



# The Impact of Typical School Provision of Physical Education, Physical Activity and Sports on Adolescent Mental Health and Wellbeing: A Systematic Literature Review

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## Abstract

Typical school provision of physical education, physical activity and sports, which is reflective of the school’s response to the national curriculum, available resources and school ethos, may impact adolescent mental health and wellbeing. Systematic literature reviews have not yet considered this impact. The Web of Science, SPORTDiscus, PsychINFO, ERIC and MEDLINE databases were searched for relevant literature (2000–2022) pertaining to adolescents aged 12–18 years in secondary schools. Twenty studies met the inclusion criteria, including thirteen interventions, five cross-sectional and two longitudinal studies. Included studies contributed 108 reported effects, that examined depression, anxiety, self-esteem, self-efficacy, wellbeing, life satisfaction and positive mental health. Anxiety was the most frequently reported outcome, with 59% of the reported findings found to be non-significant, 24% significantly positive, 12% significantly negative and 6% reporting a negative trend but with no test of significance. Evidence supported the impact of physical education on adolescent mental health and wellbeing. Significantly positive effects were linked to interventions with minor modifications to typical provision such as the integration of teacher workshops and/or implementation of curriculum models. This suggests the importance of supplementing typical school provision of physical education to positively influence future impact.

**Keywords** Physical Education · Physical Activity · Sport · Adolescence · School · Wellbeing

## Introduction

Physical activity predicts adolescent health (Rollo et al., 2020; Telama et al., 2005). The international guidelines for physical activity recommend an average of sixty- minutes of moderate to vigorous physical activity weekly for adolescent populations (World Health Organization, 2020). Despite this, it is estimated that more than 80% of adolescents fail to meet these specifications (World Health Organization, 2022a, 2022b, 2022c). Adolescents with lower levels of physical activity are more susceptible to developing issues with their mental health and wellbeing that track from adolescence into adulthood (Shlack et al., 2021). While evidence exists to support the positive impact of physical activity outside of school (Biddle & Asare, 2011; Conn, 2010; Stubbs et al., 2017), international health experts have emphasized the requirement for further physical activity promotion strategies to increase adolescent physical activity for mental health and wellbeing and to reduce worldwide health costs (Teychenne et al., 2020; Bouchard et al., 2006; Morton

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et al., 2016). The authors sought to address this research gap by systematically reviewing the literature that examines typical school provision of physical education, physical activity and sports as a strategy to impact adolescent mental health and wellbeing.

Schools are considered an ideal setting to enhance adolescent mental health and wellbeing by providing a variety of physical activity opportunities, including provision of school physical education, physical activity and sports (ISPAH, 2020; Morton et al., 2016; Pate et al., 2006). International policymakers have increasingly acknowledged the potential importance of health enhancing schools (World Health Organization, 2022a, 2022b, 2022c). Subsequent policy documents from leading health promoting institutions advocate for schools to strengthen their capacity as primary vehicles to promote health for living, learning and working (World Health Organization, ISPAH, 2020). However, it is estimated that approximately 20% of the primary source of physical activity for adolescents occurs outside of schools (Ding et al., 2016). Of concern, is that in the potential absence of typical school provision of physical education, physical activity and sports, adolescents would not acquire the necessary exposure to skills for physical activity for health and wellbeing across a lifetime (Pulimeno et al., 2020; World Health Organization, 2022a, 2022b, 2022c).

The International Society of Physical Activity for Health (ISPAH) recognizes the importance of physical activity for the promotion of public health by placing a key focus on the concept of a “whole of school approach” to physical activity (ISPAH, 2020). Opportunities for physical activity in school range from timetabled physical education provision to co-curricular physical activity and sports. Physical education includes “teaching students a structured curriculum to help them acquire the skills, knowledge and dispositions necessary to be “wise consumers” of physical activity” (Johnson & Turner, 2016 p3; SHAPE America, 2016). Furthermore, physical education is advocated as a primary requirement in all but 23% of countries globally (SHAPE America, 2016; Hardman et al., 2014). For the purpose of this study, the nomenclature of school physical activity refers to any skeletal muscle-driven movement that involves energy expenditure, including extracurricular activities, active recess and active classroom breaks (Caspersen et al., 1985 p126). School sports are underpinned by the ethos of participating in or preparing for school competitions beyond the curriculum, such as track and field, net and invasion games (Bailey, 2005). Previous empirical evidence points to the beneficial properties associated with physical activity outside of school on one’s mental health and wellbeing (McMahon et al., 2017; Monshouwer et al., 2013; Schuch & Vancampfort, 2021). Therefore, International health experts hypothesize

that the impact of typical school provision of physical education, physical activity and sports as a supplementary strategy, may reduce ever-growing health costs and risk factors associated with poor mental health and wellbeing.

The World Health Organization (2018 p17) recognizes schools as integral investments for “lifelong health, active lifestyles, prevention of NCD’s and mental health disorders.” NCD’s are defined as non-communicable diseases e.g., diabetes and heart disease. Mental health disorders are “characterized by a clinically significant disturbance in an individual’s cognition, emotional regulation, or behavior” (World Health Organization, 2022a, 2022b, 2022c p1). Mental health disorders are increasingly more prevalent and as such are considered the second leading risk factor for worldwide burden of illness (Kassebaum et al., 2017) and account for 45% of the burden of disease in adolescent populations (Gore et al., 2011). Much of the evidence pertaining to adolescent mental health is concentrated on negative mental health outcomes, such as depression and anxiety (Murphy et al., 2020). Depression is projected to be a leading risk factor for disability worldwide (Kessler & Bromet, 2013) and is estimated to impact 322 million people globally (World Health Organization, 2017). As such, the sale of antidepressants is the fourth most prescribed drug worldwide, accounting for \$9.9 billion annually (Cruz, 2012). The onset of anxiety is most prevalent in adolescents (Kessler et al., 2007) and is the sixth leading risk factor for disability (Zimmermann et al., 2020). Anxiety is estimated to impact 265 million people globally (World Health Organization, 2017). More commonly discussed now is the concept of wellbeing, which is considered a subgroup of mental health and pertains to positive mental health outcomes, such as life satisfaction and positive mental health (Dienlin & Johannes, 2020). However, the onset of poor mental health in adolescence is now becoming well documented and is substantially more prevalent than any other health disorders (Collishaw, 2009; Vos & Begg, 1999). Thus, strategies to combat poor mental health during this phase of life are imperative.

Although schools are recognized as ideal settings to promote physical activity, reduce poor mental health and increase adolescent wellbeing (ISPAH, 2020), a paucity of evidence exists that synthesizes the impact of typical school provision of physical education, physical activity and sports. Worldwide adoption of school physical education curricula, along with physical activity and sports policies to promote physical activity, is a public health initiative. However, little evidence exists to identify the impact of provision or if the modification to enhance its impact is required. Therefore, a review of the literature that evaluates the impact of typical school provision of physical education, physical activity and sports on adolescent mental health and wellbeing is timely.

## Current Study

Typical school provision of physical education in tandem with opportunities for physical activity and sports, has the potential to effectively respond to the current challenges associated with physical inactivity in adolescents and may have a considerable impact on adolescent mental health and wellbeing. In the context of the current study, “typical” refers to what occurs in the majority of schools with no significant departure from the norm. Provision refers to the underpinning structures and activities involved in providing the physical education curriculum, and opportunities for physical activity and sports participation in secondary schools. The extent and nature of the provision is reflective of the school’s response to the national curriculum, available resources and school ethos. Some evidence regarding the specific nature of typical school provision exists, however, no review of this evidence has been completed to date. Therefore, the present research study is underpinned by the following research questions: (1) How is typical school provision of physical education, physical activity and sports related to adolescent mental health and wellbeing? (2) Is typical school provision of physical education, physical activity and sports impactful on adolescent mental health and wellbeing? (3) Are there robust examples of best practices in schools that positively impact adolescent mental health and wellbeing? (4) Does typical school provision of physical education, physical activity and sports have a greater impact on girls or boys’ mental health and wellbeing? Accordingly, for the purposes of this systematic literature review, a narrative synthesis was applied to the current body of evidence, summarizing the key characteristics that appear to be the most pertinent to impacting adolescent mental health and wellbeing.

## Methods

Reporting in this review was underpinned by the Preferred Reporting Items for Systematic Reviews and Meta-analyses (Page et al., 2021; Shamseer et al., 2015). The review was registered with the International Prospective Register of Systematic Reviews on May 21st, 2021 (ID number CRD42021201202) (Booth et al., 2012).

## Study Eligibility Criteria

Eligible articles included male and/or female adolescent participants with a mean age of between 12 and 18 years up. If an article had participants with a mean age of below 12 or above 18 years, a breakdown for the specific target

population was required in the results section. Eligible articles also included “typical” school provision of physical education, physical activity and sports as an exposure (see earlier definition). Articles that only defined/measured school physical activity and/or sports but not physical education were excluded. Eligible studies included quantitative and/or qualitative measures of mental health and wellbeing with one or more of the following outcome variables: depression, anxiety, self-esteem, self-efficacy, wellbeing, life satisfaction and positive mental health. Articles needed to be peer reviewed and published in English between 2000 and 2022. Systematic literature reviews and meta-analyses were excluded. In intervention studies, control and/or intervention groups pre and post baseline results were utilized (provided they had not received an intervention that caused significant or deliberate change to usual practice). Articles that reported on studies including minor modifications to typical school provision of physical education, physical activity and sports were included e.g., additional time, emphasis on physical activity intensity or teacher support workshops. The setting for the physical education, physical activity and sports exposures had to be in secondary schools (i.e., post-primary, high school), within school time and extended pre and post school physical activity and sports opportunities. The setting for the outcome measures was in and/or outside secondary schools. Outcomes measured within the physical education class only were excluded.

## Sources, Search Strategies and Selection Processes

A systematic search of five electronic databases was performed in May 2021: Web of Science, SPORTDiscus, PsychINFO, ERIC and MEDLINE. Search strategies were completed in collaboration with a university library technician from inception to December 2021. Keyword search terms included: “school”, “provision”, “physical education”, “physical activity”, “sport”, “adolescents”, “wellbeing”, “depression”, “anxiety”, “self-esteem”, “positive mental health” and “life satisfaction”. A comprehensive copy of the search strategy is provided (Online Resource 1). Articles were imported to Rayyan Intelligent Systematic Review online platform where they were stored throughout the screening process (Ouzanni et al., 2016). Duplicates were removed. Screening of titles and abstracts were independently assessed for eligibility by three review authors (PR, LW, AB). Subsequently, full text articles were assessed for eligibility by five review authors (PR, AB, MA et al.). A 10% inter reviewer reliability was incorporated into stage 1 and stage 2 of the screening process which established agreement among reviewers. Disagreements were resolved by consensus. A supplementary search was conducted in November 2022 via (1) updates across five databases (2)

screening reference lists of eligible articles (3) contacting leading experts in the field.

### Quality Assessment and Data Extraction

The tools used to assess the quality of the included articles were (a) Downs and Black checklist and (b) Critical Appraisal Skills Program checklist (Downs & Black, 1998; Critical Appraisal Skills Programme, 2018). The Downs and Black checklist has been validated as a tool for assessing experimental and non-experimental quantitative study designs in the physical activity and health field (Eime et al., 2013; Nugent et al., 2021). The modified checklist included 22 items that were categorized into 5 subscales: reporting (10), external validity (1), internal validity—bias (4), internal validity—confounding (6) and power (1). Items were scored as 1 (compliance) or 0 (non-compliance). Study quality was assessed out of a total of 23 points (distribution of principal confounders were awarded 2 points). Aligning with the methodology outlined by Woods et al., (2021 p4) we “calculated the total percentage of criteria met per study, based on the criteria applicable to the type of study design.” Criteria that was not applicable were scored NA. The Critical Appraisal Skills Program checklist is widely utilized as a tool for assessing qualitative study designs. The modified checklist included 10 items and was assessed out of 10 points (1 for compliance, 0 for non-compliance). Articles were assessed independently by two review authors (PR, BOK) via Covidence software and disagreements were resolved through consensus.

Data were extracted through the use of a customised data extraction table via Covidence, by three review authors (PR, MA, LGG). A 10% inter reviewer reliability was incorporated which established agreement among reviewers. Disagreements were resolved through consensus. The data extraction table included study descriptors, population demographics and data that reported

the relationship between the exposure and outcome variables. Authors of articles were contacted to obtain omitted details where necessary.

