

A Systematic Review and Meta-Analysis of the Effects of Outdoor Education Programs on Adolescents' Self-Efficacy

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Abstract

While prior research has generally found Outdoor Education Programs (OEPs) to be beneficial to adolescents' self-efficacy, we sought to conduct a meta-analytic review of prior studies in this area in order to pinpoint the key elements to OEPs' effectiveness. Following Cooper's guidelines for synthesis research and meta-analysis, we searched six electronic databases for relevant articles: PubMed, Sciencedirect, Medline, PsycArticles, and Behavioral Sciences Collection of EBSCO, and Eric. Selection criteria were: Populations, Interventions, Comparators, Outcomes, Study Design (PICOS), and Methodological Index for Non-randomized Studies (MINORS). We estimated the effect size of the selected studies with a 95% confidence interval (CI), estimated I-squared (I^2) for heterogeneity analysis and analyzed publication bias by Egger's test. After excluding many studies, we reviewed 12 studies with 2,642 participants that were deemed to be eligible for final analysis. We discovered a high level of heterogeneity (I -squared value = 82.474) in the findings of the

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selected studies. Our meta-analyses revealed that adolescents participating in OEPs enhanced their self-efficacy (medium effect size; Hedges's $g=0.597$) but this enhancement was moderated by participants' mental health status, the length of the experiments, study groups, and the duration of the intervention. We found no evidence of publication bias (Egger: bias=2.001, 95% CI=−0.736 to 4.739, $p=.137$). We discussed our research limitations and the theoretical and practical implications of these findings and made recommendations for future research.

Keywords

experience learning, adolescents, self-concept, meta-analysis

Introduction

There has been growing support for youth engagement in various organized outdoor activities with educational designs that promote positive psychosocial development (Chapman et al., 2017; Eigenschenk et al., 2019; Margalit & Ben-Ari, 2014; McGowan, 2016; Rose et al., 2018; Sprague et al., 2020). Although there is no unified term for these activities, we use the term, Outdoor Education Programs (OEPs), as this seems to encapsulate these activities. Originating from within the camping movement of the early twentieth century in Europe, USA, Australia, and New Zealand- especially the scouting movement led by Robert Baden Powell in 1907 in the UK, OEPs have been seen as alternative learning opportunities for youth. Outdoor education leaders adopted the views of noted philosophers, such as John Dewey (1859-1952), William James (1842–1910), and John Locke (1632–1704) in designing various types of OEPs.

Today, the many different OEPs for adolescents carry such varied names as outdoor youth programs (Rose et al., 2018), wilderness therapy (Margalit & Ben-Ari, 2014), adventure-based training programs (Li et al., 2018), outdoor adventures (Mutz & Müller, 2016), and outdoor education programs (McGowan, 2016). OEP aims are diverse, including learning basic outdoor survival skills, general problem solving, enhancing teamwork (e.g., Li et al., 2018), developing leadership skills (e.g., Annesi, 2020), understanding natural environments, and promoting spirituality. To achieve these aims, OEP leaders have designed or incorporated various specific activities, such as rock climbing (e.g., Li et al., 2018), canoeing, biking, kayaking, crossing the Alps (e.g., Mutz & Müller, 2016), and high and low-level rope courses (e.g., Rose et al., 2018). Also, OEP leaders have integrated many interpersonal/social skills into their programs, such as establishing ground rules, valuing each participant's contribution to the group, assigning challenging tasks that require participants to work together to overcome difficulties, forming a research team to complete a

biological/ecological assignment, or team-building through mutual interactions (Schleien et al., 1993). Overall, OEPs are considered a valuable extra-curricular activity for young participants (Ford, 1986).

Because OEPs are designed to foster valuable educational goals and skills, research studies have examined their influence on participants' psychosocial development, including their impact on specific psychological constructs such as self-concept, leadership, and communication skills (e.g., Eigenschenk et al., 2019; Margalit & Ben-Ari, 2014; McGowan, 2016; Rose et al., 2018). A synthesized research review of 96 empirical studies investigating the effects of OEPs on participants' psychosocial development (Hattie et al., 1997) reported that OEPs not only facilitated participants' self-concept but also enhanced their interpersonal skills, personality development, and leadership. In this review of studies of medium to high quality, a meta-analysis showed a general effect size of 0.34 for enhanced psychosocial development, but there were substantial variations in the nature and length of the programs reviewed.

Adolescence is an important stage for life development, as it is one in which young people transition from childhood to adulthood; and, in this stage, adolescents interact with significant others (e.g., peers, parents, family members, teachers, and adult leaders) to learn social skills, life skills, and community roles. They compare their own abilities to those of others (Bornstein et al., 2013). OEPs directed toward adolescents are often designed to provide educational opportunities for this period of development, particularly assisting adolescents with a sense of self-efficacy, one of the most important components of self-perception.

Derived from Bandura's (1977, 1986) early work on social cognition of thoughts and actions, self-efficacy has been defined as "*People's judgments of their capabilities to organize and execute courses of action required to attain designated types of performance*" (Bandura, 1986, p. 391). Bandura (1977, 1986) proposed that any intentional or purposeful action toward a given task is determined by one's task-specific efficacy. Low self-efficacy keeps one from engaging in a task that is perceived to be beyond one's abilities or that evokes images of incompetence. Bandura (1977, 1986) contended that, as there are reciprocal relationships among individuals, the environment, and events when engaging in an activity, individuals seek information from the environment and the event; and if they successfully accomplish the given task, they receive positive information that, in turn, boosts their self-efficacy. Moreover, self-efficacy determines one's choices, effort, and persistence on the same or similar tasks. In Bandura's (1977, 1986) social cognitive model of self-efficacy, past performance accomplishments, vicarious experiences, social/verbal persuasion, and physiological responses are the major antecedents of one's perceived self-efficacy.

OEPs have been designed with multiple opportunities for cultivating self-efficacy in both pre-arranged and spontaneous activities and events. Many adventure activities such as camping, backpacking trip, rafting, rock

climbing, abseiling, kayaking, canoeing, or high and low-level rope courses require adolescents to successfully accomplish challenging tasks. Under these situations, adolescents must work together with teammates to develop coping strategies or make appropriate decisions to successfully accomplish the given mission. Thus, OEPs are often designed to cultivate adolescents' self-efficacy.

