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Personal growth effects for college students of ropes course participation: A systematic review and meta-analysis

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ABSTRACT

This systematic review and meta-analysis examines the effects of ropes course participation on personal growth outcomes in college students. Transition to college brings challenges to students', mental health and overall well-being. Ropes courses (RCs) are obstacle courses used to foster personal growth, resilience, and team-building. We reviewed 10 studies involving RC interventions, considering factors like intervention duration, RC type, and control group design. The RCs programs demonstrated overall significant effect on personal growth outcomes (standardized mean difference – Hedges' $g = 0.24$, 95% CI 0.04–0.44, $P = 0.02$), however the magnitude of Hedges' g showed no effect. In summary, the results indicate that RCs programs may have small immediate positive effects for college students on personal growth outcomes, such as self-concept and self-efficacy. However, the effectiveness of these programs is primarily dependent on their duration, with longer interventions demonstrating greater potential for positive effects. It is also essential to consider the limitations of the reviewed studies, including the lack of randomization, the use of self-report measures, and the potential for biases.

KEYWORDS

adventure; outdoor education; challenge activities; self-concept; self-efficacy

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INTRODUCTION

The transition from high school to college or university is a significant period in a student's life, marked by increased independence and higher academic and life demands. This transition can often lead to distress and contribute to mental health issues, including anxiety and depression (Eisenberg et al., 2009). Notably, these challenges can have a detrimental impact on students' academic performance and overall quality of life (Zajacova et al., 2005; Yu et al., 2018). Personal growth encompasses developing various outcomes, such a self-concept, self-efficacy, self-confidence, self-actualization, self-restraint, initiative perseverance, determination, resourcefulness, and locus of control. Developing these outcomes can positively influence an individual's functioning (Cason & Gillis, 1994; Ewert & Garvey, 2007; Hattie et al., 1997).

One method frequently employed to promote the development of these personal growth outcomes is through ropes course participation (RCs), also known as challenge courses (Cason & Gillis, 1994; Hattie et al., 1997). RCs are obstacle courses consisting of ropes, steel cable, wood and other specialized hardware usually attached to trees (Attarian, 1990; Rohnke et al., 2003). These courses are utilized in educational, recreational, and developmental settings, such as summer camps, corporate training centres, schools, and colleges, as part of adventure education courses. Their aim is to foster physical and mental health, team-building, problem-solving skills, and personal growth outcomes (Goldenberg et al., 2000; Rohnke et al., 2003). The popularity and availability of RCs have been increasing (Hatch & McCarthy, 2005) providing an opportunity to leverage these facilities to promote personal growth among college students. Engaging in challenging activities on a ropes course pushes students beyond their comfort zones and assists in the development of resilience, perseverance, and a growth mindset (Ewert, 1986; Neill & Dias, 2001; Chang et al., 2019). Overcoming obstacles and achieving personal goals in a supportive environment can enhance their self-esteem and belief in one's abilities, which are crucial for academic success (Hansen et al., 2014; Haras et al., 2005; Nowell et al., 2020).

While RCs are expected to improve outcomes such as leadership, communication, problem-solving, and personal development, research evidence concerning their effectiveness is mixed (Gillis & Speelman, 2008). Gillis and Speelman (2008) found a moderate overall effect of RCs on these outcomes, but noted that the effects varied based on the type of outcome and study design. They also identified several factors that moderate the effectiveness of ropes courses, including course duration, participant type, and challenge level. However, their meta-analysis primarily focused on diverse populations and lacked a strictly defined intervention program. Additionally, factors such as the design of the ropes course (safety measures, element height), participants' prior experience, staff qualifications and instructions, intervention duration, and weather conditions were discussed as potential influences on the effectiveness of ropes course (Priest & Gass, 2005).

To enable educators, trainers, and program facilitators to effectively utilize RCs programs in college settings, it is essential to have a comprehensive understanding of their potential benefits and limitations. Therefore, the aim of this systematic review and meta-analysis was to synthesize existing literature on the effects of ropes courses on personal growth outcomes in college students.