### Data Synthesis

Outcome data were tabulated to determine the impact of typical school provision of physical education, physical activity and sports on seven key outcome areas: depression, anxiety, self-esteem, self-efficacy, wellbeing, life satisfaction and positive mental health. Detailed descriptions of each outcome are provided in Table 1. The potential effects of typical school provision of physical education, physical activity and sports on each outcome investigated was established by two independent reviewers (PR, MA) using the method described by Panter et al. (2019). The main reported effects were assessed and extracted for all specified outcomes within each article, based on four levels of effects; significantly positive; significantly negative; inconclusive/no effect or no significant test. Many articles tested multiple outcomes, therefore, the overall evidence of impact was expressed as a percentage of the four effects within each article (i.e., significantly positive; significantly negative; inconclusive/no effect or no significant test). An article was deemed significantly positive when 50% or more of the reported effects were significant and in positive direction, significantly negative when 50% or more of the reported effects were significant and in a negative direction and inconclusive/no effect when 50% or more of the reported effects were non-significant or when results were mixed (both positive and negative). An article was deemed to have no significant test when the reported effects were not supported with a test of significance. Where no test of significance was applied, the direction of the effect was required i.e., positive/negative direction.

**Table 1** Descriptions of the Mental Health and Wellbeing Outcomes Synthesised in this Review

Outcomes	Description
Depression	“Persistent sadness and a lack of interest or pleasure in previously rewarding or enjoyable activities” (World Health Organization, 2021a, 2021b)
Anxiety	Unpleasant feelings of apprehension, tension, stress or thoughts of worry (Spielberger, 2019)
Self-Esteem	“An individual’s subjective value judgment of the self” (Krause et al., 2021 p1)
Self-Efficacy	“Belief in one’s ability to carry out specific tasks successfully” (Graham, 2011 p1)
Wellbeing	One’s experience of positive emotions and overall psychological functioning that is optimal for engaging in daily activities (Deci & Ryan, 2008). For the purpose of the current study, wellbeing was considered as one overall measure of wellbeing i.e., Warwick Wellbeing Scale, The Flourishing Scale etc
Life Satisfaction	“People’s global evaluation of the quality of their life” (Zhang, 2005)
Positive Mental Health	“A state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively” (World Health Organization, 2021a, 2021b, p1). For the purpose of the current study, both positive and negative affective states are included

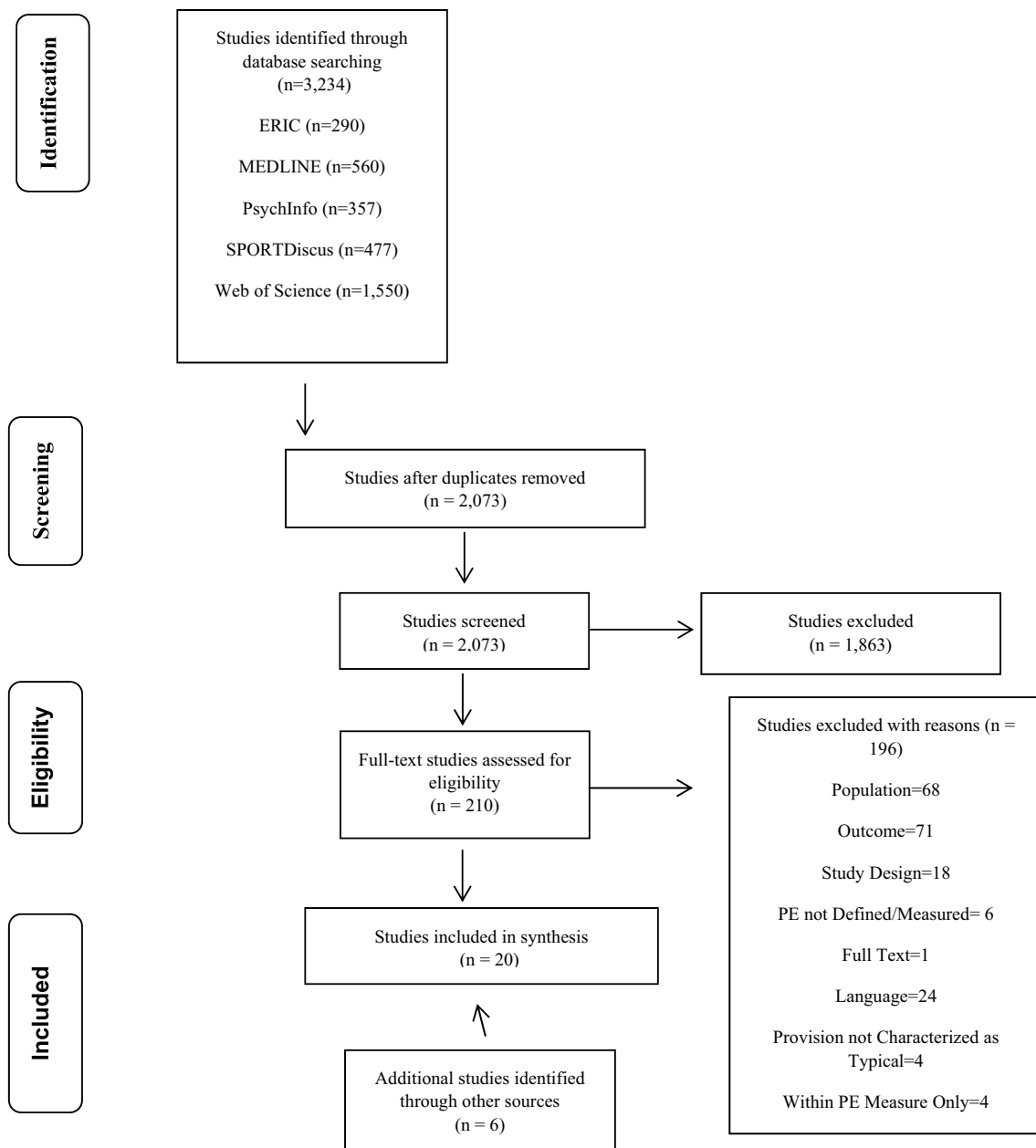


Fig. 1 PRISMA Flowchart of the Study Selection Process

## Results

### Article Identification

The search strategy yielded 3,234 peer reviewed articles (Web of Science = 1,550; SPORTDiscus = 477; PsychINFO = 357; ERIC = 290; MEDLINE = 560). A total of 2,073 articles remained after removing duplicates. Upon completing stage 1 screening of title and abstracts, 210 articles remained for full text review. Upon completion of stage 2 screening of full text articles, 14 articles

were included for analysis. The most common reasons for excluding articles at stage 2 screening were non-targeted outcomes (n = 71), and population (n = 68). A supplementary search of the literature yielded an additional six articles. See Fig. 1 for the study flowchart.

### Study Design and Location

Of the 20 articles included in this review, 13 were interventions (Baena-Extremera et al., 2012; Costigan et al., 2016; Escarti et al., 2010; Felver et al., 2015; Khalsa et al., 2012;

Kiliziene et al., 2018; Koszalka-Silaska et al., 2021; Lai et al., 2009; Lima et al., 2022; Lang et al., 2016; Luna et al., 2019; Mendez-Gimenez et al., 2022; Ruiz-Ariza et al., 2019), five were cross-sectional (Barney et al., 2019; Bertillis et al., 2018; Jochimek & Lada, 2019; Park et al., 2020; Uchoa et al., 2020) and two were longitudinal (Mastagli et al., 2020; Mendez-Gimenez et al., 2019). Twelve studies were conducted in European countries (Baena-Extremera et al., 2012; Bertillis et al., 2018; Escarti et al., 2010; Jochimek & Lada, 2019; Kiliziene et al., 2018; Koszalka-Silaska et al., 2021; Lang et al., 2016; Luna et al., 2019; Mastagli et al., 2020; Mendez-Gimenez et al., 2022; Mendez-Gimenez et al., 2019; Ruiz-Ariza et al., 2019), three in the USA (Barney et al., 2019; Felver et al., 2015; Khalsa et al., 2012), two in Brazil (Lima et al., 2022; Uchoa et al., 2020) and one in Australia (Costigan et al., 2016), Taiwan (Lai et al., 2009) and South Korea (Park et al., 2020). All articles were published in 2009 or later with sixteen of the twenty published in 2015 or later.

## Population

The number of schools sampled in each article ranged from 1 to 400, with a combined total of 453 schools and a mean of 22 schools per article. Sample sizes ranged from 30 to 28,451 participants, with a combined total of 34,250 and a mean of 1712 participants per article. The mean age of the included participants ranged from 13 to 17 years. Eighteen articles had a mixed gender sample.

## Exposure

Articles typically reported on the physical education curriculum with 19 of the 20 articles reporting this as a primary exposure (Baena-Extremera et al., 2012; Barney et al., 2019; Costigan et al., 2016; Escarti et al., 2010; Felver et al., 2015; Jochimek & Lada, 2019; Khalsa et al., 2012; Kiliziene et al., 2018; Koszalka-Silaska et al., 2021; Lai et al., 2009; Lima et al., 2022; Lang et al., 2016; Luna et al., 2019; Mastagli et al., 2020; Mendez-Gimenez et al., 2022; Mendez-Gimenez et al., 2019; Park et al., 2020; Ruiz-Ariza et al., 2019; Uchoa et al., 2020). For the purpose of this study, physical education curriculum is described as a standard physical education class in accordance with the national physical education curriculum of the specified country or state. Additional typical school provision of physical education and physical activity exposures included teaching skills, lesson planning, long-term planning, grading, prerequisites climate (Bertillis et al., 2018) and active recess (Costigan et al., 2016). Interventions with a modification to typical provision of physical education included the implementation of an adventure education programs (Baena-Extremera et al., 2012; Koszalka-Silaska et al., 2021), resistance and

aerobic exercise program (Costigan et al., 2016), the use of a range of curriculum models (Escarti et al., 2010; Luna et al., 2019; Mendez-Gimenez et al., 2022), additional class time, physical education teacher workshops (Lima et al., 2022), high intensity interval training (Ruiz-Ariza et al., 2019) and the infusion of self-esteem building activities (Lai et al., 2009). Of the 12 included interventions, the experimental group exposure was deemed outside the realms of typical provision in four (Felver et al., 2015; Khalsa et al., 2012; Kiliziene et al., 2018; Lang et al., 2016) and therefore, just the control groups were included. There were zero sports exposures found in this review.

## Outcomes

A description of the outcomes is reported in Table 1. Depression was examined in three articles (Felver et al., 2015; Khalsa et al., 2012; Lima et al., 2022), anxiety in nine articles (Barney et al., 2019; Costigan et al., 2016; Khalsa et al., 2012; Kiliziene et al., 2018; Lima et al., 2022; Lang et al., 2016; Luna et al., 2019; Mastagli et al., 2020; Park et al., 2020), self-esteem in six articles (Baena-Extremera et al., 2012; Jochimek & Lada, 2019; Khalsa et al., 2012; Kiliziene et al., 2018; Koszalka-Silaska et al., 2021; Lai et al., 2009; Uchoa et al., 2020), self-efficacy in two articles (Bertillis et al., 2018; Escarti et al., 2010), wellbeing in three articles (Costigan et al., 2016; Luna et al., 2019; Ruiz-Ariza et al., 2019), life satisfaction in three articles (Khalsa et al., 2012; Mendez-Gimenez et al., 2022; Mendez-Gimenez et al., 2019) and positive mental health in three articles (Felver et al., 2015; Luna et al., 2019; Mendez-Gimenez et al., 2019). All 20 articles used quantitative methods (e.g., surveys, many with recognised external validity) to measure each outcome variable (Baena-Extremera et al., 2012; Barney et al., 2019; Bertillis et al., 2018; Costigan et al., 2016; Escarti et al., 2010; Felver et al., 2015; Jochimek & Lada, 2019; Khalsa et al., 2012; Kiliziene et al., 2018; Koszalka-Silaska et al., 2021; Lai et al., 2009; Lima et al., 2022; Lang et al., 2016; Luna et al., 2019; Mastagli et al., 2020; Mendez-Gimenez et al., 2022; Mendez-Gimenez et al., 2019; Park et al., 2020; Ruiz-Ariza et al., 2019; Uchoa et al., 2020). Qualitative methods were also utilized in two articles (Barney et al., 2019; Escarti et al., 2010). Where possible, all data were expressed in the context of main reported effects.

## Quality Assessment

All 20 articles were assessed for quality using a modified Downs and Black checklist for quantitative studies by two reviewers (PR, BOK) (Downs & Black, 1998; Nugent et al., 2021). Three articles were given a rating of 'excellent' (85–100%), six articles were given a rating of 'good' (70–84%), nine articles were given a rating of fair (55–69%)

and two articles were given a rating of ‘poor’ (<55%). The mean quality assessment score was 69% (fair). None of the articles demonstrated external validity by ensuring the sample was representative of the entire population from which they were recruited. Two articles provided a power calculation to demonstrate an adequate sample size (see Table 2). Two articles were mixed method studies, therefore, were also assessed for quality using the Critical Appraisal Skills Program by two review authors (PR, BOK) (Critical Appraisal Skills Programme, 2018). Both articles had a rating of ‘good’ (70–84%). The mean quality assessment score was 80% (good).

