HOSTED BY
ELSEVIER
Check for updates
Available online at www.sciencedirect.com
ScienceDirect
Journal of Sport and Health Science 12 (2023) 52–64

Review

The expectancy-value theory: A meta-analysis of its application in physical education

Chaojie Shang *, Alexander Clayton Moss, Ang Chen

Department of Kinesiology, University of North Carolina at Greensboro, Greensboro, NC 27412, USA

Received 30 July 2021; revised 13 November 2021; accepted 8 December 2021
Available online 18 January 2022

Abstract

Background: The purpose of motivating students is to enhance their learning achievement. The expectancy-value theory (EVT) has demonstrated its efficacy in motivating students in classrooms and in gymnasia. Understanding student motivation in physical education is needed. This meta-analysis review aimed to reveal the determinants and functions of EVT by evaluating the evidence in physical education research.
Methods: We followed the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidelines to identify and meta-analyze the current research literature published from January 2010 to December 2020 by generating and analyzing the effect sizes from the studies.
Results: A total of 31 studies were included. The results show that social support, motivation of teachers and peers, and positive class climate can predict student EVT motivation. EVT motivation predicts student learning behaviors, situational interests, fitness performance, health behavior function, out-of-school physical activity, and physical skill development.
Conclusion: EVT motivation could facilitate learning behaviors and situational interest development in the gymnasium. It might lead to fitness enhancement, health behavior change, out-of-school physical activity participation, and physical skill development. Fostering a learning environment with a mastery-centered and/or student autonomy approach where students perceived success and the task values can enhance and maximize student EVT motivation and learning achievement.

Keywords: K–12 students; Learning strategies; Student outcomes

1. Introduction

Motivation is a mental process that inspires and empowers individuals to engage in goal-oriented actions.[1,2] It is considered an influential factor in promoting student learning achievement. Specifically, helping students enhance their motivation is necessary for improving learning in physical education. Expectancy-value theory (EVT) is one of the major motivation theories in the field that focuses on the 2 constructs most relevant to the school learning context: (a) students' expectancy beliefs and (b) students' subjective judgments of the value of the content they are being taught. EVT's impact on learning has been widely studied and documented. The theory attempts to explain the relationship between students' motivation and their learning behaviors/performance with respect to the goals of education.[3,4] In physical education, many studies guided by EVT have generated informative findings, especially in the most recent 10 years. There is, therefore, a need to carefully summarize the findings of EVT research in physical education to further our understanding of its impact on knowledge/skill learning and on students' participation in physical activities outside of physical education at school.[1] Findings from a systematic review could provide researchers and educators an evidence-based overview of EVT motivation function in student learning and physical activity behavior change. In turn, the findings can point to future EVT research directions.

By conducting this systematic review, we expect to provide the evidence upon which effective motivation strategies could be developed to facilitate student learning in physical education. In this article, we will (a) articulate EVT and its recent theoretical development, (b) narratively illustrate and critique current findings, (c) provide evidence-informed suggestions for practices, and (d) elaborate on the directions for future EVT research. The major analytical approach we used to accomplish these goals is a meta-analysis informed procedure guided by the Preferred

Peer review under responsibility of Shanghai University of Sport.
* Corresponding author.
E-mail address: c_shang@uncg.edu (C. Shang).

https://doi.org/10.1016/j.jshs.2022.01.003
Cite this article: Shang C, Moss AC, Chen A. The expectancy-value theory: A meta-analysis of its application in physical education. *J Sport Health Sci* 2023;12:52–64.

Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The purpose of this systematic meta-analytical review, therefore, was to determine the contribution made by EVT research during the period from 2010 to 2020 to the understanding of student motivation.

1.1. The expectancy-value construct

EVT postulates that students' motivation in schooling relies on their beliefs in academic success and the values they perceive relative to the task they are learning.[3,4] Theoretically, the expectancy-value construct consists of 2 independent and yet related dimensions: a student's expectancy beliefs for success and the subjective values the student places on the task at the hand. The 2 dimensions work together to determine how much effort a student is likely to invest in the learning process. *Expectancy beliefs for success* can be defined as how well students think they can meet the expectations of success for upcoming work.[4] Expectancy beliefs depend on perceptions of the difficulty of tasks and the possibility of overcoming the difficulty to succeed.[5] For example, the level of expectancy beliefs of adolescent students who perceived the Lunastix task as difficulty tended to be lower than the level of their peers who viewed this work as easy.[6] It is theorized that the more challenging a student perceives a given task to be, the lower the expectancy belief the student would attach to it.[5] Consequently, the student's motivation to overcome the challenge and succeed would be low as well.

The subjective value dimension includes 3 primary values that students are likely to attach to a learning task. *Attainment value* refers to the perceived personal importance that a student attaches to a given task. Students will attach attainment value to a task if the characteristics of this task fit or strengthen their own perceived values/self-schema/identities. [4] Individuals will attach attainment value to an activity such as a sport and could be motivated to practice and play it when there is an opportunity. Attainment value can also derive from and strengthen personal identity. For instance, native Americans are motivated to play stickball because it is a sport that reflects their cultural heritage.[7] *Intrinsic value* refers to the anticipated enjoyment an individual expects to experience from participating in a specific task. Learning that it driven by curiosity or interest is thought to be of intrinsic value.[5] For example, Fielding-Wells et al.[8] suggested that students who were interested in building pyramids were motivated by the intrinsic value of the learning tasks they were experiencing. They even requested to remain in the classroom during a break and after school hours to construct more pyramids. It is theorized that students will be deeply engaged in a specific task for an extended amount of time if they are intrinsically motivated by the work.[4] *Utility value* can be defined as how useful a task will be in the future.[4] Utility value by itself could be similar to extrinsic motivation when completing a task is the means to an end. A student motivated by utility value would likely work for tangible results in the near future. For instance, high school students who attend physical education merely to fulfill graduation requirements may not register for additional physical education classes as electives because the additional courses work not be useful to them.

Cost refers to that which a student has to give up in order to accomplish an academic task. Students tend to avoid a task if the cost of performing is high relative to anticipated benefits. Thus, they are likely to be motivated if the perceived cost is relatively lower than the benefit. Wigfield and Eccles[3] introduced 3 types of cost: *effort cost, opportunity cost, and emotional cost*. *Effort cost* refers to the energy a student needs to spend to complete a task. Students tend to avoid tasks in which they must invest too much effort because they are afraid of being viewed as incompetent if they are not successful. *Opportunity cost* is associated with choice. If a student chooses to engage in a task, she/he would not be able to engage in other works due to time constrains. *Emotional cost* is derived from psychological or emotional states which, in turn, affect actions.[4] For instance, if students perceive that a task will increase their anxiety, they will not fully engage in it so as to avoid the potential emotional costs resulting from increased anxiety.

1.2. Rationale of this review

Ennis[9] argued that physical education needs to provide a transformative learning environment that will motivate students to achieve learning goals. Creating transformation within physical education requires a thorough understanding of motivation sources. Based on summarized findings from classroom research, expectancy beliefs and task values (EBTV) have been identified as strong sources of motivation in physical education.[10,11] To substantiate the evidence, a thorough review using the meta-analytic approaches is necessary to provide both quantified and narrative accounts of the research on EVT in physical education. In this effort, we adopted the meta-analytical systematic approach to critically evaluate the evidence from multiple studies and provide consistent and generalizable findings that could clarify the role of EVT motivation in physical education.

This review is theoretically significant in that it illustrates the potential of EVT for facilitating students' motivation, mindfulness, and meaning making in physical education.[9] We will begin with the methodology that guided the review, followed by a summary, articulation, and critique of the findings based on the results of the meta-analysis. We will then interpret the findings, provide suggestions for physical education curriculum development and instruction, and discuss potential directions for future EVT research.