To examine the underlying mechanisms of OEPs influence on adolescents' self-efficacy, past researchers have conducted field experiments of varying duration (e.g., Margalit & Ben-Ari, 2014; Mutz & Müller, 2016; Rose et al., 2018) that have adopted different educational content. For example, Margalit and Ben-Ari (2014) assigned 93 at-risk adolescents to either a full wilderness therapy, a partial intervention, or a control experience in order to assess and compare the participants' cognitive autonomy and self-efficacy after eight months. The intervention programs included all types of activities and behavior therapy principles such as modeling, positive and negative reinforcement, and problem-solving. After six months, participants in wilderness therapy increased their self-efficacy compared to participants in the control group.

In contrast, Mutz and Müller (2016) recruited 15 German adolescents to participate in an 8-day excursion that included hiking with backpack, climbing, fishing and swimming in mountain lakes and streams. During their outdoor adventure, they learned geological orientation, survival skills, and were given an understanding of the flora and fauna. Participants' perceived stress, self-efficacy, mindfulness, and subjective wellbeing were assessed both before and after the adventure program; results showed that from pre-test to post-test participants reduced stress but increased their mindfulness and self-efficacy. Mutz and Müller (2016) contended that the outdoor adventure programs took place in unfamiliar natural environments with challenging tasks that required participants to learn survival and social skills in order to overcome life challenges, and that these experiences enhanced their self-efficacy and their functioning on other psychological measures such as subjective wellbeing, life satisfaction, and mindfulness.

In past research, OEPs adopted diverse educational content and timing, making these studies hard to summarize in terms of general effect size or as to whether the effects were moderated by such variables as participant characteristics, outcome measures, and research design. We aimed to synthesize the findings of these prior studies with an updated review that might better summarize the strongest research evidence for OEPs. We focused on OEPs' effectiveness in altering adolescents' self-efficacy in this systematic review and meta-analysis of existing literature. Where data were available, we separately considered participants, interventions, comparisons, outcome measures, and study designs.

Methods

Article Search Strategy

Following Cooper's (2016) suggested guidelines for research synthesis and meta-analysis and guidelines from Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA, Moher et al., 2009), we conducted a comprehensive literature search for potential articles from six electronic databases (PubMed, Sciondirect, Medline, PsycArticles, and Behavioral Sciences Collection of EBSCO, and Eric) published from January 1, 2000, to October 31, 2020. We used the following critical, related keywords (adding a Boolean operator [OR and/or AND] to combine them): "Adolescent," "youth," "young," "teenagers," "wilderness therapy," "wilderness adventure," "outdoor education," "outdoor activities," "outdoor experience," "adventure therapy," "camp," "nature," "program," "development program," "self-efficacy," and "self." We used the following search strategy in PubMed: "wilderness OR outdoor* OR adventure OR camp* OR nature OR program" AND "educat* OR experien* OR therapy*" AND "Adolescent* OR youth OR young* OR teen*" AND "self-efficacy," which was adjusted for the other databases, if necessary. Two investigators (F.B.B and F.J.L) conducted the search. All searches were limited to peer-reviewed research articles published in English. We also used reference lists from selected papers for additional relevant articles that we then searched for in Google Scholar. This process yielded 2,251 articles from online databases and two additional articles from other resources.

After reading their titles and abstracts (purposes, participants, research designs, results), we removed 16 articles that were duplicated and 2,237 that were irrelevant to our main themes of interest. This left 44 papers to further examine with regard to further processes detailed below, namely: (a) inclusion criteria and (b) exclusion criteria.

Inclusion Criteria

PICOS. To avoid selection bias, the same two investigators who performed the initial search (F.B.B and F.J.L) formulated and applied further inclusion selection criteria for the following elements of PICOS: (a) Populations (participants and settings); (b) Interventions (treatments and doses); (c) Comparative groups (e.g., placebo, standard of care or control); (d) Outcomes (scales and metrics), and (e) Study design (e.g., randomized and observational) (Zawacki-Richter et al., 2020, pp. 4–7). More specifically, we next included only those studies that met the following criteria: (a) a population sample of adolescent participants aged 10–19, in line with the definition of adolescence put forth by the World Health Organization (WHO); (b) an intervention involving

outdoor-related activities (e.g., outdoor camping, wilderness adventure, nature-based field trips, resident camp, backpacking trip.); (c) comparative groups (i.e., with experimental and control group comparisons); and (d) outcome measures of self-efficacy. We found 5 studies that were not adolescent studies, reducing the 44 to 39. Further, we used the following criteria to exclude those studies with low quality.

Exclusion Criteria

MINORS. We applied ratings from the Methodological Index for Non-randomized Studies (MINORS), as derived from Slim et al. (2003) to exclude studies with weaker methodology. The MINORS rating method has 12 different items that are each rated, with scores of “2,” “1,” or “0” as follows: (a) “2” was assigned when a study “reported adequately” on a MINORS item, (b) “1” was assigned when a study “reported inadequately,” and “0” was assigned when a study made “no report” for the item. The first 8 items of this checklist involve ratings for non-comparative studies (yielding a maximum score of 16) whereas all 12 items are used with comparative studies (yielding a maximum score of 24).

Thus, the MINORS scale checklist assessed whether and to what degree studies provided various methodological details that related to such factors as the logic and objectivity of the research design, the presence and length of any follow-up data, the rate of lost follow-up data, and the use of a control group. We judged studies with scores of 0-8 to be of low-quality; scores of 9-16 to be of medium-quality, and scores of 17-24 to be of high quality. For purposes of further analysis, we selected only those studies that were scored higher than 12 points meaning that they were all of medium-to high-quality.