## Summary of Findings

This section provides an overview of the main findings presented in Table 3. Included articles (n=20) contributed a total of 108 reported effects between typical school provision

of physical education, physical activity and sports and adolescent mental health and wellbeing. The evidence indicated that 26% of the overall reported effects were significantly positive (n=28 effects), 65% were non-significant (n=70 effects), 7% were significantly negative (n=8 effects), and 2% had no significant test applied (n=2 effects). Of the reported effects that indicated no significant test, both demonstrated a negative direction.

The impact summary of the reported effects within each article indicated that 15% were significantly positive (n=3 articles) (Baena-Extremera et al., 2012; Mastagli et al., 2020; Ruiz-Ariza et al., 2019), 70% were inconclusive/no effect (n=14 articles) (Bertillis et al., 2018; Costigan et al., 2016; Escarti et al., 2010; Felver et al., 2015; Jochimek & Lada, 2019; Khalsa et al., 2012; Kiliziene et al., 2018; Koszalka-Silaska et al., 2021; Lai et al., 2009; Lima et al., 2022; Luna et al., 2019; Mendez-Gimenez et al., 2019; Park et al., 2020; Uchoa et al., 2020), 10% were significantly negative (n=2

**Table 2** Summary of Downs and Black and Critical Appraisal Skills Program Checklist Quality Assessment Score

Study	Reporting (10 items)	External Validity (1 item)	Internal Validity (Bias) (4 items)	Internal Validity (Confounding) (6 items)	Power (1 item)	Total Score	CASP Qualitative Rating	Quality Rating
Baena-Extremera et al., 2012	8	0	3	3	0	14/23 (60%)	NA	Fair
Barney et al. 2019	8	0	2	1	0	11/14 (79%)	8/10 (80%)	Good
Bertillis et al., 2018	7	0	2	0	0	9/15 (60%)	NA	Fair
Costigan et al., 2016	10	0	4	5	1	20/23 (87%)	NA	Excellent
Escarti et al., 2010	7	0	4	2	0	13/25 (57%)	8/10 (80%)	Fair
Felver et al., 2015	10	0	4	1	0	15/23 (65%)	NA	Fair
Jochimek & Lada, 2019	9	0	2	1	0	12/14 (86%)	NA	Excellent
Khalsa et al., 2012	10	0	4	4	0	18/23 (78%)	NA	Good
Kiliziene et al., 2018	7	0	3	2	0	12/23 (52%)	NA	Poor
Koszalka-Silaska et al., 2021	10	0	4	3	0	17/23 (74%)	NA	Good
Lai et al., 2009	9	0	4	1	0	14/23 (61%)	NA	Fair
Lang et al., 2016	9	0	4	4	0	17/23 (74%)	NA	Good
Lima et al., 2022	7	0	4	3	1	15/23 (65%)	NA	Fair
Luna et al., 2019	8	0	4	2	0	14/23 (61%)	NA	Fair
Mastagli et al., 2020	9	0	4	3	0	16/20 (80%)	NA	Good
Mendez-Gimenez et al., 2019	9	0	1	1	0	11/20 (55%)	NA	Fair
Mendez-Gimenez et al., 2022	7	0	4	2	0	12/23 (52%)	NA	Poor
Park et al., 2020	9	0	2	1	0	12/14 (86%)	NA	Excellent
Ruiz-Ariza et al., 2019	9	0	4	2	0	15/23 (65%)	NA	Fair
Uchoa et al., 2020	8	0	2	1	0	11/14 (79%)	NA	Good

Quality rating of excellent (85–100%), good (70–84%), fair (55–69%) or poor (<55%) (Woods et al., 2021)

**Table 3** Summary Findings of Included Studies

Reference, Country, Study Design, QR	School Level, Pupils Age, School Number, Total Students, Aim	PE, PA, Sport Exposure	Outcome Measure, Instrument	Summary Result	Main Reported Effects, Impact Summary	Conclusion/Nuance
Baena-Extremera et al., (2012)  Spain Quasi Experiment QR: 60%	Secondary School 15.67 (±0.71) 1 School 125 Pupils/59 (Boys), 66 (Girls)  Aim: To analyse the intrinsic classroom satisfaction, physical self-concept and social goals in students after receiving a 9-week adventure education programme.	1. PE Curriculum  Typical PE class with a programme of games and sports (Control)  Typical PE class, Adventure Education Programme (Intervention)	1. Self-Esteem  Physical Self-Concept Questionnaire	Sig difference in favor of the experimental group versus the control group for self-esteem ( $p < .000$ , $R^2 = .29$ ) at follow up. <sup>c</sup>	Significantly Positive	Overall positive significant effect of the experimental program (Adventure Education) compared to the control for self-esteem.
				Sig difference between baseline and follow up for self-esteem in the experimental group ( $p < .000$ , $R^2 = .20$ ). <sup>c</sup>	Significantly Positive	
				No Sig difference between baseline and follow up for self-esteem in the control group ( $p > .05$ ). <sup>c</sup>	Non-Significant  <b>Significantly Positive Effects</b>	
Barney & Pleban (2019)  USA Cross-sectional QR: 79% (Quant) / 80% (Qual)	Secondary School 11-15 (no mean) 4 Schools 872 Pupils/ 585 (Boys), 287 (Girls)  Aim: To explore grade-level differences (7 <sup>th</sup> , 8 <sup>th</sup> , and 9 <sup>th</sup> ) among junior high school students' perceptions of the effects of participation in PE class on individual environmental stress.	1. PE Curriculum  Participation in typical PE class.	1. Stress  X4 Question Survey.	<b>Quantitative:</b> <b>Differences Across Grade Level</b>		Overall younger students (i.e., 7 <sup>th</sup> class, compared to 8 <sup>th</sup> and 9 <sup>th</sup> class) reported lower stress levels related to the PE class.  Although there were significantly negative effects across grade level, all pupils were found to have reduced stress levels post PE class.
				Q1 "When I come to this PE class, I forget about what is stressing me out". Sig decrease across grade level ( $p < .01$ , Cramer's $V = 0.08$ ). <sup>b</sup>	Significantly Negative	
				Q2 "After participating in the class activities, I feel I can handle what is stressing me out". Sig decrease across grade level ( $p < .10$ , Cramer's $V = 0.10$ ). <sup>b</sup>	Significantly Negative	
				Q3 "Rate your stress when you arrive to PE class". Sig decrease across grade level ( $p < .001$ , Cramer's $V = 0.11$ ). <sup>b</sup>	Significantly Negative	
Q4 "Rate your stress after you have finished participating in your PE class". Sig decrease across grade level ( $p < .01$ , Cramer's $V = 0.11$ ). <sup>b</sup>	Significantly Negative	<b>Significantly Negative Effects</b>				
				<b>Qualitative:</b>  Sometimes I forget about my stress after doing fun things in PE.  Running makes me calm.  After working out, my brain is empty and refreshed.		
Bertillis et al., (2018)  Sweden Cross-sectional QR: 60%	Secondary School 13 (No SD) 23 Schools 439 Pupils/ 224 (Boys), 215 (Girls)  Aim: To investigate the relationship between PE teaching and student self-efficacy, in three groups: students with disabilities, students with low grades in PE and students with high grades in PE.	1. Teaching Skills 2. Lesson Planning 3. Long-Term Plan 4. Grading 5. Prerequisites Climate	1. General Self-Efficacy  The General Self-Efficacy Scale	No Sig correlation between general self-efficacy and teaching skills, lesson planning, long-term plan, grading and prerequisites for the total sample ( $p > .05$ ). <sup>d</sup>	Non-Significant	Students with disabilities diverged from other groups in displaying predominantly negative correlations.
				Sig correlation between general self-efficacy and climate for the total sample ( $p < .05$ ). <sup>d</sup>	Significantly Positive	
				No Sig correlation between general self-efficacy and teaching skills, lesson planning, long-term plan, grading, prerequisites and climate for the sample with disabilities ( $p > .05$ ). <sup>d</sup>	Non-Significant	
				No Sig correlation between general self-efficacy and teaching skills, lesson planning, long-term plan, grading, prerequisites and climate for sample with high grades ( $p > .05$ ). <sup>d</sup>	Non-Significant	
				No Sig correlation between general self-efficacy and teaching skills, lesson planning, long-term plan, grading, prerequisites and climate for sample with low grades ( $p > .05$ ). <sup>d</sup>	Non-Significant  <b>Inconclusive/ No Effect</b>	
Costigan et al., (2016)  RCT Australia QR: 83%	Secondary School 15.8 (± 0.6) 1 School 65 Pupils/ 45 (Boys), 20 (Girls)  Aim: To evaluate the efficacy of two high intensity interval training (HIIT) protocols for improving cognitive and mental health outcomes.	1. PE Curriculum/Active Recess  Participation in typical PE class and lunchtime activities (Control).  2. PE Curriculum/Active Recess  Aerobic Exercise Program (Intervention Condition 1 (AEP))	1. Psychological Wellbeing 2. Psychological Distress  Flourishing Scale  The Kessler Psychological Distress Scale	No sig difference between the control and AEP experimental group for psychological wellbeing ( $p = 0.25$ , Cohens $D = 0.34$ ) at follow up. <sup>c</sup>	Non-Significant	While evidence highlights the potential of embedding HIIT within the school day for improving adolescent wellbeing, no significant findings emerged.
				No sig difference between the control and AEP experimental groups for psychological distress ( $p = 0.73$ , Cohens $D = 0.11$ ) at follow up. <sup>b</sup>	Non-Significant	
				No sig difference between the control and RAP experimental group for psychological wellbeing ( $p = 0.21$ , Cohens $D = 0.35$ ) at follow up. <sup>c</sup>	Non-Significant	
					Non-Significant	



Table 3 (continued)

		Resistance and Aerobic Exercise Program (Intervention Condition 2 (RAP))		No sig difference between the control and RAP experimental groups for psychological distress (p=0.89, Cohens D=0.04) at follow up. <sup>b</sup>	Inconclusive / No Effect	
<p><b>Escarti et al., (2010)</b></p> <p><b>RCT</b></p> <p><b>Spain</b></p> <p><b>QR: 57% (Quant) / 80% (Qual)</b></p>	<p>Secondary School 15.2 (± 0.40)</p> <p>2 Schools</p> <p>30 Pupils/ 23 (Boys), 7 (Girls).</p> <p>Aim: This study evaluated improvement in self-efficacy and personal and social responsibility among at risk of dropping out of school adolescents participating in a program in which Hellison's Teaching personal and Social Responsibility Model was applied in PE classes during the course of an academic year.</p>	<p><b>1. PE Curriculum</b></p> <p>Participation in typical PE class (control).</p> <p>Participation in typical PE class using the TPSR model (Intervention).</p>	<p><b>Perceived Self-Efficacy</b></p> <p>1.Enlisting Social Resources</p> <p>2.Self-Regulated Learning</p> <p>3.Self-Regulatory Efficacy</p> <p>4.Social Self-Efficacy</p> <p>The Multidimensional Scales of Perceived Self-Efficacy.</p>	<p><b>Quantitative:</b></p> <p>No Sig difference between baseline and follow up for self-efficacy of enlisting social resources in the experimental group (p=.43). <sup>d</sup></p>	Non-Significant	<p>Quantitative results showed a significant improvement in the students' self-efficacy for enlisting social resources and in self-efficacy for self-regulated learning.</p>
				No Sig difference between the control and experimental group for self-efficacy of enlisting social resources (p=.07). <sup>d</sup>	Non-Significant	
				Sig group x time interaction effect for self-efficacy for enlisting social resources in favor of the experimental group (p=.01). <sup>d</sup>	Significantly Positive	
				No Sig difference between baseline and follow up for self-regulated learning in the experimental group (p=.42). <sup>d</sup>	Non-Significant	
				No Sig difference between the control and experimental group for self-regulated learning (p=.18). <sup>d</sup>	Non-Significant	
				Sig group x time interaction effect for self-regulated learning in favor of the experimental group (p=.02, n <sup>2</sup> =.118). <sup>d</sup>	Significantly Positive	
				No Sig difference between baseline and follow up for self-regulatory efficacy in the experimental group (p=.20). <sup>d</sup>	Non-Significant	
				Sig difference between the control and experimental group for self-regulatory efficacy (p=.00). <sup>d</sup>	Significantly Positive	
				No Sig group x time interaction effect for self-regulatory efficacy (p=.14). <sup>d</sup>	Non-Significant	
				Sig difference between baseline and follow up for social self-efficacy in the experimental group (p=.00, n <sup>2</sup> =.23). <sup>d</sup>	Significantly Positive	
				No Sig difference between the control and experimental group for social self-efficacy (p=.15). <sup>d</sup>	Non-Significant	
				No Sig group x time interaction effect for social self-efficacy (p=.70). <sup>d</sup>	Inconclusive / No Effect	
<b>Qualitative:</b>						
Improved self-control in situations of conflict and respect for others.						
Improvements in self-criticism.						
Some of the members of the class have improved in their behavior while others have not, changes in the majority are evident.						
<p><b>Felver et al., (2015)</b></p> <p><b>Intervention</b></p> <p><b>USA</b></p> <p><b>QR: 65%</b></p>	<p>Secondary School 15 (± 9 months)</p> <p>1 School</p> <p>47 Pupils / 23 (Boys), 24 (Girls)</p> <p>Aim: To directly compare the acute effects of participating in a single yoga class versus a single standard PE class on student mood.</p>	<p><b>1. PE Curriculum</b></p> <p>Participation in typical PE class, 'Capture the Flag' (Control)</p>	<p>1.Depression</p> <p>2.Positive Affect</p> <p>3.Negative Affects</p>	No sig difference between baseline and follow up for depression in the control group (p=.57, Cohens D =.13). <sup>a</sup>	Non-Significant	<p>Intervention groups are not considered 'typical' PE in this study; therefore, they are excluded.</p>
			Brunel University Mood Scale	No sig difference between baseline and follow up for positive affect in the control group (p=.30, Cohens D =.11). <sup>g</sup>	Non-Significant	
			Positive and Negative Affect scale for Children	No sig difference between baseline and follow up for negative affect in the control group (p=.11, Cohens D =.19). <sup>g</sup>	Non-Significant	
<p><b>Jochimek &amp; Lada (2019)</b></p> <p><b>Cross-sectional</b></p> <p><b>Poland</b></p> <p><b>QR: 86%</b></p>	<p>Secondary School 15.96 (± 0.30)</p> <p>NA</p> <p>514 pupils/ 192 (Boys), 322 (Girls)</p> <p>Aim: To analyse the levels of aggression and self-esteem in adolescents</p>	<p><b>1. PE Curriculum</b></p> <p>Participation in typical PE class.</p>	1.Self-Esteem	No Sig difference between boys' and girls' self-esteem (p>.05). <sup>c</sup>	Non-Significant	<p>Inconclusive / No Effect</p>
			Rosenberg Self-Esteem Scale			