2. Methods

2.1. The role of systematic review in research

It has been acknowledged that a systematic review using meta-analysis can enhance understanding of a phenomenon by empirically summarizing research findings from multiple studies.[12] In our review, we followed the PRISMA 2020 method to identify, screen, and make decisions for literature inclusion.[13] Specifically, we followed (a) the 3 core methods for identifying relevant research reports for a systematic review, (b) the 7 categories for researchers to consider when writing a review

article, and (c) the 27-item checklist that identifies the information to be included in the review article. We first defined and developed a set of inclusion/exclusion criteria to determine the eligibility of research reports. We also developed a work sequency for conducting the literature search. We then decided on screening procedure to make article section decisions. Lastly, we created a data template to (a) help decide on the information to be extracted from the articles, (b) create a coding guide with variable definitions for extracted information, (c) arrange the sequency by which the extracted information was to be entered into the database, and (d) decide on a "trigger" point where a discussion would be held to create new variables or redefine the coding guide.

2.2. Eligibility criteria

It was acknowledged from the outset of the work that English was the language criterion for article selection. The following criteria were used to determine the eligibility of articles: (a) the study must include the EVT defined variables: expectancy beliefs, task values, and/or cost; (b) the study must be conducted in K−12 physical education settings; (c) the study must include a sample of K−12 school students with data collected directly from the students; (d) the study must use quantitative measurements for statistical analyses, from which effect sizes could be calculated for this review; (e) the study must be published in a peer-reviewed scholarly journal; lastly, (f) the study must have been published after 2010 (considering that the studies prior 2010 were included in the meta-analysis by Chen et al.,[14] which provides an insightful summary of the findings from those earlier studies).

2.3. Search process

Using the eligibility criteria, we conducted the literature search in Education Database, Google Scholar, PsycINFO, PubMed, and the University of North Carolina's digital library. During the search we used the keywords "Expectancy-value", "Task Value", "Expectancy-beliefs", "Physical Education", "Physical Activity", "Physical Exercise", and their combinations using the Boolean operator "AND". A restriction of keywords search in "Title" was used for Google Scholar due to the fact that it has provided the most sensitive and vast coverage in these systems.[15] Boolean and proximity operators were used to connect the keywords for search accuracy and efficiency. No restriction was implemented in the search of other databases. We first generated a list of the articles that satisfied the keywords in terms of the variables (EVT) and school levels (K−12). The abstracts of the studies were downloaded to form the initial pool. An initial screening was conducted to eliminate duplicate studies and to exclude the studies that were not on EVT or that were not conducted in K−12 physical education settings.

2.4. Screening and selection

We then followed the rest of criteria to randomly select and independently review 25% of the total articles. When there were doubts and/or questions about whether an article met any of the criteria, we met and discussed the article and, occasionally, revised the criteria. This process continued until consensus was made and issues were resolved. The process consolidated the criteria and prepared us to solve similar issues in the subsequent screening. After the process, we screened the rest of the articles. Further disagreements were resolved through discussions and involved little change of the criteria.

After excluding studies that did not meet the standards, all 3 researchers then independently screened the titles and abstracts of the remaining articles. Two researchers, the first and third authors (CS and AC), met and discussed these articles in terms of their eligibility for meta-analysis and/or narrative screening for conceptual reviews. They also developed detailed coding strategies to collect data from the identified articles for the meta-analytic procedures. The second author (ACM) was informed of the procedures and the outcomes. This process continued until a consensus was reached and any issues regarding inclusion/exclusion were resolved. The process consolidated the criteria and prepared us to solve similar issues in the subsequent review/critique. Once the criteria were applied to all selected articles, the second author independently verified the selection by re-screening the studies. Disagreements among the researchers were resolved through discussion. Most discussions resulted in further clarification of the criteria but did not lead to fundamental or substantial change of the criteria.

As shown in Fig. 1, a total of 763 articles were initially located. Of those, 694 duplicated articles were excluded. The remaining 69 articles were kept in the pool for further screening and selection decisions. After full-text reading, 38 articles were excluded for various reasons. Eventually, 31 articles were included in this review.

2.5. Potential selection bias

There are 3 potential biases that limit the scope of generalizing the findings. The first is the language bias. We limited our search to English language search engines due to a lack of access to non-English databases and due to our own language barriers. The second potential bias is from a deliberate decision to not include a search for dissertation studies. This decision was based on an assumption that high quality dissertation studies must have been published. Thirdly, excluding the studies prior 2010 may prevent us from interpreting the findings with a historical perspective. We are currently not able to assess the extent to which this exclusion would limit the significance of this study. However, we presume that understanding the current findings and implications for future research and practice would make up for the potential lack of historical perspective on EVT studies in physical education.

2.6. Data collection/extraction process

Prior to data extraction, we carefully read all selected articles separately. During the reading, we highlighted key information in the articles and kept reading notes. Then, one researcher (CS) developed an initial coding sheet for discussion. We met 3 times to examine the codes on the initial coding sheet and added, deleted, and/or combined the initial codes for data collection. The

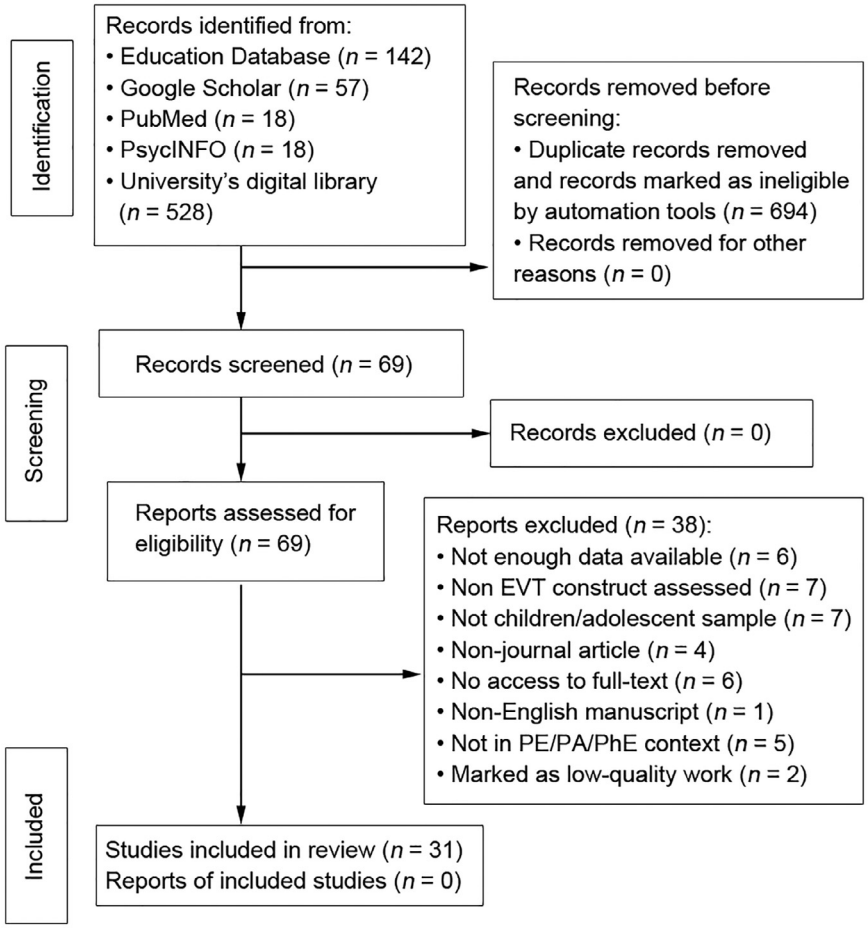

Fig 1. Flow diagram of literature search results. EVT = expectancy-value theory; PA = physical activity; PE = physical education; PhE = physical exercise.

need for new codes evolved from the subsequent review process; therefore, additional meetings were held to determine new codes. The final coding sheet included 84 codes grounded in 12 variable categories, which are organized alphabetically in Table 1. During the data collection, means, standard deviation, correlation coefficients, regression coefficients, and other statistics from the original studies were recorded in a comprehensive spreadsheet for statistical analyses.