Using MINORS, we excluded unqualified studies as follows: (a) two studies were qualitative rather than experimental; (b) 19 were not consistent with the themes of interest to this review; and (c) one was an unpublished master thesis. Of the remaining 17 articles, five were incomplete with respect to data needed for meta-analysis, leading us to email these authors for additional information. Two of the authors replied to these emails, and three did not. We listed the three studies with incomplete data and the two studies with an uncertain qualitative assessment separately (Study Numbers 22, 18, 42, 7, and 12; see Figure 1). After further excluding these five articles, we were left with only 12 articles for final meta-analyses of the effects of OEPs on adolescents’ self-efficacy (see Figure 1).

Meta-Analytic Strategies

We used Comprehensive Meta-Analysis (CMA) statistical software 2.0 to analyze the effectiveness of the OEPs in the 12 research studies distilled through this selection procedure. From the Results sections of these studies, we input each study’s Z value or paired *t*-value, or its *p*-value or pre/post correlation, its pre-/post-test means and standard deviations, and its sample sizes for the two

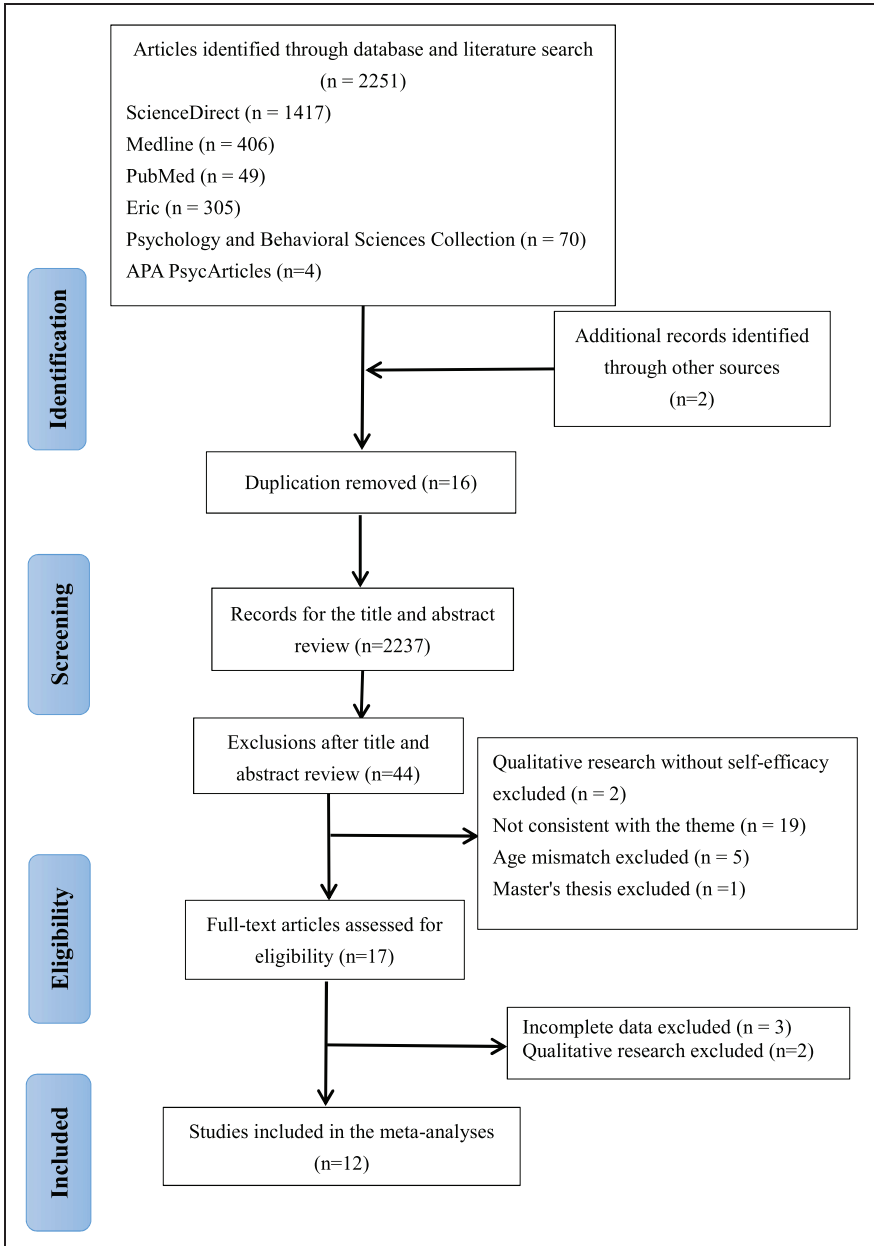


Figure 1. PRISMA Flow Chart of the Studies Included in the Systematic Review and Meta-Analysis.

comparative groups or the one pre-post group in accordance with each study's details.

We assessed inter-study heterogeneity among these 12 selected articles quantitatively, using the I^2 and Q index. As a preliminary analysis found that included studies had high heterogeneity, we used a random-effects model to estimate the overall effect of heterogeneity (Tufanaru et al., 2015).

We used the forest plot to determine the overall effect size and 95% confidence interval (CI) of the meta-analysis. In describing these effect sizes, we relied upon Cohen's (1988) effect sizes descriptions of 0.2, 0.5, and 0.8 as representative of small, medium, and large effect sizes, respectively. In order to evaluate the influence of each study on the overall effect size, we conducted a sensitivity analysis using the leave-one-out method (i.e., removing one study each time and repeating the analysis).

We evaluated publication bias by Funnel Plot (Gurevitch & Hedges, 1999), Fail-safe Number (Rosenthal, 1979), and Egger's test (Egger et al., 1997). While each of these three methods has advantages and disadvantages, we used all three methods to judge publishing bias from multiple angles. Funnel Plot is the most common method of assessing publication bias in which bias can be examined by visual inspection. When the number of included studies is small, it is difficult from this method to determine the strength of the effect size or whether there is a publication bias. So we used two other methods as auxiliary tests of publication bias. With the Fail-safe Number, we determined how many non-significant original studies are needed to make the significant research results less significant. If the results of the Meta-analysis are significant, a higher Z-value ($p < .05$) indicates less publication bias. We also used Egger's test in which the closer the Z-value is to 0 in the meta-regression intercept, the smaller the publication deviation. Egger's test detects those included studies whether they are less precise or negative effects are missing. If this condition happens, the plot will become asymmetric and the intercept will have a positive value. The larger the Egger test value indicates the bigger publication bias (Zawacki-Richter et al., 2020, p. 293).