**Table 3** (continued)

	characterised by different levels of physical activity.					
<b>Khalsa et al., (2012)</b>	Secondary School 16.80 (± 0.60)	<b>1. PE Curriculum</b>	1. Social Stress 2. Anxiety 3. Depression 4. Self-Esteem 5. Test Anxiety 6. Tension/Anxiety 7. Depression/Dejection 8. Life Satisfaction 10. Perceived Stress	No Sig difference between baseline and follow up for social stress in the control group (p<.05). <sup>b</sup>	Non-Significant	Intervention groups are not considered 'typical' PE in this study; therefore, they are excluded.
<b>Intervention USA QR: 78%</b>	1 School 121 pupils/ 70 (Boys), 51 (Girls)	Participation in typical PE class (Control)		No Sig difference between baseline and follow up for anxiety in the control group (p<.05). <sup>b</sup>	Non-Significant	
	Aim: To evaluate potential mental health benefits of yoga for adolescents in secondary school.			No Sig difference between baseline and follow up for depression/dejection in the control group (p<.05). <sup>a</sup>	Non-Significant	
			Inventory of Positive Psychological Attitudes (provides a total score for self-confidence during stress, life purpose and satisfaction)	No Sig difference between baseline and follow up for self-esteem in the control group (p<.05). <sup>c</sup>	Non-Significant	
			The Self-Report of Personality Scale, The Profile of Mood States Short Form, The Resilience Scale, The Perceived Stress Scale.	No Sig difference between baseline and follow up for test anxiety in the control group (p<.05). <sup>b</sup>	Non-Significant	
				No Sig difference between baseline and follow up for tension anxiety in the control group (p<.05). <sup>b</sup>	Non-Significant	
				No Sig difference between baseline and follow up for depression/dejection in the control group (p<.05). <sup>a</sup>	Non-Significant	
				No Sig difference between baseline and follow up for life satisfaction in the control group (p<.05). <sup>f</sup>	Non-Significant	
				No Sig difference between baseline and follow up for perceived stress in the control group (p<.05). <sup>b</sup>	Non-Significant	
					<b>Inconclusive / No Effect</b>	
<b>Kilziene et al., (2018)</b>	Secondary School 14-15 years (No SD)	<b>1. PE Curriculum</b>	1. Self-Esteem 2. Somatic Anxiety 3. Personality Anxiety 4. Social Anxiety	No Sig difference between baseline and follow up for self-esteem in the control group (p>.05). <sup>c</sup>	Non-Significant	Intervention groups are not considered 'typical' PE in this study; therefore, they are excluded.
<b>Intervention Lithuania QR: 52%</b>	1 School 428 pupils/ 219 (Boys), 209 (Girls)	Participation in typical PE class (Control)		Sig difference between baseline and follow up for social anxiety in the control group (p<.05). <sup>b</sup>	Significantly Positive	
	Aim: This study investigated the psychosocial adjustment and anxiety of adolescents during a 7-month exercise intervention.		Rogers and Dymond's Psychological Adjustment Questionnaire	No Sig difference between baseline and follow up for somatic anxiety and personality anxiety in the control group (p>.05). <sup>b</sup>	Non-Significant	
			Reynolds and Richmond's Anxiety Scale		<b>Inconclusive / No Effect</b>	
<b>Koszalka-Silaska et al., (2021)</b>	Secondary School 15.80 (± 0.40)	<b>1. PE Curriculum</b>	1. Self-Esteem	No Sig difference between baseline and follow up for self-esteem in the control group (p>.05). <sup>c</sup>	Non-Significant	Participation in the program does not improve the students' self-esteem, but comparing the experimental group, it positively influences the stability of this trait, while in the control group it tends to decrease.
<b>Intervention Poland QR: 74%</b>	1 School 70 pupils/ 70 (Boys), 0 (Girls)	Participation in typical PE class (Control)	Rosenberg Self-Esteem Scale	No Sig difference between baseline and follow up for self-esteem in the experimental group (p>.05). <sup>c</sup>	Non-Significant	
	Aim: To analyse the impact of physical education based on the adventure education programme on the social competences of adolescent boys.	Participation in typical PE class, Adventure Programme (Intervention)		No Sig main effect for group (p=0.13, Cohens D = 0.03) and for time (p=0.47, Cohens D = 0.01) between baseline and follow up for self-esteem. <sup>c</sup>	Non-Significant	
				No Sig interaction between time and group (p=0.77, Cohens D = <0.01) for self-esteem. <sup>c</sup>	Non-Significant	
					<b>Inconclusive / No Effect</b>	
<b>Lai et al., (2009)</b>	Secondary School 11-13 years (No SD)	<b>1. PE Curriculum</b>	1. General Self-Esteem 2. Academic Self-Esteem 3. Physical Self-Esteem 4. Social Self-Esteem 5. Family Self-Esteem	<b>Total Group:</b> Non sig difference between the control and experimental groups for global self-esteem, academic self-esteem, social self-esteem and family self-esteem (p >.05). <sup>c</sup>	Non-Significant	While there is preliminary evidence to suggest that incorporating self-esteem activities into the typical school health and physical education curriculum can result in significantly positive effects in students' physical self-esteem and family self-esteem, no effects were found for general, social or academic social-esteem.
<b>Intervention Taiwan QR: 61%</b>	2 Schools 184 pupils/ 99 (Boys), 85 (Girls)	Participation in typical PE class (Control)	The Rosenberg Scale	Sig difference in favor of the experimental group versus the control group for physical self-esteem (p <.05). <sup>c</sup>	Significantly Positive	
	Aim: To explore the effects on junior high school students' self-esteem program incorporated into the general health and physical education curriculum.	Participation in typical PE class, Self-Esteem activities (Intervention)		<b>Boys Group:</b> Non sig difference between the control and experimental groups for global self-esteem, academic self-esteem, physical self-esteem, social self-esteem and family self-esteem (p >.05). <sup>c</sup>	Non-Significant	
				<b>Girls Group:</b>		

Table 3 (continued)

				Non sig difference between the control and experimental groups for global self-esteem, academic self-esteem, physical self-esteem, social self-esteem ( $p > .05$ ). <sup>c</sup>	Non-Significant
				Sig difference in favor of the experimental group versus the control group for family self-esteem ( $p < .05$ ). <sup>c</sup>	Significantly Positive
					<b>Inconclusive / No Effect</b>
<b>Lima et al., (2022)</b>	Secondary School 14-16 (No SD)	<b>1. PE Curriculum</b>	1. Depression	No Sig difference between baseline and follow up for depression or social anxiety in the control group ( $p > .05$ ). <sup>h</sup>	Non-Significant
<b>Cluster RCT</b>	1 School	Participation in typical PE class (Control)	2. Social Anxiety	No Sig difference between baseline and follow up for depression or social anxiety in intervention condition 1 ( $p > .05$ ). <sup>h</sup>	Non-Significant
<b>Brazil</b>	1,296 pupils/ 572 (Boys), 724 (Girls)			No Sig difference between baseline and follow up for depression or social anxiety in intervention condition 2 ( $p > .05$ ). <sup>h</sup>	Non-Significant
<b>QR: 65%</b>		<b>2. PE Curriculum</b>	The Depression Scale of the Center for Epidemiologic Studies	No Sig difference between baseline and follow up for depression or social anxiety in intervention condition 3 ( $p > .05$ ). <sup>h</sup>	Non-Significant
	Aim: To investigate the effects of three different interventions on depressive symptoms in adolescents.	Doubling PE Class time (Intervention Condition 1)	Social Anxiety Scale for Adolescents	No Sig difference between the control and experimental group (condition 1) for depression ( $p = .41$ ) and social anxiety ( $p = .75$ ). <sup>h</sup>	Non-Significant
		PE Teacher Workshop (Intervention Condition 2)		Sig difference in favor of the experimental group (condition 2) versus the control group for depression ( $p = .02$ ). <sup>a</sup>	Significantly Positive
		Doubling PE Class time and a PE Teacher Workshop (Intervention Condition 3)		No Sig difference between the control and experimental group (condition 2) for social anxiety ( $p = .64$ ). <sup>b</sup>	Non-Significant
				No Sig difference between the control and experimental group (condition 3) for depression ( $p = .54$ ) and social anxiety ( $p = .43$ ). <sup>h</sup>	Non-Significant
				The experimental group (condition 1) did not Sig lower the risk of adolescents developing high depressive symptomology when compared with the control group ( $p = .56$ ). <sup>a</sup>	Non-Significant
				The experimental group (condition 2) lowered in 93% the risk of adolescents developing high depressive symptomology when compared with the control group ( $p = .02$ ). <sup>a</sup>	Significantly Positive
				The experimental group (condition 3) lowered in 54% the risk of adolescents developing high depressive symptomology when compared with the control group ( $p = .03$ ). <sup>a</sup>	Significantly Positive
				The experimental group (condition 1,2,3) did not Sig lower the risk of adolescents developing low depressive symptomology when compared with the control group ( $p = .82$ ; $p = .65$ ; $p = .63$ ). <sup>a</sup>	Non-Significant
					<b>Inconclusive / No Effect</b>
<b>Lang et al., (2016)</b>	Secondary School 16.22 ( $\pm 1.12$ )	<b>1. PE Curriculum</b>	1. Perceived Stress	Mean perceived stress increased from 5.82 $\pm$ 1.57 at baseline to 5.98 $\pm$ 1.57 post-test. <sup>b</sup>	Negative Direction/No Significant Test
<b>Intervention</b>	1 School	Participation in typical PE class (Control)	Adolescents Stress Questionnaire	Mean perceived stress increased from 5.82 $\pm$ 1.57 at baseline to 6.10 $\pm$ 1.69 follow-up six months later. <sup>b</sup>	Negative Direction/No Significant Test
<b>Switzerland</b>	131 pupils/ 85 (Boys), 46 (Girls)				<b>Negative Direction/No Significant Test</b>
<b>QR: 74%</b>					
	Aim: To implement a coping training program (EPHECT) within regular PE and to evaluate its effects on coping and stress among vocational students.				Intervention groups are not considered 'typical' PE in this study; therefore, they are excluded.
<b>Luna et al., (2019)</b>	Secondary School 13.82 ( $\pm 0.79$ )	<b>1. PE Curriculum</b>	1. Social Anxiety	No Sig difference between baseline and follow up for subjective wellbeing ( $p > .05$ ). <sup>c</sup>	Non-Significant
<b>Quasi-Experiment</b>	1 Secondary School	Participation in typical PE class (Control)	2. Wellbeing	No Sig difference between baseline and follow up for positive effect scores ( $p > .05$ ). <sup>g</sup>	Non-Significant
<b>Spain</b>	113 pupils/ 64 (Boys), 49 (Girls)		3. Positive Affect	No Sig difference between the control and experimental groups for social anxiety ( $p = .06$ , $\mu^2 = 0.14$ ) at follow up. <sup>b</sup>	Non-Significant
<b>QR: 61%</b>		Typical PE class, learning via the sport education model structure (Intervention)	4. Negative Affect		Significantly Positive
	Aim: This study aimed to evaluate the impact of a physical-sport education pilot programme on adolescents' subjective well-being (health-related		Social Anxiety Scale for Adolescents		
			Kidscreen 10 Index Subjective Health Related Quality of Life and Wellbeing		