2.7. Data summary and assumption testing

Standardized regression coefficients (β) and correlation (r) were the common measures in the selected studies. To compare the coefficients in the same metric, we followed Peterson and Brown's recommendation to transform β to r.[16] Although combining coefficients from different metrics could have limitations, converting a regression coefficient ranging from −0.50 to +0.50 to r was found to be acceptable in review work.[17] Coefficients that fell outside the range would be excluded from the subsequent calculation of effect size. As recommended in the PRISMA guidelines, a narrative analysis was then conducted on the coefficients to examine their consistency or inconsistency with the effect size.[13]

Prior to the analysis, we grouped findings into 2 general types. The first type was where the EVT motivation variables were conceptualized as the dependent variables. In these studies, the general purpose of the original analyses was to identify factors that influence EBTV. The variables included in these studies, in addition to EBTV, were social support, positive class climate, negative class climate, age/grade, EBTV of teachers, and EBTV of peers. The second type was where the purpose of the original analyses was to use EBTV as independent variables or predictors to determine the impact of EVT motivation on learning behaviors and outcomes. The variables in these studies would include learning behaviors (e.g., engagement, concentration), knowledge and skill development, other motivation variables (e.g., situational interests, self-efficacy), out-of-school physical activity, fitness components, and health behavior function.

To help determine the role of the EVT components as associated with these variables in the 2 groups, we separated the reported correlation and regression coefficients of these variables in each group by the EVT components and then formed subgroups under each component based on the analysis types described above. A total of 84 subgroups were formed to account for all the coefficients between the EVT components and the other variables.

Table 1
Definition of coding variables (in alphabetical order).

Coding variables	Measured in original studies
Age	Age in years
Class climate—negative	Performance climate, PA teasing
Class climate—positive	Mastery climate, intention to support, self-efficacy focused
EBTV of peers	Peers' expectancy beliefs and task values
EBTV of teachers	Teachers' expectancy beliefs and task values
Fitness	Cardiovascular fitness, muscular endurance, in-class PA intensity
Health behavior function	Physical function, social and emotional function, school function
Learning behaviors	Concentration, persistence, engagement, knowledge acquisition
Out-of-school PA	PA time, PA frequency, intention to participate in PA
Physical skills	Sports skills, coordination skills
Situational interest	Total interest and its components (attention, challenge, exploration, instant enjoyment, novelty)
Social support	Support from peers, parents' expectancy beliefs and values, autonomy support, competency support

Abbreviations: EBTV = expectancy beliefs and task values; PA = physical activity.

These coefficient groups were then subjected to the heterogeneity assumption test to determine their eligibility for effect size calculation.

2.7.1. Heterogeneity test

Social science studies tend to have high heterogeneity due to differences in study populations, research designs, and the nature of measurements (objective measures or self-report).[18] A high heterogeneity (e.g., a p value < 0.05 for a χ^2 test) indicates a violation of the assumption, which limits the generalizability (external validity) of the findings (effect size). Therefore, it is recommended that a heterogeneity test should be conducted prior to a meta-analysis procedure.[19] We adhered to the following procedures to assess heterogeneity for each of the 84 subgroups. First, a weighted mean was calculated using this formula:

$$Z_r = \frac{\sum (N_j - 3) Z_{r_j}}{\sum (N_j - 3)}.$$

Here, N_j refers to the number of sampling units. Z_{r_j} refers to the Fisher Z_r corresponding to coefficient r. Then, the following formula was implemented to calculate heterogeneity.[20] The χ^2 statistic was calculated:

$$\chi^2 = \sum (N_j - 3)\left(Z_{r_j} - \overline{Z_r}\right)^2.$$

Here, N_j and Z_{r_j} refer to the same numbers as those in the first formula, and $\overline{Z_r}$ refers to the weighted mean Z_r from the previous calculation. We excluded the coefficients whose absolute value was smaller than 0.30 because these coefficients explained a small variance.

After the χ^2 value was obtained, it was compared with the critical value to determine its statistical significance. The function of the heterogeneity testing in a meta-analysis procedure is to rule out "outlier" coefficients that might skew the pooled results and, subsequently, lead to spurious findings. When a χ^2 statistic is found to be statistically significant, the violation of the heterogeneity criterion is determined to be present. The coefficients involved should then be excluded from the interpretation based on the pooled effect size. In this case, we conducted a narrative analysis of the original coefficients by determining their consistency with the findings based on the pooled effect size.

2.8. Statistical analysis

Most of the findings in the pool were based on correlational analyses. In the meta-analyses, we first evaluated the reliability of the estimated effect size using:

$$t^c = \frac{r}{\sqrt{1 - r^2}} \times \sqrt{df}.$$

Here, t^c refers to t test, r is the coefficient, and df is the degree of freedom.[20] The null hypothesis in this formula is that there is no meaningful effect size in the relationship between the 2 variables. When the null hypothesis was rejected, we then adopted the next formula to estimate the pooled effect size among the variables in the subgroups:[21]

$$\overline{r} = \frac{\Sigma [N^i r^i]}{\Sigma N}.$$

Here, r^{i} is the coefficient in study (i), and N^{i} is the number of participants in the study (i). We followed the conventional cut-offs to interpret the effect size ($\overline{r}$) as weak ($\leq$0.35), moderate ($\leq$0.36−0.67), and strong ($\leq$0.68−1.00).[22] The two-step calculation was performed for all subgroups of coefficients to determine whether the effect size was meaningful in terms of the variables involved.

2.9. Narrative synthesis

We narratively analyzed and subsequently reported the results of the coefficients that did not meet the heterogeneity and other criteria, including cases where (a) the heterogeneity testing could not be performed due to missing measures, (b) there were fewer than 2 coefficients to be pooled, (c) t test

results showed low reliability ($p > 0.05$ in the t test), and (d) the coefficients fell out the range permitted for the β coefficient conversion (−0.50 to +0.50).

3. Results

There were 22 articles[23–44] guided by EVT exclusively; the other 5 studies[45–49] were centralized on EVT but were combined with situational interest theory, self-efficacy theory, achievement theory, goal orientation theory, or self-determination theory. Most of the articles implemented a correlation design ($n = 22$),[23–31,33,35,38–47,49] followed by experimental ($n = 5$)[26,29,33,39,44] and mixed ($n = 1$)[23] designs. Among them, 20[30–49] focused on middle and elementary school students, 3 studies[23–25] focused on high school students, and 4 studies[26–29] were with participants of mixed grades. The school settings urban ($n = 16$),[23,24,26,27,29,32,34,35,38,40–43,45,47,49] rural ($n = 6$),[25,28,30,37,41,44] and suburban ($n = 1$)[33] areas, and 4 studies[30,31,45,46] did not report contextual information. A majority of the studies measured both EBTV ($n = 23$),[23–25,27–31,34–47,49] 3 studies[26,32,33] measured task values only, and 1 study[46] measured expectancy beliefs only. Cost was examined in 5 studies.[23,34–36,50]

In terms of methods of data analysis, correlation with regression analysis was the most popular method ($n = 9$),[30,37,38,40,41,43,45,46,49] followed by correlation with structural equation modeling method ($n = 5$).[23,25,31,47,48] Five studies[28,30,32,37,38] employed hypothesis testing with correlation and regression, and 3 studies[33–35] used regression or correlation with hypothesis testing. Five studies[27,36,39,46,50] exclusively used either correlation, structural equation modeling, hierarchical linear modeling, hypothesis testing, or mixed data analyses.

Overall, the studies generated 205 EVT coefficients (including those converted from βs). Of those, 38 were with out-of-school physical activity, 37 were associated with learning behaviors, 31 with fitness components, 22 with social support, 20 with situational interests, 13 with positive class climate, 12 with physical skills, 12 with peer EBTV, and 11 with teacher EBTV. Health behavior function, negative class climate, and age/grade were the most understudied factors ($n = 6$, 2, and 1, respectively).