METHODS

Criteria for considering studies for this review

Only studies involving RC programmes and personal growth outcomes were involved. Studies focused on any other wilderness and recreational activities that are not related to ropes courses were not eligible. Studies had to be written in English. Journal articles as well as dissertations were eligible. Only intervention studies with the following design were accepted for further analysis: pretest-post-test (PP) or pretest-post-test-follow up (PPF) with both control (CG) or single group (SGS) design were included in this review. Only college students' participants, no matter gender and age were included. All types of ropes (challenge) courses interventions (low ropes courses, high ropes courses) were included. There were no limitations concerning the duration of the intervention. Studies where the RC program was not the main part of the program were not eligible. Studies involving other activities as a part of warm up (icebreakers, games etc.) were included. Self-perceived individual benefits outcomes such as self-concept, self-esteem, self-efficacy, leadership efficacy, life effectiveness skills, learning goals were included in this review. The results of the study had to be reported in a quantitative form.

Appropriate papers were identified through searches using 1) two electronic databases: EBSCOhost (www.ebscohost.com), ProQuest (www.proquest.com); 2) reference lists of eligible papers and several published reviews were hand-searched for further studies; 3) existing bibliography on challenge course-related articles (Attarian & Holden, 2005) was reviewed. When searching in the databases, academic journals and dissertations (EBSCOhost), scholarly journals and dissertations/theses (ProQuest) were chosen in type of source. The search formula in databases was as follow:

- EBSCOhost: TI challenge course OR TI ropes course OR TI adventure program AND AB (benefits or impact or influence or effect) AND AB (college or university or undergraduates)
- ProQuest: (((title (challenge course) OR title (ropes course) OR title (adventure program) AND abstract (benefit OR impact OR effect OR influence) AND abstract (college OR university OR undergraduates)) AND stype.exact ("Scholarly Journals" OR "Dissertations & Theses")) AND stype.exact ("Scholarly Journals" OR "Dissertations & Theses")) AND stype.exact ("Scholarly Journals" OR "Dissertations & Theses").

Data collection and analysis

A total of 503 studies were identified by searching EBSCOhost and PROQuest. By manually searching the reference lists, an additional 18 studies were identified. After the removal of the duplicates (n = 64), 457 studies were screened by title and abstract. After the initial screening, 28 studies were assessed for eligibility. Due to different reasons such as unclear intervention, no college students, nor individual outcomes measured in the studies, 18 were excluded. Finally, ten studies were included in the review and six of them were included in the meta-analysis (Figure 1). For a full list of studies and variables included in the analysis see Table 1.

All potential papers were first downloaded in EndNote, and then all duplicates were deleted. After removing all the duplicates, all abstracts were explored to identify