Table 3 (continued)

	quality of life, positive affect and negative affect), trait emotional intelligence and social anxiety.		The Positive and Negative Affect Schedule	Sig difference in favor of the experimental group versus the control group for subjective wellbeing ( $p=.01, \mu^2=.0.07$ ) at follow up. <sup>c</sup>	Significantly Positive	
				Sig difference in favor of the experimental group versus the control group for negative affect ( $p=.01, \mu^2=.0.12$ ) at follow up. <sup>g</sup>	Significantly Positive	
				Sig difference in favor of the experimental group versus the control group for positive affect ( $p=.01, \mu^2=.0.14$ ) at follow up. <sup>g</sup>	Inconclusive / No Effect	
<b>Mastagli et al., (2020)</b>	Secondary School Formative Assessment Group 14.95 ( $\pm 0.50$ )	<b>1. PE Curriculum</b>	1.State Anxiety	No Sig difference between formative assessment and summative assessment groups for trait ( $p=.44$ ) or state ( $p=.94$ ) anxiety in the first lesson. <sup>b</sup>	Non-Significant	Formative assessment class felt less anxiety than the summative assessment class at the end of the learning cycle. Four months later, the summative assessment class's anxiety remained the same while the formative assessment class's anxiety had improved.
<b>Longitudinal France QR: 80%</b>	Summative Assessment Group 15.14 ( $\pm 0.64$ ) 2 Schools 33 pupils/ NA (Boys), NA (Girls)	Formative and Summative Assessment.	2.Trait Anxiety	Sig difference in favor of the formative assessment group versus the summative assessment group for state anxiety ( $p=.04, n^2=.09$ ) in the last lesson. <sup>b</sup>	Significantly Positive	
	Aim: To compare the effects of summative and formative assessments on students' state-anxiety, and shot-put performance in physical education.		State-Trait Anxiety Inventory	No Sig difference between the formative assessment and summative assessment groups for state anxiety ( $p=.78$ ) during the deferred evaluation (4 months later). <sup>b</sup>	Non-Significant	
				Sig difference between lesson 1 and lesson 5 for state anxiety in the formative assessment class ( $p=.01, n^2=.47$ ). <sup>b</sup>	Significantly Positive	
				No Sig difference between lesson 1 and lesson 5 for state anxiety in the summative assessment class (no data provided). <sup>b</sup>	Non-Significant	
				Sig difference between lesson 1 and the deferred evaluation (4 months later) for state anxiety in the formative assessment class ( $p=.00, n^2=.35$ ). <sup>b</sup>	Significantly Positive	
				No Sig difference between lesson 1 and the deferred evaluation (4 months later) for state anxiety in the summative assessment class (no data provided). <sup>b</sup>	Non-Significant	
				Sig difference for time effects in favor of the formative assessment group versus the summative assessment group from lesson 1 to lesson 5 for state anxiety ( $p=.05, n^2=.09$ ). <sup>b</sup>	Significantly Positive	
				Sig difference in time effects in favor of the formative assessment group versus the summative assessment group from lesson 1 to the deferred evaluation for state anxiety (4 months later) ( $p=.02, n^2=.12$ ). <sup>b</sup>	Significantly Positive	
					—	
					Significantly Positive	
<b>Mendez-Gimenez et al., (2019)</b>	Secondary School 13.03 ( $\pm 0.93$ ) 6 Schools 282 pupils/ 151 (Boys), 131 (Girls)	<b>1. PE Curriculum</b>	1.Positive Affect 2.Negative Affect 3.Satisfaction with Life	Sig group x time interaction effect for satisfaction with life in favor of the high emotional intelligence group (cluster 1) during a full year of PE ( $p<.001, \eta^2=.05$ ). <sup>f</sup>	Significantly Positive	
<b>Longitudinal Spain QR: 55%</b>	Aim: The objectives of this study were three: (a) to explore emotional intelligence profiles of adolescents; (b) to examine how these profiles relate to different types of motivation, basic psychological needs, friendship goals, subjective wellbeing and intentions to be physically active; and (c) to analyze how these emotional profiles evolve during a full year in physical education contexts.	Participation in typical PE class (Control)	Positive and Negative Affection for Children and Adolescents	No Sig group x time interaction effect for positive affect ( $p=.05, \eta^2=.01$ ). <sup>g</sup>	Non-Significant	
			Satisfaction with Life Questionnaire	No Sig group x time interaction effect for negative affect ( $p=.71, \eta^2=.00$ ). <sup>g</sup>	Non-Significant	
					—	
					Inconclusive / No Effect	
<b>Mendez-Gimenez et al., (2022)</b>	Secondary School 13.88 ( $\pm 1.68$ ) 1 School 212 pupils/ 123 (Boys), 89 (Girls)	<b>1. PE Curriculum</b>	1. Life Satisfaction	No Sig difference main time effect for satisfaction with life for grade 7 ( $p>.05$ ). <sup>f</sup>	Non-Significant	A grade related decline was found for life satisfaction.
<b>Quasi-Experiment Spain QR: 52%</b>		Participation in typical PE class, sport education curriculum model (Intervention)	The Satisfaction with Life Questionnaire	No Sig difference main time effect for satisfaction with life for grade 10 ( $p>.05$ ). <sup>f</sup>	Non-Significant	
					Significantly Negative	

**Table 3** (continued)

	Aim: To examine the effect of a multi-season SEM-based program on self-determined motivation, basic psychological needs, emotional intelligence, satisfaction with life, and the intention to be physically active on PE students during a school year	No control group.		Sig difference across grade level for life satisfaction at time point 1 ( $p < .05$ ). <sup>f</sup>	Significantly Negative	
				Sig difference across grade level for life satisfaction at time point 2 ( $p < .05$ ). <sup>f</sup>	Significantly Negative	
				Sig difference across grade level for life satisfaction at time point 3 ( $p < .05$ ). <sup>f</sup>	Significantly Negative	
				Sig difference across grade level for life satisfaction at time point 4 ( $p < .05$ ). <sup>f</sup>	<b>Significantly Negative</b>	
<b>Park et al., (2020)</b>	Secondary School 16.41 ( $\pm$ 0.95) 400 Schools 28,451 pupils/ 14,263 (Boys), 14,188 (Girls)	<b>I. PE Curriculum</b>  Participation in typical PE class.	1.Stress  Stress was assessed using one item: "How often do you feel stress in your typical daily life?"	Physical education for >2 times/weekly was sig associated with lower likelihood of stress for boys ( $p = .01$ , AOR = 0.87) and girls ( $p = .00$ , AOR = 0.87). <sup>b</sup>  Physical education once a week was not sig associated with lower likelihood of stress for boys ( $p = .14$ , AOR = 0.91) and for girls ( $p = .43$ , AOR = 0.96). <sup>b</sup>	Significantly Positive  Non-Significant	Participating in physical education for >2 times/weekly can mitigate the risk of stress among high school students.
<b>Cross-sectional South Korea QR: 86%</b>	Aim: To investigate how physical education participation predicts suicidal ideation and stress in South Korean high school students.			When adjusted for school type and year physical education for >2 times/weekly was sig associated with lower likelihood of stress for boys ( $p = .01$ , AOR = 0.87) and girls ( $p = 0.01$ , AOR = 0.89). <sup>b</sup>  When adjusted for school type and year physical education for once a week was not sig associated with lower likelihood of stress for boys ( $p = .11$ , AOR = 0.90) and girls ( $p = 0.26$ , AOR = 0.94). <sup>b</sup>	Significantly Positive  Non-Significant	
					<b>Inconclusive / No Effect</b>	
<b>Ruiz-Ariza et al., (2019)</b>	Secondary School 13.73 ( $\pm$ 1.34) 4 School 184 pupils/ 92 (Boys), 92 (Girls)	<b>I. PE Curriculum</b>  Participation in typical PE class, including static stretching at the beginning of class (Control)	1.Wellbeing  Trait and Emotional Intelligence Questionnaire Short Form.	Sig difference between baseline and follow up for wellbeing in the experimental group ( $p < .001$ , Cohens D = .55). <sup>c</sup>  Sig difference in favor of the experimental group versus the control group for wellbeing at follow up ( $p = .00$ , Cohens D = .61) (Inactive adolescents). <sup>c</sup>	Significantly Positive  Significantly Positive	Performing 16 minutes of C-HIIT, at the beginning of PE classes, improves wellbeing and sociability in adolescents.
<b>RCT Spain QR: 65%</b>	Aim: To analyze the effect of cooperative high-intensity interval training (C-HIIT) on creativity and EI in adolescents aged 12–16 years.	Typical PE class, including 15 minutes of high intensity interval training at the beginning of class (Intervention)		Sig group x time interaction effect for wellbeing in favor of the experimental group ( $p = .00$ , $\eta^2 = .06$ ). <sup>c</sup>	Significantly Positive	
					<b>Significantly Positive</b>	
<b>Uchoa et al., (2020)</b>	Secondary School 14-18 (No SD) NA 1,011 pupils/ 484 (Boys), 527 (Girls)	<b>I. PE Curriculum</b>  Participation in typical PE class.	1.Self-Esteem  Rosenberg Self-Esteem Scale	Boys participating in physical education classes were a protection factor against low self-esteem ( $p = .00$ , AOR = 0.12). Lowered in 88% the risk of developing low self-esteem. <sup>c</sup>  Girls participating in physical education classes was not a protection factor against low self-esteem ( $p = 0.08$ , AOR = 0.66). <sup>c</sup>  Medium self-esteem was sig greater for boys than girls ( $p = 0.02$ ) who participated in physical education. <sup>c</sup>	Significantly Positive  Non-Significant  Significantly Positive (B)/Non-Significant (G)	In male adolescents' participation in physical education classes acts as a protection against low self-esteem.
<b>Cross-sectional Brazil QR: 78%</b>	Aim: To analyse the impact of the practice of physical activity on the body mass index (BMI) and self-esteem of adolescents.				<b>Inconclusive / No Effect</b>	

<sup>a</sup> Depression, <sup>b</sup> Anxiety, <sup>c</sup> Self-Esteem, <sup>d</sup> Self-Efficacy, <sup>e</sup> Wellbeing, <sup>f</sup> Life Satisfaction, <sup>g</sup> Positive Mental Health, <sup>h</sup> Depression & Anxiety  
 QR quality rating, PE physical education, PA physical activity, G Girls, B Boys

Significantly Positive = when 50% or more of the reported effects are significant and in positive direction, Significantly Negative = when 50% or more of the reported effects are significant and in a negative direction, Inconclusive/No Effect = when 50% or more of the reported effects were non-significant or when results were mixed (both positive and negative), No significant Test = when the reported effects were not supported with a test of significance the direction of the effect whether positive or negative is indicated

Lai et al., 2009) and cross-sectional studies (29%,  $n = 2$  articles) (Bertillis et al., 2018; Uchoa et al., 2020). There were no longitudinal study designs for this outcome. When analyzed by study design, the frequency of reported effects indicated that 74% ( $n = 14$  effects) occurred in intervention studies and 26% ( $n = 5$  effects) in cross-sectional studies. Of the intervention studies, the reported effects indicated

that 36% ( $n = 5$  effects) were significantly positive and 64% ( $n = 9$  effects) were non-significant. Of the cross-sectional studies, the reported effects indicated that 40% ( $n = 2$  effects) were significantly positive and 60% ( $n = 3$  effects) were non-significant.

## Self-Efficacy

Self-efficacy was identified in 11% of articles ( $n = 2$ ), representing 17% ( $n = 17$ ) of the total reported effects with a mean quality assessment score of 66% (fair). Of this, 29% ( $n = 5$  effects) were significantly positive and 71% ( $n = 12$  effects). There were zero significantly negative effects when looking at the impact of typical school provision of physical education, physical activity and sports on self-efficacy. The bulk of the evidence was most divided by intervention studies (50%,  $n = 1$  article) (Escarti et al., 2010) and cross-sectional studies (50%,  $n = 1$  articles) (Bertillis et al., 2018). There were no longitudinal studies for this outcome. When analyzed by study design, the frequency of reported effects indicated that 71% ( $n = 12$  effects) occurred in the intervention study and 29% ( $n = 5$  effects) in the cross-sectional study. In the intervention study, the reported effects indicated that 33% ( $n = 4$  effects) were significantly positive and 66% ( $n = 8$  effects) were non-significant. In the cross-sectional study, the reported effects indicated that 20% ( $n = 1$  effects) were significantly positive and 80% ( $n = 4$  effects) were non-significant.