3.1. EVT motivation as dependent variable

In the studies where EVT was the dependent variable, social support, positive class climate, negative class climate, age/grade, teacher EBTV, parent EBTV, and peer EBTV were measured as either the independent variables impacting EVT motivation or as associated variables related to the EVT variables. A conceptual classification revealed 3 EVT associations: (a) with social support, (b) with class climate and demographics, and (c) with teacher, parent, and peer EVT. Table 2 reports the heterogeneity testing results for the coefficients. Table 3 presents their effect sizes.

3.1.1. Social support and EVT motivation

As shown in Table 3, the meta-analysis results indicated that social support was moderately related to utility value ($\bar{r}$ = 0.57) but weakly related to the overall task values ($\bar{r}$ = 0.30). Four studies failed to satisfy the heterogeneity criterion, but their results seemed to be consistent with the findings from the meta-analysis. A study by Zhang et al.[45] showed that the EBTV of elementary-school children could be predicted with autonomy support ($\beta = 0.24$, $p < 0.01$) and competency support ($\beta = 0.50$, $p < 0.01$). Social support from peers emerged as a positive correlator of EBTV for students in elementary schools ($r = 0.33$, $p < 0.01$; $r = 0.28$, $p < 0.01$) and high schools ($r = 0.43$, $p < 0.01$ for expectancy beliefs).[25,29] Williams and Wiess[24] revealed that support from parents could positively shape their children's EVT motivation. It showed that the expectancy beliefs, attainment values, and utility values of parents positively predicted their children's expectancy beliefs, attainment values, and utility values ($\beta = 0.45$, $p < 0.01$; $\beta = 0.48$, $p < 0.01$; $\beta = 0.63$, $p < 0.01$; respectively).

3.1.2. Class climate and age and EVT motivation

The meta-analysis revealed that positive class climate was associated with intrinsic value ($\bar{r}$ = 0.49). A narrative analysis on the studies that did not meet the heterogeneity criterion appeared to support this association. In addition, their results further specified the role of different class climate in relation to EVT motivation. A cross-section study ($n = 336$) indicated that both mastery-involving class climate and performance-involving class climate were positively, but weakly, associated with task values ($r = 0.30$,

Table 2
Results of heterogeneity test for relations between EVT motivation and its generators.

Category	EB	TV	AT	IV	UV	Cost
	df / χ^2 / p	df / χ^2 / p	df / χ^2 / p	df / χ^2 / p	df / χ^2 / p	
SS	11 / 187.35 / <0.01	1 / 0.09 / >0.05	2 / 21.05 / <0.01	–	2 / 2.10 / >0.05	N/A
PCC	–	–	–	1 / 0.53 / >0.05	–	
NCC	–	–	–	–	–	
Age	–	–	–	–	–	
TEBTV	2 / 52.40 / <0.01	–	2 / 18.10 / <0.01	–	2 / 4.81 / >0.05	
CEBTV	3 / 79.71 / <0.01	–	2 / 4.16 / >0.05	–	2 / 4.93 />0.05	

Note: "–"means that there is either no coefficient available or less than 2 coefficients available for the test.
Abbreviations: AT = attainment value; CEBTV = classmate expectancy beliefs and task values; EB = expectancy beliefs; IV = intrinsic value; N/A = no data available; NCC = negative class climate; PCC = positive class climate; SS = social support; TEBTV = teacher expectancy beliefs and task values; TV = task values; UV = utility value.

Table 3
Effect size of correlations between class factors and EVT components.

Class factor	EVT component	Effect size ($\bar{r}$)
Social support	Task value	0.30
Social support	Utility value	0.57
EBTV of teachers	Utility value	0.41
EBTV of peers	Utility value	0.45
EBTV of peers	Attainment value	0.49
Positive class climate	Intrinsic value	0.49

Abbreviations: EBTV = expectancy beliefs and task values; EVT = expectancy-value theory.

$p < 0.01$; $r = 0.21$, $p < 0.01$) and expectancy beliefs ($r = 0.32$, $p < 0.01$; $r = 0.21$, $p < 0.01$).[40] However, the relations regarding mastery-involving climate were stronger than the relations regarding performance-involving climate. When EVT motivation was regarded as the dependent variable, EVT motivation was predicted by both types of class climates. Specifically, Gu et al.[40] reported that mastery-involving class climate predicted student expectancy beliefs ($\beta = 0.30$, $p < 0.01$) and task values ($\beta = 0.28$, $p < 0.01$) as did performance-involving class climate ($\beta = 0.17$, $p < 0.01$ for expectancy beliefs; $\beta = 0.17$, $p < 0.01$ for task values).

In addition, a study conducted in both Spain and Chile by Gallardo et al.[25] indicated that physical activity-teasing had a negative impact on student expectancy beliefs and intrinsic value ($\beta = -0.16$, $p < 0.01$; $\beta = -0.13$, $p < 0.01$). Physical activity-teasing also led to an increase in emotional cost ($\beta = 0.37$, $p < 0.01$). Although this research was consistent across both countries, students from Chile were more vulnerable to these negative influences than were students from Spain ($\beta = -0.17$ *vs.* $\beta = -0.15$ for expectancy beliefs; $\beta = -0.16$ *vs.* $\beta = -0.09$ for intrinsic values; $\beta = 0.42$ *vs.* $\beta = 0.31$ for emotional cost). This study also investigated the impact that age had on student motivation, indicating that expectancy beliefs declined with age in the Spanish sample ($\beta = -0.06$, $p < 0.01$). Kirkpatrick et al.[46] reported that EVT motivation mediated the relations between positive class climate and learning performance.

3.1.3. Teacher, parent, and peer EVT influence

Also reported in Table 3 are the associations between the EVT of teachers/peers and students' own EVT motivation. The meta-analysis results revealed that teacher and peer EBTV could positively influence students' utility value ($\bar{r}$ = 0.41 and 0.45, respectively) and that the EBTV of peers also had an influence on attainment value ($\bar{r}$ = 0.49). One study examined the association between the components of the EVT of parent and their children.[24] It reported that the expectancy beliefs and attainment values of parents predicted their children' expectancy beliefs ($\beta = 0.20$, $p < 0.01$) and attainment values ($\beta = 0.14$, $p < 0.01$). It also reported that the expectancy beliefs and attainment and utility values of peers predicted children's beliefs ($\beta = 0.28$, $p < 0.01$), attainment values ($\beta = 0.24$, $p < 0.01$), and utility values ($\beta = 0.19$, $p < 0.01$).

In summary, the results from both meta-analysis and narrative analysis were consistent, suggesting positive associations between EVT motivation and positive social support, positive class climate, and teacher and peer EVT motivation. The findings illustrated the importance of maintaining a positive learning environment for student EVT motivation.

3.2. EVT motivation as independent variable

The second group of studies focused on the purpose of motivating students, which was to help them gain knowledge, be active, and develop skills and fitness. The EVT components, therefore, were used as independent variables to predict their impacts on learning outcomes. The outcome variables, including learning behaviors, physical skills, situational interests, out-of-school PA, fitness components, positive class climate, negative class climate, and health behavior function were regarded as the dependent factors of EVT motivation. Below are the results of meta-analyses on the subgroups of the relations between the EVT components and these outcome variables. Table 4 reports the results of heterogeneity testing for this group of studies. Table 5 reports the effect sizes from the meta-analysis on the studies that met the heterogeneity criterion ($p > 0.05$). In each section below, the results are reported first, followed by narrative reporting on studies that did not meet the criterion.