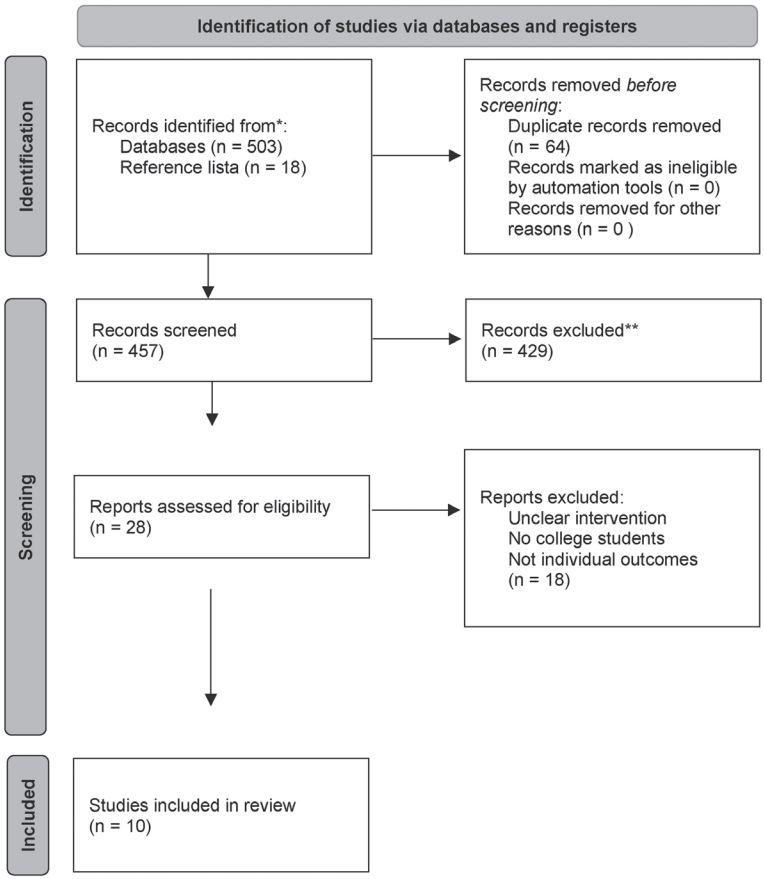

Figure 1 Prisma flow diagram

relevant papers for subsequent selections. If from the abstract the papers seemed suitable, full texts were examined in detail. Additionally, other papers were identified through the reference lists of papers and reviews gained by the database search.

Measures of treatment effect were calculated using the standardized mean difference for each study, and then the Cochran-Mantel-Haenszel statistical method based on a random-effect model to calculate an effect size (Mantel & Haenszel, 1959). We estimated the heterogeneity using the Cochran Q statistic, I^2, Tau^2 (τ^2) and Chi^2 (χ^2). A rough guide to the interpretation of I^2 is as follows: 0 to 40% might not be important, 30% to 60% may represent moderate heterogeneity, 50% to 90% may represent substantial heterogeneity, and 75% to 100% represents considerable heterogeneity. Tau^2 (τ^2) estimates the true variance in effect sizes across studies, beyond random sampling error. A higher Tau^2 value indicates greater variability in study effects. Chi^2 (χ^2) Test assesses whether observed differences between studies exceed what would be expected by chance. A low p-value (< 0.05) suggests significant heterogeneity, while a high p-value (> 0.05) indicates that variations may be due to random error

Table 1 Study Characteristics

Study	Type	Design	Measured outcomes	Time of intervention	Sample (N)	Age (years)
Cordle (2015) [#]	T	SGS, PPF	Self-efficacy, Task specific self-efficacy	4 hours	52 (26/26)	20.0
Finkenberg (1994) [##]	JA	CG, PP	Self-concept	40 hours in 16 weeks	50 (18/32)	21.0
Flood et al. (2009) [#]	JA	SGS, PP	Life effectiveness skills	8 hours in 2 weeks	57	–
Jordan (2013) [##]	D	CG, PP	Learned resourcefulness	6.5 hours	40 (20/20)	18.0–19.0
Luna (2018) [##]	D	CG, PP	Self-concept	12 hours in 6 weeks	92 (62/30)	NS
Odello et al. (2008) [#]	JA	SGS, PPF	Leadership efficacy, work efficacy	4 hours	43	–
Schary et al. (2015) [#]	JA	SGS, PPF	Learning goals	4–6 hours	375*/78**	21.1*/ 21.99**
Smith (1992) [##]	T	CCG, PP	Self-concept, Self-efficacy	10 hours in 10 weeks	71	21.5
Sturdivant (1991) [##]	D	CG, PP	Self-concept, Affective behaviour	8 hours	26 (12/14)	–
Sung (2004) [##]	D	CG, PP	Self esteem	8 hours	112 (56/56)	19.0–55.0

Type of the study (T – thesis, D – dissertation, JA – journal article), Study design (SGS – single group study, CG – study included control group, CCG – study included control and comparison group, PP – pretest-posttest-test, PPF – pretest-posttest-follow-up), Sample (N experimental group/N control group, * pretest-post test phase, ** follow up phase), [#] Study used in systematic review, [##] Study used in systematic review and meta-analysis

rather than real differences (Higgins et al., 2003). Statistics were carried out using Review Manager 5.4 (The Cochrane Collaboration, 2020).

