Journal of Outdoor Recreation and Tourism 21 (2018) 76–86

Contents lists available at ScienceDirect

Journal of Outdoor Recreation and Tourism

journal homepage: www.elsevier.com/locate/jort

Using outdoor adventure to enhance intrinsic motivation and engagement in science and physical activity: An exploratory study

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ARTICLE INFO

Keywords:
Adventure recreation
Positive psychology
Edutourism
Flow
Self-determination theory
Learning Outside the Classroom

ABSTRACT

Many nations are seeking novel approaches to increasing youth physical activity levels, as well as academic performance in science-related disciplines. This study investigated an integrated approach to addressing both issues by exploring student experiences in (a) a pilot outdoor adventure-based science course, and (b) their normal school settings before and after this course. Twenty-two high school students participated in a five-day snow science program that incorporated winter outdoor adventure activities within a science curriculum. Variables related to attitudes, identity, intrinsic motivation, basic psychological needs, and engagement in science education and outdoor physical activities were measured, along with actual physical activity levels. Participants' reported engagement, intrinsic motivation, enjoyment, self-determination, and physical activity levels were significantly higher during the outdoor adventure-based science course compared to pre and post-school settings. Findings provide preliminary support for further developing and evaluating adventure education and recreation programs with the dual aims of improving student engagement in science education and physical activity.

Management implication: This study explored outdoor physical activity and science learning in a publicly operated residential science school program based in a ski area and State park. The results can assist managers of public and private agencies implement innovative experiences that meet growing demand for personal development, education, health, wellness and meaning, in addition to enjoyment. Recreation managers can apply findings to create novel programs during school breaks that appeal to youth, parents and school administrators alike.

Findings suggested that integrated outdoor adventure-based programs may:

- enhance participants' intrinsic motivation to engage in both physical activity and science education;
- provide a novel means of addressing two pressing social issues (sedentary lifestyles, underperformance in science).

In terms of program structure and implementation, managers should focus on facilitating intrinsic motivation, autonomy, competence, and relatedness through techniques such as:

- supporting positive group dynamics;
- providing participants choices about how and where learning happens;
- allowing time to develop recreation skills as well as science skills;
- fostering flow opportunities through dynamically matching challenges with progressive skill instruction over the course of the program (or several programs).

Finally, in terms of assessing programs and experiences, managers might consider measuring aspects such as flow, intrinsic motivation, or physical activity in addition to customary 'satisfaction' measures.

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https://doi.org/10.1016/j.jort.2018.01.008
Received 9 October 2017; Received in revised form 30 January 2018; Accepted 31 January 2018
2213-0780/

1. Introduction

Childhood and adult obesity rates are reaching epidemic proportions in many developed nations (Flegal, Carroll, Ogden, & Curtin, 2010). Despite the critical role that consistent physical activity plays in promoting long-term well-being and health, physical activity amongst American youth (ages 3–17 years) is low and tends to decline significantly during adolescence (U.S. Department of Health & Human Services, 2012). Only 4% of U.S. elementary schools and 2% of high schools provide daily physical education (Centers for Disease Control & Prevention CDC, 2010). In England, there is no minimum physical education requirement in terms of hours per week for primary or secondary schools, and only 18% of youth aged 5–15 years met the World Health Organization's physical activity recommendations between 2012 and 2014 (WHO, 2016b). These trends have been documented globally, as reflected by World Health Organization's (2016a) statement that over 80% of the world's adolescent population is insufficiently physically active.

The Centers for Disease Control (2011) indicates that schools play a critical role in health promotion by providing opportunities to learn about and practice physical activity (PA) behaviours. Improved academic performance, problem solving ability, and concentration have been linked to ongoing PA opportunities, such as those offered in school programs (e.g., Castelli, Hillman, Hirsch, Hirsch, & Drollette, 2011; Shephard, 1997), and outdoor recreation environments (e.g., Berto, 2014; Faber Taylor & Kuo, 2009; Herzog, Black, Fountaine, & Knotts, 1997; Richmond, Collins, Sibthorp, Pohja, & Gookin, 2014). Numerous studies have demonstrated positive relationships between green space and self-reported indicators of physical and mental well-being (Bird, 2007; Bratman, Hamilton, & Daily, 2012; Hartig, Evans, Jamner, Davis, & Garling, 2003; Health Council of the Netherlands, 2004; Kuo, 2015; Tyrvainen, Ojala, Korpela, Lanki, Tsunetsugu & Kagawa, 2014; Ward, Thompson & Aspinall, 2011; Zhang, Piff, Iyer, Koleva, & Keltner, 2014). Beyond the mental (e.g., attention restoration, subjective vitality) and physical (e.g., reduced blood pressure, cardiovascular health) benefits afforded by outdoor environments, research also suggests that PA in natural environments, such as those often found in nature-based recreation and tourism settings, may have additive or synergistic effects above and beyond those of PA alone (Laumann, Garling, & Stormark, 2003; Pretty, Peacock, Sellens, & Griffin, 2005; Ryan et al., 2010). Thus, providing opportunities for youth to engage in outdoor PA across education, recreation, and tourism contexts may be one way to reduce obesity and increase physical and mental health.