3.2.1. EVT motivation and learning behaviors

As shown in Table 5, expectancy beliefs ($\bar{r}$ = 0.27) and attainment values ($\bar{r}$ = 0.25) emerged as positive contributors to student learning behaviors, although the effect size suggested the contribution might be limited. Findings from the narrative analysis revealed that EBTV were positive predictors for student engagement, persistence, and concentration across middle and high school.[23,28,41,45] Expectancy beliefs ($\beta = 0.24-0.26$, $p < 0.01$) and intrinsic value ($\beta = 0.19$, $p < 0.01$) predicted student engagement.[23] Intrinsic value significantly influenced student engagement ($\beta = 0.77$, $p < 0.01$).[41] Expectancy beliefs ($\beta = 0.19-0.27$, $p < 0.01$), attainment value ($\beta = 0.13-0.36$, $p < 0.01$), and intrinsic value ($\beta = 0.18-0.50$, $p < 0.01$) predicted student engagement.[28] It also reported that expectancy beliefs and intrinsic value positively predicted student class performance ($\beta = 0.17-0.43$, $p < 0.05$).[28]

In studies where task value measures were pooled as an aggregated variable of general task value, it was found that the overall task value had a greater predictive effect on student concentration ($\beta = 0.49$, $p < 0.01$) than did expectancy beliefs ($\beta = 0.14$, $p < 0.01$). In addition, overall task value predicted student persistence as well ($\beta = 0.60$, $p < 0.01$).[45] In terms of active engagement in learning, however, Gu et al.[40] reported that both expectancy beliefs ($\beta = -0.03$, $p = 0.66$) and the overall task value ($\beta = -0.15$, $p < 0.05$) had insignificant or negative impacts on student engagement at the elementary level.

EVT motivation was found to impact other learning behaviors as well. Garn et al.[29] reported that support-seeking behavior could be explained by its association with expectancy beliefs ($r = 0.33$, $p < 0.01$) and task values ($r = 0.28$,

Table 4
Results of heterogeneity test for relations between EVT motivation and learning outcomes.

Category	EB	TV	AT	IV	UV	Cost
	df/χ^2/*p*	*df* / χ^2 / *p*	*df* / χ^2 / *p*	*df* / χ^2 / *p*	*df* / χ^2 / *p*	
LB	5 / 4.06 / >0.05	3 / 24.42 / <0.01	3 / 6.88 / >0.05	3 / 19.43 / <0.01	2 / 141.10 / <0.01	N/A
PS	4 / 4.54 / >0.05	–	–	–	–	
SI	5 / 42.76 / <0.01	1 / 2.49 / >0.05	1 / 20.10 / <0.01	4 / 25.50 / <0.01	2 / 2.26 / >0.05	
OPA	10 /151.54 / <0.01	3 / 0.47 / >0.05	3 / 0.47 / >0.05	2 / 10.41 / <0.01	–	
FC	10 / 26.08 / <0.01	–	–	2 / 0.99 / >0.05	–	
PCC	2 / 46.60 / <0.01	1 / 6.65 / <0.01	1 / 6.65 / <0.01	1 / 0.53 / >0.05	–	
NCC	–	–	–	–	–	
HBF	4 / 5.41 / >0.05	–	–	–	–	

Note: "–" means that there is either no coefficient available or less than 2 coefficients available for the test.
Abbreviations: AT = attainment value; EB = expectancy beliefs; EVT = expectancy-value theory; FC = fitness components; HBF = health behavior functions; IV = intrinsic value; LB = learning behavior; N/A = no data available; NCC = negative class climate; OPA = out-of-school physical activity; PS = physical skill; PCC = positive class climate; SI = situational interest; TV = task values; UV = utility value.

$p < 0.01$). Zhu and Chen[47] found in a path model analysis that expectancy beliefs had a positive impact on self-efficacy development ($\beta = 0.77, p < 0.05$).

3.2.2. EVT motivation and knowledge/skills

As shown in Table 5, the effect size seems to support the idea that expectancy beliefs positively result in physical skills development ($\bar{r} = 0.30$). The narrative analysis revealed expectancy beliefs to be a positive predictor of physical skill achievement ($\beta = 0.38, p < 0.01$).[42] Ding et al.[35] reported that utility value negatively predicted arm-striking skill achievement ($\beta = -0.09, p < 0.05$) and total skill acquisition ($r = -0.01, p < 0.05$). In a later study, however, Ding et al.[41] found that utility value was positively related to striking skill achievement ($r = 0.13, p < 0.05$) and intrinsic value was a positive predictor for total skill acquisition ($\beta = 0.41, p < 0.01$). As Ding et al.[41] theorized, these findings may suggest instances of motivation content specificity.

Research findings regarding the impact of EVT motivation on knowledge acquisition were mixed. Expectancy beliefs ($\beta = 0.14, p < 0.05$) and utility value ($\beta = 0.31, p < 0.05$) were found to positively influence student knowledge acquisition.[40] However, Gu et al.[40] also reported that attainment value and intrinsic value negatively predicted knowledge acquisition ($\beta = -0.16, p < 0.05$; $\beta = -0.21, p < 0.05$).

Table 5
Effect size of correlations between EVT components and learning outcomes.

EVT component	Learning outcome	Effect size ($\bar{r}$)
Engagement measures		
Expectancy beliefs	Learning behaviors	0.27
Attainment value	Learning behaviors	0.25
Task values	Situational interests	0.49
Utility value	Situational interests	0.37
Outcome measures		
Attainment value	Fitness components	0.30
Intrinsic value	Fitness components	0.37
Expectancy beliefs	Health behavior function	0.37
Task values	Out-of-school physical activity	0.32
Attainment value	Out-of-school physical activity	0.41
Expectancy beliefs	Physical skills	0.30

Abbreviation: EVT = expectancy-value theory.

3.2.3. EVT motivation and situational interests

As an indicator of active engagement, situational interest can be a measure of instant motivation outcome in physical education.[43] The meta-analysis found that task values, especially utility value, were moderately and positively associated with situational interests ($\bar{r} = 0.49$ and 0.37, respectively). The narrative analysis showed that EBTV were positively related to the sources of situational interest, including attention, challenge, exploration, total interest, instant enjoyment, and novelty ($r = 0.15–0.80, p < 0.01$);[41] and EBTV emerged as positive predictors of enjoyment ($\beta = 0.31, p < 0.01$; $\beta = 0.18, p < 0.05$).[29]

3.2.4. EVT motivation and out-of-school physical activity

As shown in Table 5, out-of-school physical activity was positively predictive with respect to task values and attainment values ($\bar{r} = 0.32$ and 0.41, respectively). Narrative analysis, however, seemed to suggest inconclusive findings about the impact of EVT motivation on the intention to engage in out-of-school physical activity. Expectancy beliefs were reported to have a positive impact by Latterman et al.[31] ($\beta = 0.26, p < 0.05$) and Gallardo et al.[25] ($\beta = 0.48, p < 0.01$). In addition, Xiang et al.[48] showed that the EVT motivation of elementary school children was positively associated with their intention for future participation in running ($r = 0.51–0.80, p < 0.01$). Gu et al.,[43] however, reported that instead of expectancy beliefs, attainment value, intrinsic value, and utility value were effective predictors ($\beta = 0.33, p < 0.01$; $\beta = 0.27, p < 0.01$; $\beta = 0.11, p < 0.05$; respectively).

EVT motivation impact on out-of-school physical activity participation was also examined using participation time and frequency measures. A study by Simpkins et al.[27] reported that students with high task values tended to spend more time on out-of-school physical activity than did their counterparts ($\beta = 0.28, p < 0.05$). Gråstén[44] revealed that intrinsic value had a negative impact on out-of-school physical activity participation ($\beta = -0.34, p < 0.05$), suggesting that providing

many "fun" activities during physical education might be counterproductive to helping students become active during after-school time.