To calculate the standardized mean difference, in our case Hedges' *g*, the sample size for the experimental and control group and the above-mentioned mean differences (after-before) with standard deviation (SD) for both groups were used. In the case that they were not available, they were calculated using baseline and follow-up means and SD as a simple post-pre difference; we estimated SD as Higgins et al. (2003).

$$SD_{E,change} = \sqrt{SD^2_{E,baseline} + SD^2_{E,final} - \left(2 \times Corr \times SD_{E,baseline} \times SD_{E,final}\right)}$$

(SD – standard deviation, Corr – correlation; E,change – experimental group change; E,baseline – experimental group baseline results; E,final – experimental group final results)

Hedges' *g* of 0.2, 0.5, and 0.8 were interpreted as small, medium, and large effects, respectively (Cohen, 1988; Hedges, 1981).

RESULTS

Systematic review

Ten studies were selected for analysis, consisting of four journal articles, four dissertation theses, and two Master's theses. Six of the studies utilized a pretest-post-test design with a control group, while the remaining were single-group studies, with one utilizing a pretest-post-test design and three utilizing a pretest-post-test-follow-up design. Personal growth outcomes were assessed, including self-concept (measured in four studies), self-efficacy (measured in two studies), task-specific efficacy, leadership, work efficacy (measured in three studies), and outcomes such as life effectiveness skills, learned resourcefulness, affective behaviour, self-esteem, and learning goals (measured in one study each).

The RCs programs varied across studies, with six studies utilizing a one-day intervention lasting between four and eight hours, and the remaining studies utilizing regular or irregular multiple sessions lasting between two and sixteen weeks. The interventions also varied in terms of the type of RCs utilized, with two studies utilizing low RCs, one study utilizing high RCs, and six studies utilizing a combination of both. One study did not specify the type of RCs utilized as an intervention.

The results of three one-day intervention studies indicated significant ($P < 0.05$) immediate effects of RCs intervention on self-efficacy, task self-efficacy, leadership and work efficacy and learning goals (Cordle, 2015; Odello et al., 2008; Schary et al.,

Table 2 Effect of ropes course intervention on different outcomes – overview of all included studies in systematic review

Study	Intervention	Measured outcomes	WGIE	WGLE
Cordle	HRC	Self-efficacy, Task specific self-efficacy	↑ ↑	– * – *
Flood	LHRC	Life effectiveness skills	↑	NA
Odello	LRC	Leadership efficacy Work efficacy	↑ ↑	↑ ** ↑ **
Schary	LHRC	Learning goals	↑	– ***
Study	Intervention	Measured outcomes	BGIE	BGLE
Finkenberg	LHRC	Self-concept	↑	NA
Jordan	LHRC	Learned resourcefulness	–	NA
Luna	LRC	Self-concept	↑	NA
Smith	NS	Self-concept Self-efficacy	– –	NA NA
Sturdivant	LHRC	Self-concept	–	NA
Sung	LHRC	Self-esteem	–	NA

Type of the intervention (LRC – low ropes course, HRC – high ropes course, LHRC – low and high ropes course, NS – not specified), intervention effect (WGIE – Within group immediate after intervention effect, WGLE – Within group long-duration 2–12 weeks after intervention effect – * 2–4 weeks, ** 6 weeks, *** 12 weeks, BGIE – Between group immediate after intervention effect, BGLE – Between group long-duration 2–12 weeks after intervention effect, ↑ significant effect, – non-significant effect, NA – not applicable; Effects reported by the given study)

2015). However, the other three one-day intervention did not find any immediate effect on learned resourcefulness, self-concept and self-esteem (Jordan, 2013; Sturdivant, 1991; Sung, 2004). It is noteworthy that these three studies involved a control group.