In addition to youth obesity and inactivity, there is a need to address youth underperformance in science by developing engaging and meaningful science education (e.g., Sanders, 2009). Schools have traditionally taught subjects such as science in isolation, without drawing upon connections to other areas of study. For example, U.S. high school students often have five to seven classes per day, moving between diverse subjects such as science, English, mathematics, social studies, and electives (see Table 1). In traditional school settings, these courses are rarely integrated in a purposeful way across the curriculum. It is even rarer to see collaboration with outside agencies, such as recreation or tourism providers, to develop more meaningful and engaging science opportunities for youth.

One way to improve student engagement in science is by integrating other disciplines and practical applications (Katehi, Pearson, & Feder, 2009), such as using outdoor adventure, nature-based learning, forest schools, or Learning Outside the Classroom (LOtC) approaches. Systematic reviews of these educational approaches have identified a range of learning benefits in addition to positive social, emotional, and physical health outcomes (e.g., Davies, Jindal-Snapeb, Collier, & Digbya, 2013; Hattie, Marsh, Neill, & Richards, 1997; Malone, 2008; Mygind, 2016). Sproule et al. (2013) suggested that some of these benefits may result from enhancing students' self-determination. These authors advocated for increased outdoor and adventurous educational opportunities based on findings that, in comparison with normal academic school experiences, an adventurous project-work program increased key self-determination theory (SDT) constructs linked to learning and engagement, such as autonomy support, intrinsic motivation, and perceived competence (Sproule et al., 2013). A recent review of the effects of outdoor education on students' learning, social, and health outcomes found that "school-and curriculum-based OEPs [outdoor education programs] can promote students in respect of social, academic, physical and psychological dimensions" (Becker, Lauterbach, Spengler, Dettweiler, & Mess, 2017, p. 485). Despite these promising findings, Becker et al. identified the need for further quasi-experimental research on outdoor education impacts, such as effects on participants' PA.

Table 1
Typical daily schedule in participants' traditional high school setting.

Time	Class / Activity
6:40–7:30 a.m.	*Zero Hour: Optional class period*
7:35–8:35 a.m.	First Period: English
8:40–9:40 a.m.	Second Period: Mathematics
9:45–10:45 a.m.	Third Period: Science
10:50–11:50 a.m.	Fourth Period: World history
11:50–12:20 p.m.	Lunch
12:25–1:25 p.m.	Fifth Period: Speech
1:30–2:30 p.m.	Sixth Period: Elective

Note. Order of classes and subjects vary by year and student. All students must complete a required number of credits in the following subject areas: Science, English, Mathematics, Social Studies, Humanities, Physical Education/Health, and Technology. Students are required to complete two required credits of Physical Education/Health in their first year of high school.

Building on this literature, the current study explored a novel approach to two pressing social issues – decreased youth engagement in physical activity and science education – by investigating student experiences during an integrated outdoor adventure-based science curriculum (OASC), and in their normal school settings before and after this course. Related, but distinct, bodies of literature, including outdoor adventure education, experiential education, and LOtC research, have continually underscored the need to move beyond simply highlighting outdoor education and recreation benefits to identifying factors that foster positive (or negative) outcomes (e.g., Hattie et al., 1997; Henderson, 2004; Sibthorp & Jostad, 2014). Thus, the current study drew upon established psychological frameworks of engagement, intrinsic motivation, and self-determination in an effort to explore how an integrated OASC might potentially differ from traditional school settings in terms of participants' engagement with science education and PA.

2. Review of literature

This section begins by exploring the varied terminology and delivery methods associated with learning in outdoor environments across global contexts to help situate the current study. As this exploration drew upon a number of research areas (see Fig. 1), the review of literature discusses convergent findings that, in aggregate, suggested an OASC could provide a range of benefits towards enhancing PA and science engagement. This review identifies various benefits of PA, outdoor settings, and adventure for learning and well-being, and concludes by discussing the relevance of key psychological frameworks employed in the current study

2.1. Education in outdoor environments: Diverse approaches and benefits

Outdoor learning, outdoor adventure education (OAE), experiential education, and Learning Outside the Classroom (LOtC) are just a few of the many terms used in academic literature to denote learning that occurs outside of traditional classrooms, often in settings involving