Other studies explored the topic using frequency measures such as active days per week. Gu and colleagues[40] reported that EVT motivation was positively related to out-of-school physical activity frequency ($r = 0.28-0.35$, $p < 0.05$). Chen and Chen[23] found a low–moderate correlation between utility value and out-of-school physical activity frequency ($r = 0.21$, $p < 0.05$). In other studies, expectancy beliefs were found to be predictive of out-of-school physical activity frequency ($\beta = 0.20$, $p < 0.05$; $\beta = 0.28$, $p < 0.05$) and explained 11.2% of the variance for out-of-school physical activity frequency.[30,49] Internationally, utility value and intrinsic value were found to be positive predictors for out-of-school physical activity frequency for Chinese students ($\beta = 0.38$, $p < 0.001$; $\beta = 0.23$, $p < 0.01$), and intrinsic value was found to be a predictor for students from Finland ($\beta = 0.36$, $p < 0.001$).[28,32] One study, however, reported that EVT motivation indirectly, rather than directly, impacted out-of-school physical activity frequency, with scientific knowledge about physical activity serving as an important mediator.[42]

3.2.5. EVT motivation and fitness

The meta-analysis results showed significant effect sizes on fitness by attainment value and intrinsic value ($\bar{r} = 0.30$ and 0.37, respectively). With respect to specific fitness components, Gu et al.[30] and Latterman et al.[31] found that expectancy beliefs positively predicted cardiovascular fitness ($\beta = 0.34$, $p < 0.01$; $\beta = 0.27$, $p < 0.05$; respectively); this finding was also supported by Zhu and Chen[47] ($\beta = 0.31$, $p < 0.05$). The narrative analysis produced similar findings, indicating a positive association between task values and cardiorespiratory fitness ($r = 0.23-0.67$, $p < 0.01$).[47,48] When gender and body weight were controlled, however, expectancy belief was found to be the only predictor of cardiorespiratory fitness ($\beta = 0.38$, $p < 0.001$) as well as muscular endurance ($\beta = 0.19$, $p < 0.05$).[38]

3.2.6. EVT motivation and health behavior function

The effect size for the impact of expectancy beliefs on health behavior function was moderate ($\bar{r} = 0.37$). The narrative analysis seemed to suggest consistent findings. A study by Gu et al.[40] reported that expectancy beliefs emerged as a positive predictor of students' health behavior function development ($\beta = 0.24$, $p < 0.01$).

4. Discussion

The purpose of this review was to determine the contribution of EVT research to the understanding of student motivation. It also aimed to provide research evidence for the future development of motivation strategies to facilitate student learning in physical education. The results of the review, as indicated above, have clearly demonstrated the positive impact of EVT on our understanding of student motivation in relation to instructional variables in physical education. Furthermore, grouping the studies according to the nature of the relationship between EVT components and instructional variables further allowed us to identify the factors influencing EVT motivation and the role of EVT motivation in relation to student learning outcomes.

4.1. Factors contributing to EVT motivation

Student motivation relies on many factors in the classroom, which themselves stem from the overall environment where learning is taking place.[3,4,51] The findings of this review contribute to this general observation by specifically pointing to 3 primary factors in physical education: social support learners receive in the classroom, motivation displayed by teachers and peers, and a positive class climate. In addition, the meta-analysis also provides one-to-one specificity in terms of the correlation effect size for the strength and meaningfulness of the relationship for each EVT component (Table 3).

Social support has a generally positive influence on student motivation through its impact on the aggregated scores of task values (Table 3). Most studies used the aggregated score to present an overall task-value based student motivation. When analyzing the data by specific task values, we find that utility value stands out as the one that benefits the most from social support in physical education ($\bar{r} = 0.57$). The finding may suggest that social support from teachers and/or peers could enhance the understanding that physical education learners have of the usefulness of the content to their lives, either currently or in the future. This finding encourages physical educators to create and maintain a supportive environment to enhance student motivation and engagement.[52]

Interestingly, the results showed that the EVT motivation of students is associated with the EVT motivation of their teachers and peers. The associations are once again most salient in the EVT components of utility value. The effect sizes show that the influence of peers seems to be stronger than that of teachers. Schunk[2] has observed that teachers and peers can be a strong source of motivation for learners. Specifically, he suggested that motivation from peers may be more impactful because learners can be effectively influenced by peer modeling. In other words, peers in class can serve as role models for other students; the motivation they display encourages others to become motivated. A motivated teacher tends to have a strong influence on their students' motivation to learn. Xiang et al.[53] reported that through motivated instruction, a teacher can create and maintain as supportive environment for students to concentrate on task and autonomous learning. The finding may, theoretically, enhance our application of the social constructivist learning theories in physical education.[54] A major tenet of the social constructivist learning is the concept of zone of proximity development, wherein a student must be socially supported by knowledgeable others in order to gauge the distance between what she/he expects to be able to accomplish and what she/he will be able to do. The influence of peer social support might indicate that another important function of the zone of proximity development is to elevate the EVT motivation of fellow learners.

Class climate plays a vital role in student motivation development.[51] The above findings about the impact of social support and teacher/parent/peer EVT motivation may demonstrate the impact of a positive class climate on EVT motivation. In the studies we reviewed, however, the class climate variable was operationalized differently according to various different achievement motivation theories, including the achievement goal theory to the self-efficacy theory and the perceived competence theory (Table 1). Students learning in a mastery-involving class climate tended to have stronger motivation toward physical education than did those who were subjected to a performance-involving class climate. It is consistent among the findings that achievement goals relate to EBTV and generate desired learning outcomes. Mastery goals can outperform or at least match performance goals.[51,55] In addition, the association between positive class climate and intrinsic value appears to indicate the role of an interesting or enjoyable climate in the positive development of intrinsic value. One alarming finding reveals the negative consequence of teasing on student motivation in physical education. Gallardo et al.[25] warn us that peer-to-peer interaction in physical education is not always a positive experience. Additional studies are needed to inform researchers and teachers about the extent of the consequence for student motivation that teasing peers in the physical education setting may have. These studies can inform the effort to develop effective curricular approaches to preventing such incidents.

In this review, the only demographic factor contributing to EVT motivation change appears to be age. This finding is consistent with many studies in education.[56] Studies in this subgroup report a decline in EVT component measures by age. The finding may support the notion that biological development coupled with social influence may influence student EVT motivation.[5,51]

In summary, this group of studies provides strong evidence (as manifested in moderate-to-high−moderate effect sizes) regarding factors that might shape student EVT motivation. From the curricular and instructional perspectives, these factors can be controlled by curriculum designers and teachers when they are planning for learning context and tasks. The findings appear, at least theoretically, to support the notion that motivation can be nurtured during the learning process and should be planned for in terms of learning tasks.[57]

4.2. EVT motivation contributions to learning outcomes

The purpose of studying student motivation is to enhance learning experiences and outcomes for students.[58] Many studies have focused on how EVT motivation contributes to physical education learning outcomes, with measures including knowledge, skills, engagement, and in-class and after-school physical activity behaviors (Table 5). This collective effort has begun to fill an important gap in motivation research in physical education.[58] As shown in Table 5, however, the effect sizes ranging from 0.25 to 0.49 indicate that the impact of EVT motivation on learning outcomes may be moderate overall. More specifically, we see that expectancy beliefs contribute to measures of student achievement, while task values contribute to measures of student choice, effort, and intention. The evidence seems to confirm the unique content-specificity characteristics of EVT motivation.[47,59] The pattern provides initial evidence for curriculum designers and teacher who may want to consider the nature of assigned tasks as they relate to motivation strategies. The learning outcomes can be further categorized, as illustrated in Table 5, by the engagement measures that demonstrate student willingness to engage in learning processes and by the outcome measures that signify gains made as a result of physical education learning. Results from the meta-analysis and narrative reported findings clearly show the important and unique characteristics of EVT motivation.

It seems apparent that task characteristics have a major influence on student engagement motivation. When a task is perceived as important by students (attainment value), they tend to demonstrate positive and motivated learning behaviors. General positive task values contribute to situational interest, which strengthens the attractiveness of the learning task and, thereby, increases engagement. It is interesting that when a task is perceived as useful, it is also perceived as interesting to students, which leads to higher levels of engagement.[60]

With respect to learning outcome measures, it seems that content specificity is at work. Expectancy beliefs are the best predictors of student skill gain and health behavior function development. In these learning domains, students are most likely to be motivated when they believe they can be successful in mastering learning tasks and meeting teachers' expectations.[5,51] Along with attainment value, the general perception of task values contributes to out-of-school physical activity participation. The review findings indicate the importance of individual perception when it comes to physical education. When the content is perceived as meaningful, students can be motivated to pursue physical activity participation on their own.[12] Both attainment value and intrinsic value contribute to fitness outcome measures, a finding which suggest the importance of explicit and deliberate instruction to help students connect physical education content with their understanding of health and quality of life. Also, this finding implies the significance of designing interesting and attractive tasks to more effectively deliver the content to students.