## Wellbeing

Wellbeing was identified in 15% of articles ( $n = 3$ ), representing 6% ( $n = 7$ ) of the total reported effects with a mean quality assessment score of 71% (good). Of this, 57% ( $n = 4$  effects) were significantly positive and 43% ( $n = 3$  effects) were non-significant. There were zero significantly negative effects when looking at the impact of typical school provision of physical education, physical activity and sports on wellbeing. The evidence was most prevalent in intervention studies (100%,  $n = 3$  articles) (Costigan et al., 2016; Luna et al., 2019; Ruiz-Ariza et al., 2019). There were no cross-sectional or longitudinal study designs for this outcome.

## Life Satisfaction

Life satisfaction was identified in 15% of articles ( $n = 3$ ), representing 7% ( $n = 8$ ) of the total reported effects with a mean quality assessment score of 62% (fair). Of this, 12.5% ( $n = 1$  effects) were significantly positive, 37.5% ( $n = 3$  effects) were non-significant and 50% ( $n = 4$  effects) were significantly negative. The evidence was most prevalent in intervention studies (66%,  $n = 2$  articles) (Khalsa et al., 2012; Mendez-Gimenez et al., 2022) and longitudinal studies (33%,  $n = 1$  article) (Mendez-Gimenez et al., 2019). There were no cross-sectional study designs for this outcome. When analyzed by study design, the frequency of reported effects indicated that 87.5% ( $n = 7$  effects) occurred in intervention studies and

12.5% ( $n = 1$  effects) occurred in longitudinal studies. Of the intervention studies, the reported effects indicated that 43% ( $n = 3$  effects) were non-significant and 57% ( $n = 4$  effects) were significantly negative. There were zero significantly positive effects associated with life satisfaction intervention studies. Of the longitudinal studies, the reported effects indicated that 100% ( $n = 1$  effect) was significantly positive.

## Positive Mental Health

Positive mental health was identified in 15% of articles ( $n = 3$ ), representing 6% ( $n = 7$ ) of the total reported effects with a mean quality assessment score of 60% (fair). Of this, 29% ( $n = 2$  effects) were significantly positive and 71% ( $n = 5$  effects) were non-significant. There were zero significantly negative effects when looking at the impact of typical school provision of physical education, physical activity and sports on positive mental health. The bulk of the evidence was most prevalent in intervention studies (66%,  $n = 2$  articles) (Felver et al., 2015; Luna et al., 2019) and longitudinal studies (33%,  $n = 1$  article) (Mendez-Gimenez et al., 2019). There were no cross-sectional study designs for this outcome. When analyzed by study design, the frequency of reported effects indicated that 71% ( $n = 5$  effects) occurred in intervention studies and 29% ( $n = 2$  effects) in longitudinal studies. Of the intervention studies, the reported effects indicated that 40% ( $n = 2$  effects) were significantly positive and 60% ( $n = 3$  effects) were non-significant. Of the longitudinal studies, the reported effects indicated that 100% ( $n = 2$  effects) were non-significant. Figures 2, 3 and 4 illustrates the frequency of reported effects by outcome, study design and exposure.

## Discussion

Increasing adolescent physical activity for the betterment of adolescent mental health and wellbeing is a global public health priority. This is evident in the promotion of policy and investment in typical school provision of physical education, physical activity and sports (ISPAH, 2020; World Health Organization, 2018; European Parliament, 2016; Kohl et al., 2013; Australian Department of Health, 2021). While some previous empirical evidence investigates the effects of physical activity outside of schools on a range of mental health and wellbeing indicators (Biddle & Asare, 2011), further school-based health promoting strategies are required (Teychenne et al., 2020; Bouchard et al., 2006; Morton et al., 2016). The authors sought to address this gap by systematically reviewing, organizing and evaluating the extant literature pertaining to typical school provision of physical education, physical activity and sports on adolescent mental health and wellbeing. Twenty articles, the bulk of which were published from

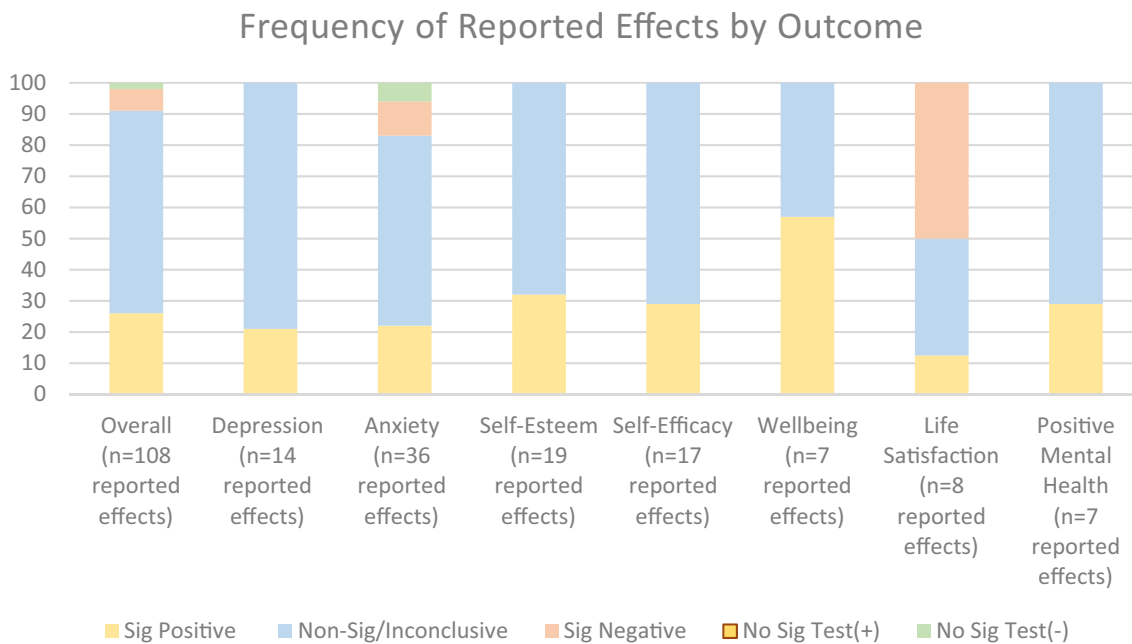


Fig. 2 Frequency of Reported Effects by Outcome

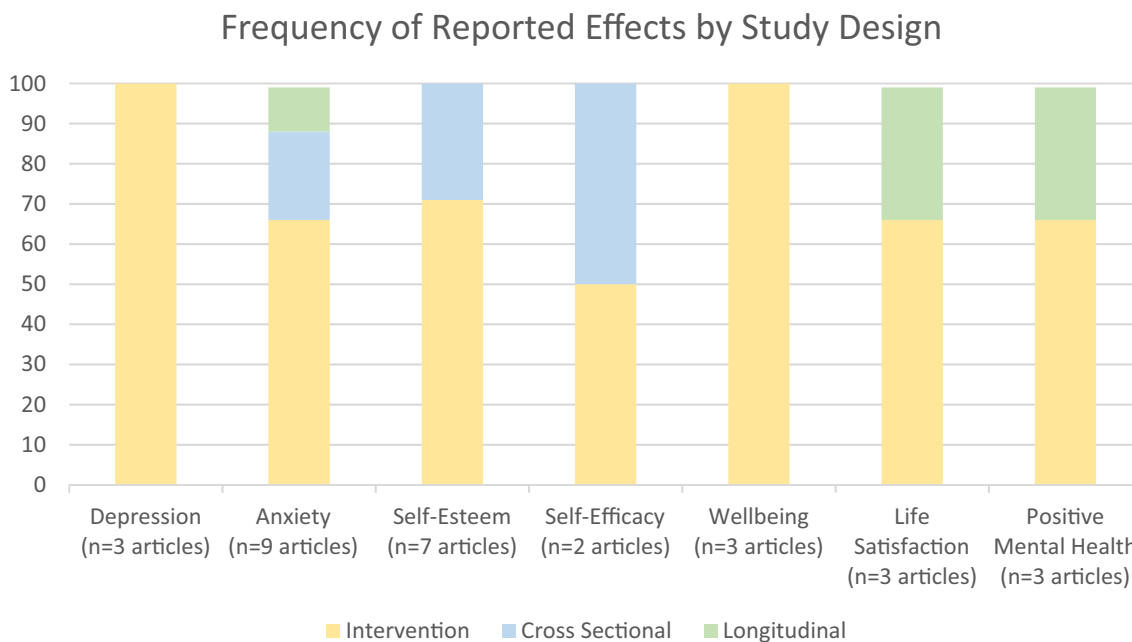
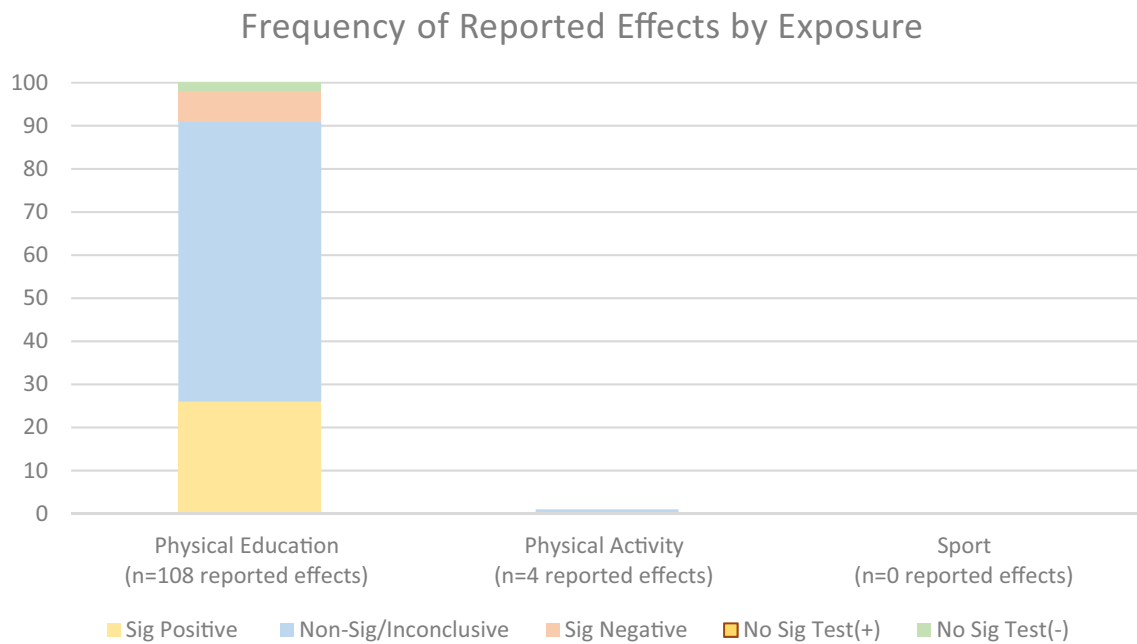


Fig. 3 Frequency of Reported Effects by Study Design

2015 onwards, illuminating the recent nature of inquiry into this research area, with an average rating of fair quality, were rigorously evaluated. The overarching evidence indicates that there are grade related increases in negative mental health outcomes e.g., depression and anxiety and decreases in positive indicators of wellbeing e.g., self-esteem, life satisfaction and positive mental health that

are in need of intervention. While worldwide adoption of policy advocates for a whole of school approach to physical activity for adolescent health (ISPAH), much of the evidence presented in this study pertains to individual components of provision that cohere to contribute to a whole school approach. Therefore, the results indicate that it may be worthwhile for future research in this field to holistically



**Fig. 4** Frequency of Reported Effects by School Exposure

consider the additive impact of physical education, physical activity and sports provision in schools. Intervention studies indicated non-significant effects between baseline and follow up for control groups, if there were no modifications to supplement typical provision, even relative minor modifications. This suggests that modifications to existing provision may be required to have a positive impact or at least to slow the grade related decline of adolescent mental health and wellbeing. Where possible, robust examples of best practices that implemented modifications to typical provision and had a positive impact on adolescent mental health and wellbeing are illuminated.