Results

Descriptions of Study Characteristics

As noted above, 17 studies were selected as relevant, based on our search strategy and quality assessment criteria, but five of these 17 contained incomplete data or uncertain quality assessment (Study numbers 22, 18, 42, 7, 12 see Table 1), as they were quasi-experimental designs and/or used face-to-face interviews as outcome assessments. Two of these five studies did not report the Z value or paired t -value, or p -value or the pre/post correlation (Study numbers 22, 42), one reported no significant changes observed across time on

Table 1. General characteristics of relevant studies.

No.	Study (authors)	Participants, age (M, ±SD) EG/CG	Country (sample size, n)	Intervention program	Follow-up (months)	Measures	Results summary	Quality assessment
2	Margalit & Ben-Ari (2014)	Experiencing social or educational difficulties and being at risk of maldevelopment and delinquency. 14 - 16/14 - 16	Israel, 93	10 preparation meetings (include outdoor experiential activities such as camping, outdoor training, navigation, and constructing devices.), a 4-day backpacking trip, and two closure meetings.	5	Potency Scale (Ben-Sira, 1985)	A significant increase in self-efficacy was found across the three waves of study, $F(2, 180) = 78.83, p < .001, \eta^2 = 0.47$, as well as between the study groups, $F(3, 90) = 57.14, p < .001, \eta^2 = 0.66$. A significant difference in self-efficacy between the intervention group and the control group ($CI\ 0.786-0.512, p < .001$). Self-efficacy ratings among intervention participants were significantly higher in wave 2 (at the end of the program) when compared to wave 1 (at the beginning of the program) ($CI\ 0.866-1.172, p < .001$), and in wave 3 (at 5-month follow-up) when compared to wave 1 ($CI\ 0.766-1.001, p < .001$).	High
4	Rose et al. (2018)	15 (0.46)	Australia, 160	5-9 days outdoor camp (include remote bushwalking, rafting, rock climbing, abseiling, and high ropes, mountain bike riding, sea kayaking, or canoeing)	0.25	GSES (Schwarzer & Jerusalem, 1995)	No differences were found between Time 1 (3 weeks before attending camp) and Time 2 (1 week before camp commenced) scores (pre-test); however, a significant difference was noted between baseline and Time 3 (1 week following completion of camp)	Medium

(continued)

Table 1. Continued.

No.	Study (authors)	Participants, age (M, ±SD) EG/CG	Country (sample size, n)	Intervention program	Follow-up (months)	Measures	Results summary	Quality assessment
9	McGowan (2016)	16.46	Canada, 26	one-semester outdoor edu- cation (5-day winter camping trip, 5-day canoe trip, a solo experience.)	3	SAQ (Ferencevych, 2004)	Analysis of the t tests for the treatment phase (pre to post) showed significant increase for self-efficacy ($t = 4.29$, $p = .001$, Cohen's $d = 1.18$ effect sizes > 0.8). Analysis of the t-tests for the posttest phase (post to follow- up) showed no significant dif- ferences in self-efficacy ($t = -0.289$, $p = .777$). Self-efficacy scores changed only marginally ($ES = 0.26$, $p = .188$) compared to the baseline measure. (1 week prior to the hike (t1) to 4 days after the return from the hike (t2))	Medium
17	Mutz & Müller (2016)	14	Germany, 12	9-days hike ("Crossing the Alps")	None	GSES (Schwarzer & Jerusalem, 1995)		Medium
21	Chapman et al. (2017)	Low academic and social self-efficacy. 13 - 15	New Zealand, 327	3-weeks wilderness adven- ture, 7–10 days wilderness trek, community challenge.	None	Social SE (Moore's, 2005)	Participants showed large, statis- tically significant improve- ments in social self-efficacy from baseline ($M = 4.11$, $SD = 0.93$) to post-program ($M = 4.68$, $SD = 0.64$). $p < .001$, Cohen's $d = 0.76$. SD in means = 0.714, CI 0.556- 0.872.	Medium

(continued)

Table 1. Continued.

No.	Study (authors)	Participants, age (M, ±SD) EG/CG	Country (sample size, n)	Intervention program	Follow-up (months)	Measures	Results summary	Quality assessment
24	Li et al. (2018)	Survivors of cancer who reported symptoms of fatigue. 12.8 (2.6)/12.4 (2.6)	HongKong,China, 222	4-days adventure-based training program (include ice-breaking and team-building games, shuttle runs, rock climbing, high- and low-level rope courses, and descending.)	12	PA-SE (Matheson et al., 2004)	Data collection was conducted at the time of recruitment (T1), 6 months after starting the intervention (T2), 12 months after starting the intervention. There were statistically significant main effects for interaction on outcomes, indicating that the change in self-efficacy in the experimental group differed from that in the control group ($F = 20.19, p < .001$, Effect size (Eta squared) = 0.06 Power = 0.92) Participants in the experimental group reported higher levels of self-efficacy than in the control group during the 12-month follow-up.	High
26	Sprague et al. (2020)	Low-income black and Hispanic 11.9 (1.0)	USA,122	15-weeks, monthly nature-based field trips (include hiking, rock climbing, overnight camping trip, canoe trip, cave trip.)	None	STEM self-efficacy	STEM self-efficacy mean and median score significantly increased from pre- intervention to post-intervention ($M = 1.0, SD = 0.8$ to $M = 1.7, SD = 0.5, p = .001$).	Medium
27	Annesi (2020)	Experienced with year-round leadership training programs. 14.6 (0.6)	USA, 129	2-weeks summer resident camp, leadership training activities, video lessons.	6	Self-Control Schedule (Rosenbaum, 1980)	Changes in self-control coping efficacy, Time 1 (summer resident camp) to Time 2 (winter conference) ($M = 29.30, SD = 8.72$ to $M = 31.44, SD = 8.87$, score change in	Medium

(continued)

Table 1. Continued.