5. Reflections and conclusion

5.1. Overall application

The review findings suggest that when selecting effective teaching strategies, physical educators should emphasize the EVT principles to motivate students by demonstrating opportunity for success along with the value of learning tasks. To achieve this, a careful content design is necessary to ensure that specific content and tasks are indeed providing value with regard to attainment, usefulness, and enjoyment. Fostering a learning environment with a mastery-centered and/or student autonomy approach where students perceive that they are supported to pursue success and value can enhance and maximize their motivation and achievement. With enhanced mastery and

autonomy support, students would be more motivated to actively engage in class activities.

A unique finding from the review is that the EVT works best in a supportive learning environment where task mastery and student autonomy are expected, maintained, and sustained by teachers. If teachers have higher expectations for mastery and autonomy, students will attach strong task values to the content of physical education. Therefore, strategies that promote the self-efficacy and autonomy needs of learners and that develop a mastery-oriented learning climate should be encouraged in physical education to assist in improving students' EVT motivation.

The findings from this review should encourage physical educators to focus on teaching competence-based content and to develop assessments to provide evidence for students to identify their achievements. Evidence demonstrating achievement outcomes can enhance students' motivation through identifiable success and task values. Whenever possible, physical educators should explain and elaborate the values of learning tasks, especially those of physical activities, in order to promote student engagement. In addition, given the positive relationship between EVT and other motivation constructs, physical educators can help students develop their learning behaviors, including concentration, persistence, engagement, effort, in-class physical activity, and situational interests, by promoting their EBTV. EBTV have a demonstrated impact on student learning achievement. Students' attainment value and intrinsic value should be attached to health-enhancing physical activity tasks in order to promote their fitness and physical activity behavior change. Expectancy beliefs could be used to facilitate students' health behaviors and physical skills. Task value, especially attainment value, could motivate students to participate in out-of-school physical activity.

5.2. Limitations

There are 2 limitations to the present study. The first is that we only searched databases of English language. Therefore, all the studies reviewed were published in the English language. This means that the findings are most relevant in regions where the English language, and perhaps the Western culture, is prevalent. This constrains or weakens the generalizability of the findings to non-English speaking regions and non-Western cultures. The second limitation of this study has been documented widely, and it has to do with the omission of the "gray" literatures. We did not attempt to identify and include unpublished lab reports (e.g., preliminary data reports, technical reports, internal/self-study reports), unpublished theses and dissertations, conference proceedings, and reports to funding agencies. Associated with this omission is our inability to locate those studies that researchers decided not to submit for publication due to non-significant findings—the so-called file-drawer effect. We are aware that these omissions might lead to an overestimation (around 15%) of effect sizes,[61] which might undermine the external validity of the findings. Although this overestimation will not reverse the review findings, precautions should be taken when one attempts to interpret the reported effect sizes.

5.3. Future directions

The review also exposes areas of EVT research that need to be strengthened. Cost has been conceptualized as an equally important component in the task category of the construct. Yet, of the studies reviewed here, few have focused on cost, and it has not been measured or analyzed meaningfully. Considered by education scholars to be the only demotivator in EVT that can make or break student engagement decisions, cost and its impact on EVT motivation, engagement, and learning achievement must not be neglected. Similarly, research is lacking on older children. Most participants in the studies were from elementary or middle schools; studies on high school students were (and are) scarce. We know EVT. motivation declines with age, but we do not know the reasons. Establishing K−12 student EVT motivation profiles may be of interest to curriculum designers and teachers, who would use the evidence as content-specific guidelines to develop meaningful tasks that are consistent with students' task value perspective.

5.4. Conclusion

There are a few key findings from this review. In comparison to the studies before 2010, the recent studies clearly show a strong focus on the factors contributing to the development of EVT motivation and EVT motivation contributions to learning outcomes. These developments have brought elevated significance to the research of motivation in physical education. However, the meta-analysis and narrative summary of the findings also indicate a strong need to advance motivation research based on what we already know. First, although motivation tends to be influenced by multiple factors, its relationship with these factors could be stable or not depending on learning context and differences in individual characteristics. For example, age is found to be the only meaningful factor. Research on motivation's relationship to gender, culture and ethnicity, and body characteristics is still lacking. These relationships can be particularly important in informing physical education curriculum decisions and teaching strategies. Second, this group of studies has generated insightful evidence showing EVT motivation's contributions to learning outcomes. However, one learning outcome seems to be missing from the measures, and that is knowledge gain. Since physical education continues to be a formal subject matter in schools, including knowledge gain in kinesiology science as a learning outcome measure seems to be appropriate and timely for future research.

Acknowledgment

Supported by the National Institutes of Health (Grant No. R25GM129805).

Authors' contributions

CS was responsible for the overall concept/content of this opinion article and involved in all steps; ACM was involved literature screening and data interpretation and editing; AC was involved in literature research, data analysis, writing, and critical revision of multiple versions of the manuscripts. All authors have read and approved the final version of the manuscript, and agree with the order of presentation of the authors.

Competing interests

The authors declare that they have no competing interests.