### Impacts on Depression and Anxiety

A large proportion of the extant evidence indicated a mix of non-significant and significantly positive findings when examining the impact of typical school provision of physical education, physical activity and sports on depression. Zero significantly negative effects were reported. The relationship between typical school provision of physical education, physical activity and sports and depression in adolescents was investigated in just three research articles (intervention studies), confirming the paucity of evidence in this field of study. Of the significantly positive effects, a randomized control trial that integrated a minor modification to existing provision of physical education, consisting of a teacher workshop to update teachers on pedagogical and health related topics, lowered in 93% of adolescents, the risk of developing high depressive symptomology (Lima et al.,

2022). Clinical studies suggest the prevention of depressive symptomology in adolescence, which is an indicator for depression, has the potential to serve as a protective mechanism that tracks into adulthood and positively impacts future quality of life (Copeland et al., 2009; Fergusson et al. 2005; Kim-Cohen et al. 2003; Bardone et al., 1998). Therefore, public health policies that subtly integrate health related teacher workshops into the typical physical education class should be considered as a potential factor that could positively impact mental health and wellbeing indicators, such as depression in adolescents. Of the non-significant effects, the current study reported no differences between baseline and follow up in control groups when examining the effect of typical provision of physical education on depression, without the implementation of an intervention with a minor modification (Felder et al., 2015; Khalsa et al., 2012). Prevalence of depression in adolescent populations has been found to worsen across grade level (Dooley et al., 2018). Therefore, future research should consider investigating the additive impact of alternative components of provision, such as physical activity and sports, to supplement physical education. It is conceivable that these may serve as integral strategies to positively impact adolescent depression.

In the context of anxiety, alternative exposures, such as physical education class assessment, were examined (Mastagli et al., 2020). Over a 4-month period, formative assessment (ongoing informal evaluation to monitor student learning e.g., essay or quiz) was found to demonstrate significantly positive effects when compared to summative assessment (formal evaluation of student learning e.g., end



of year exam). These findings are consistent with existing literature that illuminate the implications associated with summative assessment in physical education for adolescents (Lentillon-Kaestner et al., 2018). Given that positive experiences with physical activity in adolescents track into adulthood (Telama et al., 2005), physical educators may consider the use of formative assessment techniques to positively influence future impact. Indeed, future research may consider the effects of a hybrid approach to classroom assessment (formative and summative) on adolescent anxiety. The current study also found significantly positive associations with total weekly physical education classes in a sample of 28,541 adolescents (Park et al., 2020). Implementation of physical education classes on two or more occasions weekly was found to be associated with lower levels of stress for both boys and girls which is consistent with previous qualitative research (Howard, 2011). In contrast, there were non-significant findings for levels of stress in boys and girls where provision consisted of just one day of physical education class weekly. This suggests that additional physical education classes are pertinent to impacting adolescent mental health and wellbeing. It must be noted that the current study also found significantly negative effects for stress across grade-level when exposed to typical provision of physical education. This was also noted by Barney et al., (2019) in their qualitative findings and is consistent with the national study of youth mental health in the Republic of Ireland consisting of 10,459 adolescents (Dooley et al., 2018). The study reported a grade-level increase in the severe range for anxiety, once more indicating the need to investigate the supplementation of physical education with additional components of physical activity provision in schools (e.g., active recess, active classroom breaks and active transport to schools). Similar to the results on depression, non-significant differences were found across an array of typical physical education control groups, in intervention studies, for social, general and somatic anxiety. Interventions consisted of basketball, team competition and traditional teaching models (Khalsa et al., 2012; Lima et al., 2022; Luna et al., 2019). Intervention studies with a minor modification to typical physical education provision, such as additional time, teacher workshops and use of the sport education curriculum model, also demonstrated non-significant effects, on social anxiety (Lima et al., 2022; Luna et al., 2019). These findings are consistent with literature regarding social relationship variables (Mendez-Gimenez et al., 2015; Cuevas et al., 2015). However, they contradict previous research that demonstrates positive effects (Kao 2019; Wallhead et al., 2014). Further investigation to analyze the effects of alternative components of provision on social anxiety is warranted. It must also be noted that while some intervention studies with minor modifications demonstrated non-significant effects on social anxiety, the intervention group almost always slowed

the grade related increase in comparison to the control group. Slowing the grade related increase of negative mental health and wellbeing indicators, such as anxiety, is a relatively new phenomenon in this field of research and pertains to many of the non-significant intervention effects in this review. However, further research is required to understand and strengthen these findings. It is noteworthy that while there was one significantly positive effect for typical physical education provision on social anxiety (Kiliziene et al., 2018), the exposure beyond the national curriculum was not specified, which was common throughout this review. Active recess (PA), aerobic and resistance exercise (PE) were found to be non-significant contributors to reducing psychological distress (Costigan et al., 2016). While this is inconsistent with research examining the impact of physical activity outside of school on psychological distress (Hung et al., 2013; Perales et al., 2014; Zhao et al., 2013), further research investigating the effects of physical activity inside school as an additional strategic arm to reduce mental ill health in adolescent populations is required. Currently, there exists little evidence on differences in depression and anxiety across gender when exposed to typical school provision of physical education, physical activity and sports which should also be considered.

### Impacts on Self-Esteem and Self-Efficacy

There were zero significantly negative effects associated with typical school provision of physical education, physical activity and sports on adolescent self-esteem and self-efficacy. Regarding self-esteem, an intervention that integrated a minor modification to existing provision consisting of an adventure education program was found to have significantly positive effects in comparison to a typical physical education control program of volleyball, football and athletics (Baena-Extremera et al., 2012). Comparatively, the current review found a similar intervention study with an adventure education experimental group exposure to demonstrate non-significant effects (Koszalka-Silska et al., 2021). These findings are consistent with the most recent systematic literature review in this research area, consisting of 16 articles that found mixed effects regarding the role of adventure education programs in increasing adolescent self-esteem (West & Crompton., 2001). The current study found an intervention that infused a minor modification to existing physical education provision consisting of self-esteem related “athlete spirit”, “knowing myself” and “I am the best” activities, to have significantly positive effects on physical and family self-esteem in comparison to a typical physical education class consisting of athletics, gymnastics, and badminton (Lai et al., 2009). This is consistent with findings that allude to the effective components associated with self-esteem enhancing programs (Dalgas-Pelish, 2006;

articles) (Barney et al. 2019; Mendez-Gimenez et al., 2022) and 5% demonstrated a negative direction but with no test of significance ( $n = 1$  article) (Lang et al., 2016).

When analyzed by study design, the overall frequency of reported effects showed that 72% ( $n = 78$  effects,  $n = 13$  articles) occurred in intervention studies with a mean quality assessment score of 66.5% (fair) (Baena-Extremera et al., 2012; Costigan et al., 2016; Escarti et al., 2010; Felver et al., 2015; Khalsa et al., 2012; Kiliziene et al., 2018; Koszalka-Silka et al., 2021; Lai et al., 2009; Lima et al., 2022; Lang et al., 2016; Luna et al., 2019; Mendez-Gimenez et al., 2022; Ruiz-Ariza et al., 2019), 17% ( $n = 18$  effects,  $n = 5$  articles) in cross-sectional studies with a quality assessment score of 78.33% (good) (Barney et al., 2019; Bertillis et al., 2018; Jochimek & Lada, 2019; Park et al., 2020; Uchoa et al., 2020) and 11% ( $n = 12$  effects,  $n = 2$  articles) in longitudinal studies with a quality assessment score of 62.5% (fair) (Mastagli et al., 2020; Mendez-Gimenez et al., 2019).

The bulk of significantly positive effects (64%,  $n = 18$  effects) and non-significant effects (77%,  $n = 54$  effects) were reported most frequently in intervention studies. Longitudinal studies had the highest percentage (although infrequent) of significantly positive effects (50%,  $n = 6$  effects) and cross-sectional studies had the highest percentage (although infrequent) of significantly negative effects (22%,  $n = 4$  effects). Of the 13 intervention studies included, the impact summary indicated that 15% ( $n = 2$  articles) were significantly positive (Baena-Extremera et al., 2012; Ruiz-Ariza et al., 2019), 69% ( $n = 9$  articles) were inconclusive/no effect (Costigan et al., 2016; Escarti et al., 2010; Felver et al., 2015; Khalsa et al., 2012; Kiliziene et al., 2018; Koszalka-Silka et al., 2021; Lai et al., 2009; Lima et al., 2022; Luna et al., 2019; Mendez-Gimenez et al., 2019; Park et al., 2020; Uchoa et al., 2020), 8% ( $n = 1$  article) was significantly negative (Mendez-Gimenez et al., 2022) and 8% ( $n = 1$  article) demonstrated a negative direction but with test of significance (Lang et al., 2016). Of the five cross-sectional studies, 80% ( $n = 4$  articles) were inconclusive/no effect (Bertillis et al., 2018; Jochimek & Lada, 2019; Park et al., 2020; Uchoa et al., 2020), while 20% ( $n = 1$  article) was significantly negative (Barney et al. 2019). Of the two longitudinal studies, 50% ( $n = 1$  article) was significantly positive (Mastagli et al., 2020) while 50% ( $n = 1$  article) was inconclusive/no effect (Mendez-Gimenez et al., 2019). Table 3 provides an in-depth analysis of each outcome.

## Depression

Depression was identified in 15% of articles ( $n = 3$ ), representing 13% ( $n = 14$ ) of the total reported effects with a mean quality assessment score of 69% (fair). Of this, 21% ( $n = 3$  effects) were significantly positive and 79% ( $n = 11$  effects) were non-significant. There were zero significantly

negative effects when looking at the impact of typical school provision of physical education, physical activity and sports on depression. The evidence was most prevalent in intervention studies (100%,  $n = 3$  articles) (Felver et al., 2015; Khalsa et al., 2012; Lima et al., 2022). There were no cross-sectional or longitudinal study designs for this outcome.

## Anxiety

Anxiety was identified in 45% of articles ( $n = 9$ ), representing 33% ( $n = 36$ ) of the total reported effects with a mean quality assessment score of 74% (good). Of this, 22% ( $n = 8$  effects) were significantly positive, 61% ( $n = 22$  effects) were non-significant, 11% ( $n = 4$  effects) were significantly negative and 6% ( $n = 2$  effects) indicated a negative direction but with no test of significance. The bulk of the evidence was most prevalent in intervention studies (66%,  $n = 6$  articles) (Costigan et al., 2016; Khalsa et al., 2012; Kiliziene et al., 2018; Lang et al., 2016; Lima et al., 2022; Luna et al., 2019), then cross-sectional studies (22%,  $n = 2$  articles) (Barney et al. 2019; Park et al., 2020) and longitudinal studies (11%,  $n = 1$  articles) (Mastagli et al., 2020). When analyzed by study design, the frequency of reported effects indicated that 53% ( $n = 19$  effects) occurred in intervention studies, 22% ( $n = 8$  effects) in cross-sectional studies and 25% ( $n = 9$  effects) in longitudinal studies. Of the intervention studies, the reported effects indicated that 5% ( $n = 1$  effect) was significantly positive, 84% ( $n = 16$  effects) were non-significant and 11% ( $n = 2$  effects) indicated a positive direction but with no test of significance. There were zero significantly negative effects associated with anxiety in intervention studies. Of the cross-sectional studies, the reported effects indicated that 25% ( $n = 2$  effects) were significantly positive, 25% ( $n = 2$  effects) were non-significant and 50% ( $n = 4$  effects) were significantly negative. Of the longitudinal studies, the reported effects indicated that 56% ( $n = 5$  effects) were significantly positive and 44% ( $n = 4$  effects) were non-significant. There were zero significantly negative effects in the longitudinal study on anxiety.

## Self-Esteem

Self-esteem was identified in 35% of articles ( $n = 7$ ), representing 18% ( $n = 19$ ) of the total reported effects with a mean quality assessment score of 66% (fair). Of this, 32% ( $n = 6$  effects) were significantly positive and 68% ( $n = 13$  effects) were non-significant. There were zero significantly negative effects when looking at the impact of typical school provision of physical education, physical activity and sports on self-esteem. The bulk of the evidence was most prevalent in intervention studies (71%,  $n = 5$  articles) (Baena-Extremera et al., 2012; Khalsa et al., 2012; Kiliziene et al., 2018; Koszalka-Silka et al., 2021;

Park & Park, 2015). The results illuminate the unique impact this may have to positively influence adolescent mental health and wellbeing outcomes, such as self-esteem, when incorporated into typical school provision of physical education. However, further research incorporating generalizability measures would be useful. When comparing boys with girls, this investigation found physical education participation to serve as a protective mechanism against low self-esteem for boys in comparison to their female counterparts (Uchoa et al., 2020). This may be because often the objective of exercising is often underpinned by weight loss for female adolescents (Cowley et al., 2021). As such, physical activity may be thought of as important by female adolescents, but not in a school environment. Thus, renewed strategies to promote self-esteem in girls via school physical activity would be beneficial. Research based upon longitudinal study designs that examine cause and effect, rather than cross-sectional study designs, such as in this review, are worthy of consideration. Similar to the depression and anxiety results, the evidence suggests a grade related decline in levels of self-esteem during adolescents that is likely to track into adulthood. This points to the importance of self-esteem promoting strategies, e.g., motivating teaching styles, during this phase of life (Dooley et al., 2018; Kiviruusu et al., 2015; Huang 2010). Once more, it is evident that the bulk of the intervention-based evidence in the current study presents non-significant effects for typical physical education provision in control groups without any modification to existing provision (Lai et al., 2009; Baena-Extremera et al., 2012; Costigan et al., 2016; Escarti et al., 2010; Khalsa et al., 2012; Kiliziene et al., 2018; Koszalka-Silska et al., 2021; Lima et al., 2022; Luna et al., 2019). This suggests that the power generated from physical education alone does not appear to be sufficient to improve adolescent mental health and wellbeing. Therefore, future research that considers strategies to successfully implement a whole of school, systems-based approach to supplement the impact of physical education provision on adolescent mental health and wellbeing (ISPAH, 2020) is worthy of consideration. In view of the absence of school physical activity and sports throughout the bulk of the articles presented in this review, programs that endeavor to include such exposures in unison with physical education may be impactful.