No.	Study (authors)	Participants, age (M, ±SD) EG/CG	Country (sample size, n)	Intervention program	Follow-up (months)	Measures	Results summary	Quality assessment
37	Gabrielsen et al. (2019)	social anxiety, depression, behavior disturbance, adjustment disorders, and mental fatigue. 16.5 (0.57)/16.5 (0.57)	Norway, 32	8 single days and 2 wilderness overnight trip over an eight-to ten-week period.	12	GSES (Schwarzer & Jerusalem, 1995)	M = 2.14, score change in SD = 7.65, t = 3.18, p = .002, CI 0.81-3.47, Cohen's d = 0.25). Correlates of change scores in coping efficacy r = -.42. Changes in general perceived self-efficacy were small, and pre- and post tests were non-significant, but there was a moderate effect size on pre- and follow up data (M = 24.5, SD = 6.4 to M = 28.4, SD = 6.6, Cohen's d = 0.60, p < .05).	Medium
6	Richmond & Sibthorp (2019)	Come from single-parent homes, live below the poverty line, and/or come from high-risk neighborhoods. 14.9	USA, 165	7-days outdoor adventure education (OAE) backpacking course	None	SF Scale (Bandura, 2006); Coping Efficacy Scale (Chesney et al., 2006)	It revealed that time was significant for self-efficacy for dealing with challenging situations (SE_CHLING), β = .76, t (164) = 7.59, p < .001, and self-efficacy using help-seeking behaviors (SE_HELP), β = .83, t(164) = 5.74, p < .001. Participation in the OAE experience was associated with a .76 increase in the SE_CHLING score (Pseudo R ² = .25) and a .83 increase in the SE_HELP score (Pseudo R ² = .16). Female were significantly associated with lower levels of self-	Medium

(continued)

Table 1. Continued.

No.	Study (authors)	Participants, age (M, $\pm$ SD) EG/CG	Country (sample size, n)	Intervention program	Follow-up (months)	Measures	Results summary	Quality assessment
							efficacy in both scales at both measurement points. SE_CHLING ($\beta = -.91$, $t(163) = -4.93$, $p < .001$, Pseudo $R^2_s = .05$), SE_HELP ($\beta = -.973$, $t(163) = -3.31$, $p < .001$, Pseudo $R^2_s = .01$)	
40	Deane et al. (2017)	low self-efficacy 3 - 15/ 13 - 15	New Zealand, 1177	3-weeks wilderness adventure, a 10 days community service component, 1 year of mentoring.	12	SEQ (Moore, 2005)	Academic self-efficacy. Time 1 (at the end of the program): experimental group vs control group (Cohen's $d = 0.43$, CI 0.37-0.49). Social self-efficacy. Time 1: experimental group vs control group (Cohen's $d = 0.44$, CI 0.39-0.50). Bivariate correlations between pre- (Time 0: baseline) and post (Time 1) tests in academic self-efficacy $r = .35$, $p < .05$, in social self-efficacy $r = .37$, $p < .05$.	High
41	Purdie et al. (2002)	With experience in OEPs, 148	Australia, 177	5-6 days OEP, including rock-climbing, abseiling, canoeing, high ropes, overnight hiking, orienteering, regaining, and mountain-bike riding.	2	ROPE (Neill et al., 1997)	A significant result was found between pre (Time 1) and post (Time 2), mean difference scores and SD (38 ± 95 , $F = 29.29$, $p < .001$, Cohen's $d = .40$) With respect to the ROPE, a non-significant multivariate result was obtained between the post (Time 2) and follow up (Time 3)	Medium

(continued)

Table 1. Continued.

No.	Study (authors)	Participants, age (M, $\pm$ SD) EGI/CG	Country (sample size, n)	Intervention program	Follow-up (months)	Measures	Results summary	Quality assessment
22#	Hayhurst et al. (2015)	16.51/16.43	New Zealand, 146	10-day developmental voyage	5	ROPE (Purdie et al., 2002)	The first to the last day of the voyage (T2 to T3), self-efficacy (M = 18.08, SD = 2.46 to M = 19.50, SD = 2.62), F (1, 72) = 24.11, $p < .001$, $\eta^2 = 0.25$. There were no significant changes observed across time on the WEL or PSEQ measures assessing self-efficacy.	Incomplete data
18#	Lloyd-Richardson et al. (2012)	Over BMI 14.33 $\pm$ 1.02/14.33 $\pm$ 1.02	USA, 118	16-week group-based cognitive-behavioral treatment, combined with either aerobic exercise or peer-based adventure therapy.	24	WEL (Clark et al., 1991), PSEQ (Janicke et al., 2009)		Incomplete data
42#	Buckner et al. (2007)	Has asthma 12 - 15	USA, 34	3-night, 4-day residential camp experience (include swimming, hiking, games, crafts, canoeing, horse-back riding, night activities, and others.)	6	SES (Sherer et al., 1982)	General self-efficacy increased from before camp (baseline 3.67) to 6 weeks after camp (3.86), although not significantly. Social self-efficacy from baseline to 6 weeks (mean difference 0.5 $\pm$.8, $p < .01$)	Incomplete data
7#	Fuller et al. (2017)	From manual or unemployed households. 14 - 16/14 - 16	UK, 24	twice yearly, three-day outdoor residential visits across the three years (include woodland archery, canoeing, mountain biking)	None	unstructured interviews	The increased sense of efficacy gained from the outdoor education program expressed in terms of classroom engagement and schoolwork, more importantly, improvement in grades awarded by teachers for all but two students.	N/A

(continued)

Table 1. Continued.