References

1. Chen A. Top 10 research questions related to children physical activity motivation. *Res Q Exerc Sport* 2013;**84**:441–7.
2. Schunk DH. *Learning theories: An educational perspective*. 8th ed. Hoboken, NJ: Pearson; 2020.
3. Wigfield A, Eccles JS. The development of achievement task values: A theoretical analysis. *Dev Rev* 1992;**12**:265–310.
4. Eccles JS, Wigfield A. From expectancy-value theory to situated expectancy-value theory: A developmental, social cognitive, and sociocultural perspective on motivation. *Contemp Educ Psychol* 2020;**61**:1–13.
5. Eccles JS, Wigfield A. Motivational beliefs, values, and goals. *Annu Rev Psychol* 2002;**53**:109–32.
6. Li W, Lee A, Solmon M. The role of perceptions of task difficulty in relation to self-perceptions of ability, intrinsic value, attainment value, and performance. *Eur Phy Educ Rev* 2007;**13**:301–18.
7. Welch NM, Siegele J, Hardin R. For the sga-du-gi (community): Modern day Cherokee stickball. *Am Indian Cult Res J* 2017;**41**:93–114.
8. Fielding-Wells J, O'brien M, Makar K. Using expectancy-value theory to explore aspects of motivation and engagement in inquiry-based learning in primary mathematics. *Math Educ Res J* 2017;**29**:237–54.
9. Ennis CD. Educating students for a lifetime of physical activity: Enhancing mindfulness, motivation, and meaning. *Res Q Exerc Sport* 2017;**88**:241–50.
10. Héfer Bembenutty, Karabenick SA. Self-regulation, culture, and academic delay of gratification. *J Cogn Educ Psychol* 2013;**12**:323–37.
11. Feldon DF, Callan G, Juth S, Jeong S. Cognitive load as motivational cost. *Educ Psychol Rev* 2019;**31**:319–37.
12. Fagard RH, Staessen JA, Thijs L. Advantages and disadvantages of the meta-analysis approach. *J Hypertens Suppl* 1996;**14**(Suppl. 2):13. doi:10.1097/00004872-199609002-00004.
13. Page MJ, McKenzie JE, Bossuyt PM, et al. Mapping of reporting guidance for systematic reviews and meta-analyses generated a comprehensive item bank for future reporting guidelines. *J Clin Epidemiol* 2020;**118**:60–8.
14. Chen S, Chen A, Zhu X. Are k-12 learners motivated in physical education? A meta-analysis. *Res Q Exerc Sport* 2012;**83**:36–48.
15. Giustini D, Boulos MN. Google scholar is not enough to be used alone for systematic reviews. *Online J Public Health Inform* 2013;**5**:214–23.
16. Peterson RA, Brown SP. On the use of beta coefficients in meta-analysis. *J Appl Psychol* 2005;**90**:175–81.
17. Vasconcellos D, Parker PD, Hilland T, et al. Self-determination theory applied to physical education: A systematic review and meta-analysis. *Front Psychol* 2019;**10**:2115. doi:10.1037/edu0000420.
18. Tong G, Guo G. Meta-analysis in sociological research: Power and heterogeneity. *Sociol Methods Res* 2019;**51**:566–604.
19. Hardy RJ, Thompson SG. Detecting and describing heterogeneity in meta-analysis. *Stat Med* 1998;**17**:841–56.
20. Rosenthal R. *Meta-analytic procedures for social research*. Revised edition Newbury Park, CA: Sage Publications; 1991.
21. Schmidt FL, Hunter JE. *Methods of meta-analysis: Correcting error and bias in research findings*. 3rd ed. Los Angeles, CA: Sage Publications; 2015.
22. Taylor R. Interpretation of the correlation coefficient: A basic review. *J Diagn Med* 1990;**6**:35–9.
23. Chen S, Chen A. Ninth graders' energy balance knowledge and physical activity behavior: An expectancy-value perspective. *J Teach Phys Educ* 2012;**31**:293–310.
24. Williams SM, Weiss W. Influence of significant others on high school students' expectancies of success and task value in physical education. *Phys Educ* 2018;**75**:229–44.
25. Gallardo LO, Abarca-Sos A, Doña AM. Expectancy-value model related to physical activity behaviors in Chilean and Spanish adolescents. *Int J Environ Res Public Health* 2020;**17**:8219–34.
26. Yli-Piipari S, Jaakkola T, Liukkonen J, Kiuru N, Watt A. The role of peer groups in male and female adolescents' task values and physical activity. *Psychol Rep* 2011;**108**:75–93.
27. Simpkins SD, Fredricks JA, Eccles JS. Charting the Eccles' expectancy-value model from mothers' beliefs in childhood to youths' activities in adolescence. *Dev Psychol* 2012;**48**:1019–32.
28. Yli-Piipari S, Kokkonen J. An application of the expectancy-value model to understand adolescents' performance and engagement in physical education. *J Teach Phys Educ* 2014;**33**:250–68.
29. Garn AC, Centeio E, Shen B, Martin J, McCaughtry N. A moderated mediation analysis of children's physical activity enjoyment. *J Posit Psychol* 2016;**11**:428–38.
30. Gu X, Solmon MA, Zhang T. Using expectancy-value model to examine students' physical activity engagement and cardiovascular fitness in physical education. *Int J Sport Psychol* 2012;**43**:385–402.
31. Latterman LW, Liu J, Xiang P, et al. Expectancy-value motivation in a summer sports camp: A prospective study. *Res Q Exerc Sport* 2016;**87** (Suppl. 2):A-18.
32. Pang B, Sau Ching Ha A. Subjective task value in physical activity participation: the perspective of Hong Kong schoolchildren. *Eur Phy Educ Rev* 2010;**16**:223–35.
33. Leonetti M, Zhu X, Chen S. Improving students' knowledge and values in physical education through "physical best" lessons. *Eur Phy Educ Rev* 2017;**23**:223–36.
34. Chiang ES, Byrd SP, Molin AJ. Children's perceived cost for exercise: Application of an expectancy-value paradigm. *Health Educ Behav* 2011;**38**:143–9.
35. Ding H, Sun H, Chen A. Gender, BMI, values, and learning in physical education: A study on Chinese middle schoolers. *Learn Individ Differ* 2011;**21**:771–8.
36. Sun H, Ding H, Chen A. Nothing but being there matters: Expectancy-value motivation between us and Chinese middle school students. *Int Educ* 2013;**42**:7–20.
37. Agbuga B. Expectancy-value model of achievement choice and self-reported disruptive behaviors of elementary school students. *Egit* 2011;**36**:24–37.
38. Chen H, Sun H, Dai J, Griffin M. Relationships among middle school students' expectancy beliefs, task values, and health-related fitness performance. *J Teach Phys Educ* 2017;**36**:40–9.
39. Chen S, Chen A, Sun H, Zhu X. Physical activity and fitness knowledge learning in physical education: Seeking a common ground. *Eur Phys Educ Rev* 2013;**19**:256–70.
40. Gu X, Solmon MA, Zhang T. Understanding middle school students' physical activity and health-related quality of life: An expectancy-value perspective. *Appl Res Qual Life* 2014;**9**:1041–54.
41. Ding H, Sun H, Chen A. Impact of expectancy-value and situational interest motivation specificity on physical education outcomes. *J Teach Phys Educ* 2013;**32**:253–69.
42. Zhu X, Chen A. Adolescent expectancy-value motivation, achievement in physical education, and physical activity participation. *J Teach Phys Educ* 2013;**32**:287–304.
43. Gu X, Zhang T, Xiang X. Motivational predictors of Chinese students' intentions and physical education knowledge. *Res Q Exerc Sport* 2014;**85** (Suppl. 1):29. doi:10.1080/00220973.2010.486809.
44. Grästén A. Children's expectancy beliefs and subjective task values through two years of school-based program and associated links to physical education enjoyment and physical activity. *J Sport Health Sci* 2016;**5**:500–8.

45. Zhang T, Solmon MA, Gu X. The role of teachers' support in predicting students' motivation and achievement outcomes in physical education. *J Teach Phys Educ* 2012;**31**:329–43.
46. Kirkpatrick B, Gu X, Chen YL, Zhang T. Children's motivation in physical education, physical activity, and psychomotor skills. *Res Q Exerc Sport* 2016;**87**(Suppl. 2):S22–3.
47. Zhu X, Chen S. The impacts of adolescent beliefs in performing a cardiorespiratory fitness test. *Int J Sport Exerc Psychol* 2015;**13**:182–92.
48. Xiang P, Liu Y, McBride RE, Bruene A. Longitudinal goal patterns and their effects on students' motivation in running programs. *Int J Exp Educ* 2011;**79**:295–318.
49. Chen S, Sun H, Zhu X, Chen A. Relationship between motivation and learning in physical education and after-school physical activity. *Res Q Exerc Sport* 2014;**85**:468–77.
50. Zhu X, Chen A. Motivational cost aspects of physical education in middle school students. *Educ Psychol* 2013;**33**:465–81.
51. Pintrich PR, Schunk DH. *Motivation in education: Theory, research, and applications*. 2nd ed. Upper Saddle River, NJ: Merrill; 2002.
52. Liu XX, Gong SY, Zhang HP, Yu QL, Zhou ZJ. Perceived teacher support and creative self-efficacy: The mediating roles of autonomous motivation and achievement emotions in Chinese junior high school students. *Think Skills Creat*. 2021. doi:10.1016/j.tsc.2020.100752.
53. Xiang P, Chen S, Gao Z. Instructional choices and student engagement in physical education. *Res Q Exerc Sport* 2013;**10**:90–7.
54. Vygotskiĭ LS, Cole M, Cole M. *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press; 1978.
55. Xiang P, McBride RE, Bruene A. Fourth graders' motivation in an elementary physical education running program. *Elem Sch J* 2004;**104**:253–66.
56. Saracho ON. *Handbook of research on the education of young children*. 4th ed. New York, NY: Routledge; 2020.
57. Chen A. Operationalizing physical literacy for learners: Embodying the motivation to move. *J Sport Health Sci* 2015;**4**:125–31.
58. Chen A, Darst PW, Pangrazi RP. What constitutes situational interest? Validating a construct in physical education. *Meas Phys Educ Exerc Sci* 1999;**3**:157–80.
59. Chen A, Martin R, Ennis CD, Sun H. Content specificity of EBTV in elementary physical education. *Res Q Exerc Sport* 2008;**79**:195–208.
60. Chen A, Darst PW. Situational interest in physical education: A function of learning task design. *Res Q Exerc Sport* 2001;**72**:150–64.
61. Paez A. Gray literature: An important resource in systematic reviews. *J Evid Based Med* 2017;**10**:233–40.