The studies using multiple sessions in two and more weeks with varying total hours of program indicated significant ($P < 0.05$) immediate increases in self-concept and life-effectiveness skills (Finkenberg, 1994; Flood et al., 2009; Luna, 2018). One study has not shown any significant effects on self-concept and self-efficacy (Smith, 1994). Except for one study (Flood et al., 2009), all multiple-session studies involved a control group. While long-term effect was found for leadership and work efficacy in only one single group study (Odello et al. 2008), no long term-duration effect was observed in studies utilizing control group. For a full list of studies included in the systematic review and their effect, see Table 2.

Meta-analysis

Six studies were included in the meta-analysis. One study was divided into female and male subgroups (Finkenberg, 1994), and one study included two different outcomes, self-concept and self-efficacy (Smith, 1994). Finally, data from 210 participants in experimental (RCs) groups and 192 participants in the control (non-RCs) groups were included in the overall effect of the meta-analysis. The RCs programs demonstrated overall significant effect on personal growth outcomes (Hedges' $g = 0.24$, 95% CI 0.04–0.44, $P = 0.02$), however the magnitude of Hedges' g showed small effect. For a full meta-analysis see Figure 2.

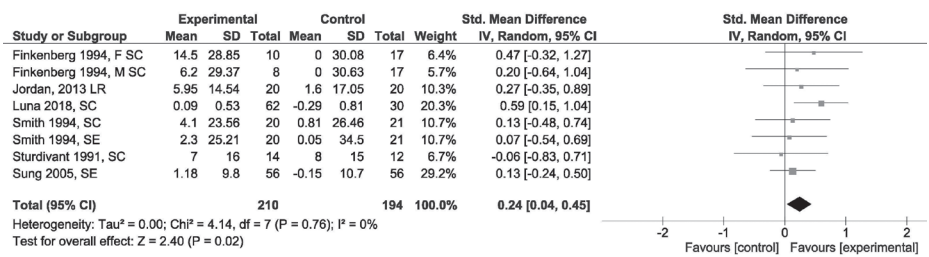

Figure 2 Meta-analysis
F – female, M – male, SC – self concept, LR – learned resourcefulness, SE – self-efficacy

DISCUSSION

Systematic review

The findings of this systematic review indicate several key points regarding the effects of RC on personal growth outcomes in college students. Firstly, studies without control groups generally reported significant immediate positive effects of RC on various outcomes, such as self-concept, self-efficacy, life effectiveness skills, leadership efficacy, work efficacy, and learning goals. However, when studies with control groups were considered, the overall effect of RC on personal growth outcomes was not confirmed.

This lack of significant findings may be attributed to limitations in the design or implementation of the courses, as well as the measurement tools used.

Apart from control group, the following factors may have contributed to affect final results: selection of participants and lack of control over their behavioural changes, researchers' expectancies, the personality and teaching skills of RCs instructors, individual perception of RC challenge and its debriefing after the program, and finally the duration of the program.

The duration of the program appears to be one of the main factors affecting outcome of the RC courses. While one-day programs (≤ 8 hours) demonstrated immediate positive effects on certain individual outcomes, such as self-efficacy (Cordle, 2015), leadership and work efficacy (Odello et al., 2008), learning goals (Schary et al., 2015), the long-term effect was observed on leadership-efficacy and work-efficacy only (Odello et al., 2008). The multiple-session programs with longer duration (> 10 hours) (Finkenberg, 1994; Luna, 2018) demonstrated low to medium immediate effect on self-concept. Moreover, the length of the program when using CG design shows stronger immediate effects for longer than shorter programs. It appears that positive effects with interventions lasting at least 6 weeks with programs ≥ 2 hours a week may provide some benefits, while one-day RC programs or multisession programs lasting up to 10 hours do not provide any substantial effects on personal growth outcomes.