No.	Study (authors)	Participants, age (M, $\pm$ SD) EG/CG	Country (sample size, n)	Intervention program	Follow-up (months)	Measures	Results summary	Quality assessment
12#	Richmond et al. (2017)	From an independent all-girls school 13 - 18	USA, 30	6-day and 5-night expeditions in three times	None	Semi-structured interviews	Participants reported that their outdoor experiences built self-efficacy in leadership through new and different roles, more student-directed decision-making, reflection, and coaching and mentorship.	N/A

Note. EG: Experimental Group; CG: Control Group; GSES: The Generalized Self-Efficacy Scale; Self-authorship Questionnaire; PA-SE: Physical Activity Self-Efficacy Scale; STEM: Science, technology, engineering, and math; GSE: General Perceived Self-Efficacy Scale; SEQ: Self-Efficacy Questionnaire; ROPE: The Review of Personal Effectiveness scale; WEL: Weight Efficacy Life-Style Questionnaire; PSEQ: The Physical Self-Efficacy Questionnaire; SES: The Self-Efficacy Scale.

#Did not include in the meta-analysis.

self-efficacy, with no data details (e.g., mean, standard deviation) (Study numbers 18), two were qualitative studies that had no data (Study numbers 7, 12). Four of these five studies yielded similar results to the included studies, with self-efficacy increasing after the OEP intervention (Study numbers 22, 42, 7, 12), and two of the studies reported that this change remained constant during the follow-up period (Study numbers 22, 42). Excluding these five studies (Study numbers 22, 18, 42, 7, 12) with their various limitations, we included only 12 studies for further quantitative analyses.

The characteristics of the 12 included studies (with MINORS quality ratings from 12 to 24 that categorized them as a medium- to high-quality) are summarized in Table 1. The total number of participants across these interventions was 2,642, with an age range of 11 to 19 years old, and the average proportion of male participants was 49.52%. These studies were conducted in eight different countries and were published between 2002 and 2020. Four were pre-experimental in research design, four were quasi-experimental, two used randomized controlled trials, and two used mixed methods with an experimental design and qualitative outcome data from participant interviews.

All of these 12 studies involved several days of OEPs, with treatment duration ranging from four days to a full academic semester. These studies used pre-test/post-test self-report surveys to examine participant's self-efficacy before and after participation in OEPs. The self-efficacy measurement tools included the Generalized Self-Efficacy Scale (GSES, Schwarzer & Jerusalem, 1995) in three studies, the Potency Scale (Ben-Sira, 1985), the Self-Efficacy Scale (SES, Bandura, 2006), the Coping Efficacy Scale (Chesney et al., 2006), the Self-Authorship Questionnaire (SAQ, Ferencevych, 2004), the Self-Efficacy Questionnaire (SEQ, Moore's, 2005), the Physical Activity Self-Efficacy Scale (PA-SE, Matheson et al., 2004), the Review of Personal Effectiveness scale (ROPE, Neill et al., 1997), the Self-Control Schedule (Rosenbaum, 1980), and the STEM self-efficacy (hanging the three headers—advancing support for policies, establishing legitimacy and achieving political gains—to a lower level). The content of the measures involved generalized self-efficacy (SE), academic SE, social SE, coping SE, SE for dealing with a challenge, and SE using help-seeking behaviors. Four studies had a control group (Study numbers 2, 24, 37, 40), and two analyzed gender differences (Study numbers 4, 6). The follow-up periods varied from 0–12 months, and four studies had no follow-up investigation.

The time of the data collection varied across studies. Four studies gathered data at the beginning of the OEPs and again at the end of them (Study numbers 6, 21, 26, 27). Five studies gathered additional follow-up data at two months (Study number 41), three months (Study number 9), five months (Study number 2), and 12 months (Study numbers 37, 40). The remaining three studies collected data at unusual times: one study conducted data one week before the OEP (a hike) and again at the end of it (Study number 17); one study collected data at a summer resident camp and after one semester of school (Study

number 27); and the last one collected data at three points – at the time of recruitment, six months after starting the intervention, and 12 months after starting the intervention (Study number 24).

Meta-Analysis

Meta-analysis of results for all studies showed a significant increase in self-efficacy following the OEP interventions, and, in studies with follow-up data, this change remained at the time of follow-up testing. In addition, studies comparing males and females (Study numbers 4, 6) found that males experienced a greater increase in self-efficacy than females.

Heterogeneity Analysis. The meta-analysis of these 12 studies indicated significant heterogeneity with the Q-value: $Q_{(13)} = 74.174$ ($p < .001$) and an I^2 value of 82.474, indicating a high level of heterogeneity that justified our use of a random-effects model. (See the moderation analysis for this high heterogeneity below.)

Sensitivity Analysis. Sensitivity analysis determines the robustness of each contributing study's results. We removed one study at a time from the analysis to determine the change of overall effect size when the study was removed. These studies' results, after one study was removed, led to I^2 values that ranged from 77.344 to 83.791, showing little change, when compared with the overall analysis I^2 value of 82.474, confirming that each separate study contributed to these stable results.

Publication Bias. We identified no significant publication bias by Funnel Plot (Figure 2), although the Funnel Plots indicated a degree of asymmetry. This method of determining publication bias has always been controversial and not representative particularly because it is difficult to judge the symmetry of the subjective visual graph with only a few articles. Thus, we also conducted Egger's test and found no evidence of publication bias, with Egger: bias = 2.001 (95% CI = -0.736 to 4.739) ($p = .137$). Finally, we also used the Fail-safe Number test and found a Z-value of 18.417 ($p < .001$), indicating no publication bias. The number of missing studies that would bring the p -value to $> .05$ in order to overturn the conclusion of the positive effect of the study was 1,223.