The relationship with adolescent self-efficacy was examined in just two articles (Bertillis et al., 2018; Escarti et al., 2010), illuminating the lack of evidence in this research area. An intervention study that integrated the teaching personal and social responsibility curriculum model into typical provision of physical education had significantly positive effects for perceived self-efficacy (Escarti et al., 2010). This is consistent with previous empirical evidence that suggest that through learning personal and social responsibility, one cultivates more optimistic attitudes regarding ability to

manage social resources and strengthen one's self-efficacy beliefs (Pajares & Urdan 2006; Vecchio et al., 2007). Therefore, the use of the teaching personal and social responsibility curriculum model in physical education class may be a viable strategy to enhance adolescent self-efficacy. However, longitudinal effects are in need of further investigation. Like many of the outcome variables discussed in this review, there were no differences between baseline and follow up in the control groups when examining the effect of typical school provision of physical education on self-efficacy without the implementation of a minor modification (Escarti et al., 2010). A cross-sectional study with alternative typical provision of physical education exposures, such as teaching skills, lesson planning and long-term planning, were also found to have non-significant effects in a diverse sample e.g., adolescents with disabilities, high grades, and low grades (Bertillis et al., 2018). This is inconsistent with studies that indicate the potential relationship between teaching style and student-teacher interactions on adolescent self-efficacy (Wentzel & Miele, 2016; Chen et al., 2022; Gunzenhauser et al., 2013). However, it must be noted that a paucity of empirical evidence exists that illuminates the impact of teachers on self-efficacy in adolescents with disabilities. Evidence suggests the pertinent role of teachers to promote "student persistence in demanding physical challenges, future health behavior and participation and higher self-efficacy for future success" (Usher & Pajares, 2008, Bertillis et al., 2018 p2; Gao et al., 2008; Feltz & Magyar, 2006). Future studies that include randomized controlled trials with a minor modification to existing provision to examine cause-effect relationships between intervention and outcome rather than a cross-sectional study design may be beneficial. In contrast, however, this review reported a positive interaction between the physical education classroom climate and adolescent self-efficacy (Bertillis et al., 2018). This suggests that the physical education classroom climate "may serve as an indicator of how students experience their learning environment" (Bertillis et al., 2018 p 10) and that a cohesive learning environment is important to facilitate positive learning experiences for adolescents (Haegele & Sutherland, 2015). Currently, little evidence examines differences in self-efficacy across gender when exposed to typical school provision of physical education, physical activity and sports which should also be considered.

### **Impacts on Wellbeing, Positive Mental Health and Life Satisfaction**

The extant evidence indicated a mix of non-significant, significantly positive and significantly negative effects when examining the impact of typical school provision of physical education, physical activity and sports on wellbeing, positive mental health and life satisfaction. Of all the outcomes

reported in this review, typical school provision of physical education, physical activity and sports had the greatest impact on the bulk of these variables with the evidence reporting 57% significantly positive effects when examining wellbeing and 29% significantly positive effects when examining positive mental health. However, this relationship was investigated in a total of just eight articles across all three variables, indicating the scarcity of evidence in this research area. In the context of adolescent wellbeing, the data was spread across three intervention studies with varying degrees of minor modifications to existing provision. While a randomized controlled trial consisting of 8–10 min of high intensity interval training (shuttle runs, jumping jacks, bodyweight exercises) implemented into physical education classes over an eight-week period indicated a positive relationship that slowed the grade related decline of wellbeing, in comparison to a typical physical education control group, the effects were non-significant (Costigan et al., 2016). However, a follow up randomized control trial that further explored the possibility of this beneficial effect by infusing 16 min of high intensity interval training into the beginning of typical physical education classes over 12 weeks, found significantly positive effects on adolescent wellbeing, in comparison to a static stretching control group (Ruiz-Ariza et al., 2019). Future studies that generalize these findings to a larger, representative sample would be beneficial. Currently, there is no evidence to suggest the negative impact of high intensity interval training on adolescent mental health and wellbeing (Teychenne et al., 2020). Therefore, maximizing opportunities to engage in physical activity, such as high intensity interval training at the beginning of physical education class, could be considered when strategizing to positively impact adolescent mental health and wellbeing. Interestingly, a quasi-experiment study that embedded a sport education curriculum model into the physical education framework had significantly positive effects on adolescent wellbeing (Luna et al., 2019). This is explained via a systematic literature review of 14 articles that examined the impact of the sports education curriculum model and found significant associations with adolescent intrinsic motivation (Tendinha et al., 2021). It is noteworthy that previous literature suggests a close association between motivation in school and adolescent wellbeing (Beiswenger and Grolnick 2010). Therefore, “a motivating school context, enabled by the implementation of the sport education model” may be a viable strategy to impact adolescent wellbeing (Luna et al., 2019 p8).

Similar to wellbeing, a sport education model embedded within typical physical education class was found to positively affect indicators of adolescent positive mental health, such as positive and negative affect (Luna et al., 2019; Diaz-Garcia et al., 2020). However, the dearth of evidence in this research area is clear. Considering that “mood

and affect in school-aged youth have been shown to predict” psychological functioning (Felver et al., 2015 p8; Weinstein & Mermelstein, 2013; Rothon et al., 2009), interventions with minor modification to existing provision, such as the inclusion of a sports education framework, should be considered as a conceivable strategy to impact adolescent mental health and wellbeing. However, further investigation is required to identify if the short-term effects of implementing a sport education model translate to improved long term outcomes. Consistent with the findings of this review, articles that examined typical provision of physical education, without the implementation of an intervention with a minor modification, yielded non-significant findings on positive and negative affect (Felver et al., 2015; Mendez-Gimenez et al., 2019). This notwithstanding, evidence in the literature suggests the positive effects of physical activity outside of school on components of positive mental health, such as positive and negative affect (Buecker et al., 2021). Therefore, alternative modes of school sport and physical activity, such as active classroom breaks, active recess and extra-curricular activities, should be strongly considered to support the provision of physical education classes. Similar to many of the outcome variables discussed in this review, the wider evidence suggests a grade-related decline in adolescent positive mental health that tracks into adulthood (Guo et al., 2018). This points to the importance of identifying positive mental health strategies during this phase of life.

A review of literature consisting of 141 empirical articles by Proctor et al. (2009), showed a decrease in life satisfaction in adolescence that tracks into adulthood. This is consistent with this current review that reported significantly negative effects across grade-level for life satisfaction when exposed to a sport education model, embedded within typical physical education class, over a school year (Mendez-Gimenez et al., 2022). Considering that the evidence indicates “a near universal decrease in life satisfaction during adolescence,” strategies to combat this decline are important during this phase of life (Orben et al., 2022 p1; Marquez & Long, 2021). This current study reported that during a full year of physical education, adolescents with high emotional intelligence were found to have higher levels of life satisfaction in comparison to adolescents with low emotional intelligence (Mendez-Gimenez et al., 2019). Positive relations between emotional intelligence and life satisfaction emerge frequently in the literature (Cazan & Nastasa, 2015; Barreiro 2014). Therefore, fostering a physical education environment that enables adolescents to recognize, control and appreciate their own emotions during classes could be an effective strategy to impact adolescent life satisfaction. In the context of healthcare costs, it must be noted that low life satisfaction is a significant and independent predictor of higher healthcare utilization, pertaining to the highest cost category (top 5%) in comparison to those with high life satisfaction (Goel et al., 2018). With adolescence

considered to be a life phase in which future mental health and wellbeing patterns for adulthood are laid down, public health policies that enhance adolescent life satisfaction are an important factor in the promotion of adolescent wellbeing. Currently, there is little research available that examines differences in life satisfaction across gender when exposed to typical school provision of physical education, physical activity and sports, which is a common trend across many of the outcome measures discussed in this review.

## Strengths and Limitations

This systematic literature review is the first to examine how the provision of typical school offerings of physical education, physical activity and sports impact adolescent mental health and wellbeing. In addition, a wide assessment of the literature was undertaken. This was enabled via the development of a comprehensive search strategy. Bias was reduced through the use of multiple reviewers at each phase of the study and allowed for a thorough examination of the literature. The investigation of an array of mental health and wellbeing outcomes enabled a comprehensive review of current standings and opportunities for future research. The data included quantitative and qualitative methods and a comprehensive supplementary search of the literature was conducted. The overall integrity and rigor of this systematic literature review was enhanced via the use of quality assessment tools that were appropriately regarded.

Heterogeneity associated with the article's methodologies, nature of the outcomes, modes of analysis and a general lack of consensus on the constructs of mental health and wellbeing, presented difficulties in synthesising the data. The data was collected via self-report methods. Generalisability of the findings to low-income countries is problematic due to a large proportion of the participants residing in high income countries (Hamadeh et al., 2022). The exposure within the intervention studies' control groups were often not reported. The methodological quality of the data was fair, indicating the dearth of high-quality methodological designs in this research area. Grey literature was not included. Regarding data analysis, some articles had a higher frequency of reported effects which were not taken into account. Lastly, seldom was the interaction effect of typical school provision of physical education, physical activity and sports investigated.

## Conclusion

A review of the literature that examines the impact of typical school provision of physical education, physical activity and sports, as a strategy to enhance adolescent mental

health and wellbeing and reduce global health costs, is a public health priority. The bulk of the evidence, however, pertained to physical education provision only, with a distinct paucity of data examining the additive impact of school physical activity and sports. In the context of the typical school provision of physical education framework, the current study illuminated a range of robust examples of best practices, including minor modifications to typical provision that positively impact adolescent mental health and wellbeing. The integration of physical education teacher workshops into the curriculum to update teachers on pedagogical and health related topics, short bouts of high intensity internal training, extended days dedicated to physical education weekly ( $\geq 2$  days), formative assessment techniques, adventure education programs, self-esteem promoting programs, sport education/teaching personal and social understanding curriculum models and classroom climates that endorses high emotional intelligence, are viable strategies to enhance adolescent mental health and wellbeing. Many of the significantly positive effects implemented an intervention with a minor modification to typical provision, while control groups without a minor modification were often ineffective. This was a consistent finding across the outcome measures. These findings indicate the need to supplement typical school provision of physical education with alternative components of provision as noted above or via school provision of physical activity and sports. Indeed, the evidence suggests that the developmental benefits generated from physical education alone do not appear to be enough to enhance adolescent mental health and wellbeing. In addition, there were very few significantly negative effects in this review and while some of the evidence was found to be non-significant, the concept of slowing the grade related increase of negative mental health outcomes and decrease in positive indicators of wellbeing was clear and should be further examined. Future research should also consider gender differences when evaluating the impact of typical school provision of physical education, physical activity and sports as gender differences are often neglected in this research area.

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**Authors' Contributions** PR conceived of the study, participated in its design and coordination, performed the analysis and drafted the manuscript; MA participated in the design and interpretation of the data; BOK conceived of the study, participated in its design and coordination and interpretation of the data; LW participated in the design and

interpretation of the data; AB participated in the design and interpretation of the data; LGG participated in the design and interpretation of the data and performed the analysis; FC participated in the design and interpretation of the data; MS participated in the design and interpretation of the data; IS conceived of the study, participated in its design and coordination, performed the analysis and drafted the manuscript; PMM conceived of the study and participated in its design and coordination; CMD conceived of the study, participated in its design and coordination, performed the analysis and drafted the manuscript. All authors read and approved the final manuscript.

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## Declarations

**Conflict of interest** The authors report no conflict of interest.

**Preregistration** A structured protocol for this systematic literature review was registered on the International Prospective Register of Systematic Reviews (ID number CRD42021201202).

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