Indeed four studies in this systematic review researched the effects of cooperative learning across units lasting seven lessons or less. Therefore, implication for further research might be to extend the intervention duration to generate positive effects.

### 3.6 Strength and weaknesses of the included studies and the current systematic review

To our best knowledge, this review is the first that examines the effects of cooperative learning on different outcomes and that was not limited by publication year of studies. Furthermore, we evaluated the quality of included studies and presented a lucid summary of effects of cooperative learning in PE.

Despite the concerns about study quality with only eight studies were randomized-controlled trials, there is a lack of reporting intervention content in the included studies. Only five studies refer to how the five elements of cooperative learning were implemented. Nevertheless, including the five key elements of cooperative learning in PE lessons is fundamental to bring students in interaction to each other [23]. Furthermore, only two of the included studies reported teachers' or students' experiences with cooperative learning structures and therefore conclusions on effects should be drawn cautiously. Additionally, some studies evaluated the effects of cooperative learning for at least seven weeks or less and this can lead to no significant effects.

However, this systematic review also has some limitations. The review is limited to English language articles and did not include studies published in other languages. Furthermore, the research was limited to peer-reviewed journal articles and thus, results of other intervention studies published in other types of literature were excluded. Due to high heterogeneity of study outcomes we were not able to conduct meta-analysis. In addition, this research only involved students in their PE classes. An analysis of the effects of cooperative learning structures in extra-curricular interventions was not carried out.

### 3.7 Practical implications

Despite the positive effects of cooperative learning in PE, the use of various teaching styles



depending on different situations and students' needs is recommended. This could stimulate the physical, social and psychological development of girls and boys more than insisting on one pedagogical approach [24]. Moving away from a teacher-centered and a competitive model towards a student-centered pedagogy takes a lot of time, effort in adaption and critical reflection. Professional development programs must provide training in a variety of teaching models and practice [24]. Educators and practitioners should be aware of the multidimensional nature of PE and physical activity and the variety of educational possibilities when PE should fulfill the recommended double task. As only one study in this systematic review reported special training of the teachers and most studies were carried out by researchers, a variety of studies did not show any effect on teachers' knowledge of theory and application of cooperative learning structures. To support changes in learning structures in PE, university researchers should work with pedagogical school staff on their professional development to promote multiple pedagogical approaches that have the potential to improve the physical, social, behavioral and psychological development of children and adolescents [25]. Facing the complex setting of schooling and burdens from society implies constant development of knowing and using teaching structures that consider individual requirements and needs of children and adolescents. In this sense, researchers and teachers should reflect the theory and practice of pedagogical approaches to encourage lifelong engagement in physical activity and healthy development of students.

#### 4. Conclusion

Due to the changing society, soft skills related to social interaction and personal development are becoming more and more important in order to meet requirements [1]. This review was able to show that cooperative learning structures improves not only motor skills but also social aspects and psychological, behavioral and personality-building aspects. Kirk argued that we should focus on how we can best promote "educationally beneficial outcomes on students, across a range of domains" (ebd, p. 6). Bailey et al. [26, 27] argued that learning always takes place in relation to different domains. Cooperative learning seems to be suitable for addressing different learning domains and achieving corresponding effects. To improve children's and adolescents' physical, social, behavioral and psychological competences, to engage

them in lifelong physical activity and to promote a healthy development of students, the integration of different teaching styles, e.g. cooperative learning, is recommended. Therefore, teachers should be able to gain experience regarding different teaching styles during their own education. Finally, it is recommended to teach in cooperative teams, e.g. in cooperation with research staff.

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### **Ethics Approval**

Ethics approval is not required.

### **Additional Materials**

Additional materials are available on request from the corresponding author, Dr. Carolin Schulze ([carolin.schulze@hsw.tu-chemnitz.de](mailto:carolin.schulze@hsw.tu-chemnitz.de)).

### **Author's contribution & Statement**

CS prepared a draft of the manuscript. CS and MvH performed the searches, conducted the screening of the search, appraised the study quality and extracted the data. CS and MvH contributed to the interpretation of the results. MvH critically reviewed the manuscript.

### **Conflict of interest**

No conflicts were reported by the authors.

### **Does this article screened for similarity?**

Yes

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