Effects of Outdoor Education and Self-Efficacy. A summary of the random effects meta-analysis presented in Figure 3 and corresponding forest plots shows the estimated standardized mean difference and its 95% CI. The Point estimate Cohen's $d = 0.603$ ($p < .001$), and 95% confidence interval (CI = 0.458 ~ 0.747) indicated that OEPs had positive effects on self-efficacy for adolescents. From the results of the forest plots, each of the 12 studies showed positive effects of

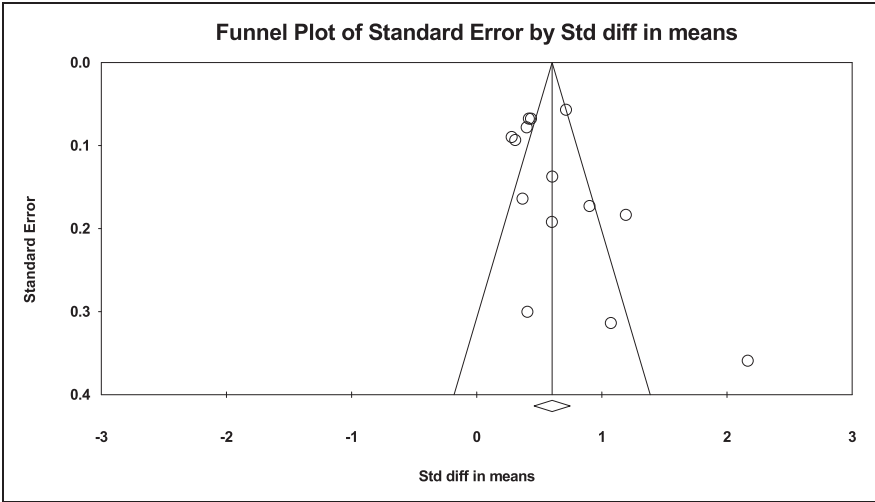


Figure 2. Funnel Plot Showing Publication Bias for the 12 Included Studies.

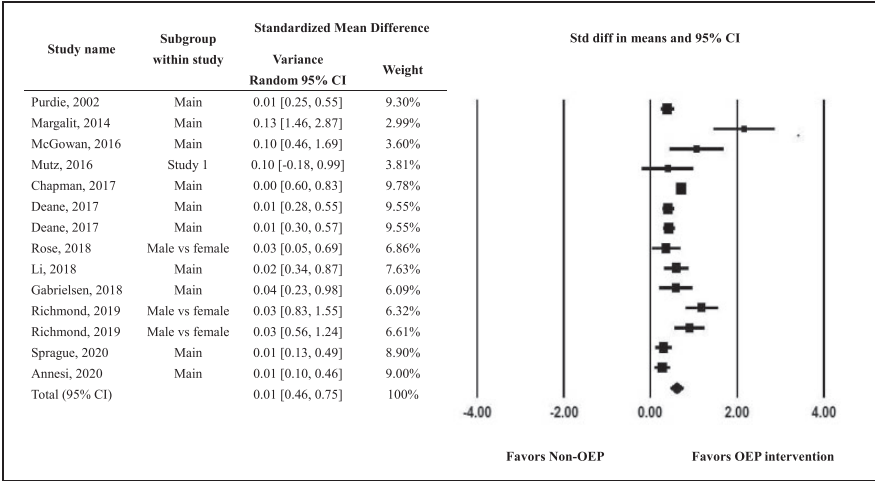


Figure 3. Meta-Analysis of All 12 Studies Investigating the Effect of OEPs on Adolescents' Self-Efficacy.

OEPs on adolescents' self-efficacy. The results of the meta-analysis found Hedges's $g=0.597$; according to Cohen's (1988) rule of thumb, this effect of OEPs on adolescent's self-efficacy was a medium effect size.

Moderation Analyses. In the context of the high heterogeneity found in these included studies, Fletcher (2007) suggested that methodological differences

such as research design and duration of the experiments may be a cause. Thus, we examined the moderation effects of participants' mental health status, length of experiments, study groups, and the duration of the intervention, and found the following results: (a) experiments with no follow-up data showed a large effect (Cohen's $d=0.704$), while experiments with follow-up data revealed a medium effect (Cohen's $d=0.528$); (b) experiments with no contrast group showed a large effect (Cohen's $d=0.623$), but experiments with contrasting groups showed a medium effect (Cohen's $d=0.573$); (c) studies with participants with challenging personal characteristics (i.e., low social economic status, low self-efficacy, mental problems) demonstrated a large effect (Cohen's $d=0.612$), but studies with healthy participants showed a medium OEPs effect (Cohen's $d=0.562$); and (d) experiments with shorter duration OEPs (under/equal to 10 days) showed a large effect, (Cohen's $d=0.758$), but studies with long-duration OEPs (>10 days) had a small effect (Cohen's $d=0.431$).

Discussion

Theoretical Implications

In the present study, we conducted a meta-analytic review of research articles addressing the effectiveness of OEPs on adolescents' self-efficacy. A series of steps for locating and selecting articles to review narrowed a vast published literature on OEPs to just 12 middle- and high-quality research studies that were shown to reflect considerable heterogeneity. Overall, there was a medium effect size for enhanced adolescent self-efficacy through participation in OEPs. There were moderating effects related to research heterogeneity such that there was a large effect size evident for participants with mental health concerns, OEP experiments of shorter duration, and OEP experiments with no comparative groups (Cohen's $d=0.43\sim0.758$) and medium effect size for other participants, OEP experiments of longer duration and OEP experiments with comparative groups. Through further analysis, we found no evidence of publication bias.

By its' nature, meta-analysis is a formal, quantitative means of systematically assessing the results of previous research in order to derive summary conclusions about a specific scientific issue (Walker et al., 2008). In this focused review, we narrowed a large literature on OEPs to focus on rigorous empirical analyses of OEP effectiveness for altering adolescents' self-efficacy and found good support for this specific application of OEPs. Based on Shavelson et al. (1976) hierarchical model of self-perception, our review of OEP literature suggests that adolescents' participation in OEPs can promote their interpersonal, intellectual, and physical skills and competence. These fundamental perceptions enhance their second-level self-concepts (e.g., science, mathematics, peer relationship, leadership, physical ability, and social ability). Subsequently, these second-level aspects of self-concept contribute to higher self-perceptions in such specific

areas as academic self, social self, emotional self, and physical self. All of these higher domain-specific selves contribute to a global self-concept, making it important for OEP leaders to design and provide diverse and effective OEPs for adolescents.

Our review differed in its narrow focus from an earlier research synthesis by Hattie et al. (1997) of 96 studies that examined the effects of OEPs on 40 different psychosocial outcomes involving a wide range of participants of varied ages (11 to 42 years old). This earlier review produced diverse results making it difficult to pinpoint how or why participation in OEPs enhanced participants' psychosocial well-being. Although our study only included 12 quality studies focused on a narrower range of interest, our obtained results were more specific, reliable, and theoretically insightful. Adolescents' self-efficacy perceptions play a very important role in their psychosocial development. Our meta-analytic review offers a robust summary of a cause-and-effect relationship between OEPs and this self-efficacy outcome, and our theoretical literature review offers a potential explanation for why OEPs have been effective in facilitating adolescents' self-efficacy.