The effectiveness of interventions within adventure education programs is also contingent upon participants' perception of risk and the quality of debriefing provided (Leberman & Martin, 2004; Taniguchi et al., 2005). Six studies (Cordle, 2015; Flood et al., 2009; Luna, 2018; Sturdivant, 1991; Sung, 2004; Schary et al., 2015) claimed experienced and trained RC' leaders. Moreover, apart from two studies (Finkenberg, 1994; Smith, 1992), some kind of debriefing of the program was used. In four studies (Cordle, 2015; Flood et al., 2009; Luna, 2018; Jordan, 2013), the level of challenge was considered. However, it is impossible to assess the direct impact of debriefing and challenge level on the personal growth outcome in the studies involved due the limited level of evidence.

Meta-analysis

In our study, the overall effect size, regardless of the measured outcome, was Hedges' $g = 0.24$ ($P = 0.02$), which means small effect. In a meta-analysis by Gillis and Speelman (2008), which focused on the impact of challenge courses on university students, the overall effect size was found to be d = 0.18 across 11 studies, with no intervention longer than 10 hours.

Our meta-analysis has shown different Hedges' g effects on self-concept (–0.06–0.59) across 4 studies (5 effect sizes), whereas Gillis and Speelman (2008) found an effect size of d = 0.26 across 20 studies for self-concept and self-esteem. However, our analysis showed no meaningful effects (Hedges' $g = 0.07–0.13$) on self-efficacy among two studies, differing from previous meta-analyses where significant effects were noted (Cohen's d = 0.48 in Gillis and Speelman, 2008; Cohen's d = 0.35 in Thor, 2014; Hedges' $g = 0.4$ in Speelman, 2013). Speelman (2013) also reported an overall effect size of Hedges' $g = 0.29$ for self-esteem and Hedges' $g = 0.5$ for other personal outcomes. The contradictions are likely due to the different population involved and all factors mentioned at the beginning of the discussion. These discrepancies also

highlight the need for cautious interpretation and further research, considering the nuances in outcomes and the influence of specific studies on the overall effect size.

Although this review primarily focused on the effects of RCs programs on personal growth outcomes, it is important to acknowledge the limitations of the reviewed studies. Most studies utilized either single-group designs or quasi-experimental designs with non-randomized control groups. Additionally, self-report measures were commonly employed, which can be subject to biases and inaccuracies. These limitations should be considered when interpreting the findings. It is important to note that the influence of factors such as the height and design of the RCs, participants' prior experience with such obstacles, staff qualifications, instructions and presence of debriefing could not be estimated due to limited evidence. Therefore, further research should be undertaken with stronger experimental design and confounding variable description to better understand the extent and generalizability of the benefits of RC programs, including their long-term effects.

Our main limitation in our study was the small number of studies included in the meta-analysis, that is the reason why various indicators of personal growth were combined. It is possible that the programs may only affect certain indicators. Additionally, the wide range of publication years may introduce a potential generational effect that could influence the results. Curiously, the oldest study included, published in 1991, is about to turn 35, and only a few studies have been published since then.

CONCLUSION

In summary, this systematic review and meta-analysis indicate that RCs programs may have small immediate positive effects for college students on personal growth outcomes, such as self-concept and self-efficacy. However, the effectiveness of these programs is primarily dependent on their duration, with longer interventions demonstrating greater potential for positive effects.

Based on the findings of this review, it is recommended to implement longer (≥ 6 weeks) and regular (≥ 2 hours a week) RCs programs rather than shorter interventions lasting only a few hours or a single day. This outcome suggests that sustained engagement with RCs activities may be necessary to achieve meaningful and lasting personal growth outcomes. It is also essential to consider the limitations of the reviewed studies, including the lack of randomization, the use of self-report measures, and the potential for biases.

Disclosure statement

The authors report there are no competing interests to declare.

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