We found many different self-efficacy measures to have been used in past research on OEPs, many reflecting different aspects of self-efficacy learned from participation in OEPs. General self-efficacy (GSES, Mutz & Müller, 2016) represents adolescents' perception of their ability to successfully achieve the desired outcome through actions. According to Schwarzer and Jerusalem (1995), general self-efficacy is a self-belief that one can cope with a variety of difficult life demands. Our results confirmed the effectiveness of improved general self-efficacy through adolescents' participation in OEPs.

Social self-efficacy has been defined as "an individual's confidence in her/his ability to engage in the social interactional tasks necessary to initiate and maintain interpersonal relationships" (Smith & Betz, 2000, p. 286). According to Erikson's (1958, 1963) eight stages of psychosocial development, social competence is very important for an individuals' later life. According to Schleien et al. (1993), OEPs can offer an appropriate opportunity for adolescents to learn social skills that traditional classroom education can not provide. Thus, social competence cultivated in OEPs is meaningful to adolescents as a means of resolving both current and subsequent crises and thereby cultivating positive personality development.

Coping self-efficacy has been defined as "*self-appraisals of capabilities to cope with environmental demands* (Pisanti et al., 2008; p. 238)." Research has found that coping self-efficacy mediated the relationship between negative cognitions and posttraumatic distress (Cieslak et al., 2008), and coping self-efficacy has negatively predicted athletes' pre-competitive anxiety even while it has positively predicted performance (Nicholls et al., 2010). In many OEPs, instructors design challenging tasks such as backpacking trips, rafting, rock climbing, abseiling, kayaking, or canoeing, in which participants must overcome difficulties. OEPs'

leaders generally provide constructive opportunities for adolescents to learn coping skills. With these successful experiences, the adolescent's coping self-efficacy has been enhanced.

Limitations and Directions for Future Research

Despite significant and meaningful findings from this meta-analytic review, several study limitations should be discussed. First, we only searched databases for studies written in English, perhaps limiting our awareness of OEP efficacy in other cultures and limiting the generalizability of our findings to different cultures. Although we searched six major databases, we did not search the CHINAHL database, studies that were not published as full-text papers in journals (Balslem et al., 2013), or such gray literature as government agencies' reports, academic institutions' dissertations and theses, and commercial publishers' proceedings or textbooks. Future studies might include different language databases and cast a wider net in order to increase generalizability. Additionally, our meta-analysis was limited by the small number of studies within it, meaning that we could not examine a number of potentially relevant moderators (e.g., age, gender, program period) that could have changed the effect size. By examining only one outcome variable - adolescents' self-efficacy - we may have missed other important effects that OEPs did or did not have on adolescent development, perhaps including adolescents' optimism, gratitude, altruism, hope, and resilience (Snyder & Lopez, 2001). Future research and reviews might examine these and other variables, in turn. Finally, all systematic reviews and meta-analyses are limited in that conclusions depend on the quality of individual studies included. Various researchers (e.g., Ioannidis, 2016; Weir et al., 2016) have advised following published guidelines not only of PRISMA, but also of AMSTAR (Assessing Methodology Quality of Systematic Reviews), and PROSPERO (International Prospective Register of Systematic Reviews), to assess the risk of bias within studies, checking the appropriateness of the included papers, and avoiding performing a meta-analysis of studies with a high risk of bias and redundancy (Marks-Anglin et al., 2020). Our attempt to follow this advice left us with a small number of studies, though their quality gives us high confidence in this narrower range of conclusions.

Conclusion

In this systematic review and meta-analysis, we found robust evidence of OEPs' benefits on adolescent participants' self-efficacy. Perhaps unsurprisingly, among the small number of research articles that met all of our inclusion/exclusion criteria, those with higher quality (i.e., comparative group analyses and follow-up data) showed a somewhat reduced (medium level) effect size relative to the effect size (large level) of those with weaker methodology. We were also

able to identify several other moderating variables that affected the effect size of these benefits, including (a) that adolescent participants who experienced mental health concerns showed larger gains than those that entered studies with fewer of these concerns, and (b) adolescents showed greater gains from shorter duration experiences.

Author's Note

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Sean H. Liu: earned his master degree in sport & exercise psychology from the Graduate Institute of Physical Education, National Taiwan Sport University, Taiwan. Liu is currently a doctoral candidate at the Graduate Institute of Sport Coaching Science of Chinese Culture University, Taiwan. Liu's major interests in academics are social psychology of sport and exercise, and measurements in sport and exercise psychology. He is also an active member of the International Society of Sport Psychology (ISSP) and Exercise Psychology for Taiwan (SSEPT). In addition to academic activities, he likes to play football and basketball during his leisure time.

Theresa Chyi: is an associate professor in the Department of Exercise and Health Promotion, Chinese Culture University. She earned her Ph.D. degree from Tunghai University in life science. Her research focuses on the psychosomatic aspect of physical activity and sports. She actively participates in many international conferences such as the Asian South-Pacific Association of Sport Psychology (ASPASP), International Society of Sport Psychology (ISSP), and International Seminar in Sport and Exercise Psychology (ISSEP). She teaches activity classes such as Petanque and physical fitness for disabled students at the Chinese Culture University. In class, she teaches health management, the neuro-scientific aspect of body movement, and motor development.

Bin Chen: is a lecturer in the Department of Public Physical Education, Fujian Agriculture and Forestry University. He received his master's degree from Shanghai University of Sport in 2014. He is currently a doctoral candidate in the College of Management, National Taiwan Sport University. He is an active member of the Chinese Psychological Society (CPS) and Society of Sport and Exercise Psychology for Taiwan (SSEPT). His research interest focuses on the positive psychology of sport and physical activity, specifically moral reasoning in physical education, character development, and building through physical activity and sports.

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