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Running Head: Cognitive Learning Outcomes in Outdoor Education

Testing a Proposed Model of Perceived Cognitive Learning Outcomes in Outdoor Education

1 **Abstract**

2 The purposes of this study were to propose a model of cognitive learning outcomes in outdoor
3 education and examine their relationships with two antecedents (quality of support resource and
4 involvement) and one consequence (satisfaction). A total of 343 physical education student
5 teachers in Singapore completed a questionnaire upon completion of a 5-day outdoor education
6 camp. The questionnaire consisted of 25 items measuring cognitive learning outcomes, quality of
7 support resource, involvement, and satisfaction with the camp. A confirmatory factor analysis
8 confirmed the four-dimensional construct of cognitive learning outcomes with adequate global
9 and internal structure fit. Structural equation modeling supported the proposed sequences
10 indicating both quality of support resource and involvement as antecedents and satisfaction as a
11 consequence of cognitive learning outcomes. This study provides insightful information on the
12 design, implementation, and evaluation of outdoor education **curricula** to enhance student
13 teacher's satisfaction with **the course** during their pre-service **training**.

14

15 **Keywords:** outdoor education, cognitive learning outcome, quality of support resource,
16 involvement, satisfaction

17

Introduction

In 2014, the Ministry of Education in Singapore rolled out a new physical education (PE) syllabus. One of the key initiatives is that outdoor education has become a compulsory component in primary and secondary school curricula. There is evidence to support that outdoor education strengthens the quality of education by positively influencing pupils' psychological and behavioural outcomes (Rickinson et al., 2004). Wang et al. (2004) emphasised that outdoor education benefits young Singapore adolescents in developing cognitive, affective, and psychomotor domains through holistic learning experiences. Based on such pedagogical benefits, outdoor education has become a significant prominence of PE in Singapore education. Currently students in Singapore are required to attend two outdoor residential camps, one during upper primary years and the other during secondary years. In 2016, as part of the National Outdoor Adventure Education Masterplan, the Singapore government has introduced another scheme that all secondary Year 3 pupils will have to participate in a new, five-day Outward Bound Singapore (OBS) outdoor residential camp. This policy will be implemented from 2020 onwards. The aim is to provide students with authentic and often challenging situations, where they need to work in teams and learn to take responsibility for decisions they make (Yang, 2016). Due to these initiatives, Singapore students will have to attend at least three outdoor adventure camps during their school years.

With a growing demand for outdoor education, the Ministry of Education has structured and formalised the OBS programme to operate residential camps for schools (Ho, 2016). Due to the limited resources and manpower, however, OBS is not able to accommodate all schools' programmes. Instead, many schools have had to heavily rely on their PE teachers to develop and implement own outdoor programmes (Martin & Ho, 2009). Given this important role of PE

1 **teachers**, it is important to develop an **effective** outdoor training programme in teacher training
 2 institutes to ensure that student PE teachers are equipped with the necessary knowledge and
 3 **skills** to deliver outdoor education courses in their schools upon graduation (Gassner & Russell,
 4 2008; Martin & Yo, 2009). Therefore, a further investigation on how PE student teachers
 5 perceive learning outcomes and evaluate their experiences with the outdoor education course
 6 during pre-service training is warranted. In addition, it is also worthwhile to identify relevant
 7 factors in predicting the students' perceived learning outcomes.

8 Building on the conceptual model of Duque and Weeks (2010), which was originally
 9 designed to assess student learning outcomes and satisfaction in education in general, we
 10 developed the theoretical framework to guide the domain of outdoor education. Specifically, the
 11 study sought to propose a model of the cognitive learning outcomes in outdoor education and to
 12 examine their relationships with two antecedents (perceived quality of support resource and
 13 students' involvement) and one consequence (satisfaction) among PE student teachers enrolled
 14 in various pre-service training programmes (e.g., diploma, degree, and postgraduate diploma) in
 15 Singapore (see Figure 1).

16 **Perceived Cognitive Learning Outcomes in Outdoor Education**

17 A common definition of cognitive learning outcomes refers to “demonstrable acquisition of
 18 specific knowledge and skill gained through the programme of study” (Fry et al., 2009, p. 42). In
 19 the outdoor education context, it refers to the development of personal growth and social
 20 awareness, the acquisition of knowledge and skills related to outdoors, and the protection and
 21 care for the environment (Zink & Boyes, 2006). Outdoor education in Singapore has been
 22 designed to achieve the desired **learning** outcomes through guided direct experience in the
 23 outdoors, particularly with a strong emphasis on the development of tenacity and strength of

character, along with other sports and rugged activities within PE (Ministry of Education, 2010a). Drawing upon the established learning outcomes developed by the Ministry and OBS, the physical education and teacher education (PETE) institute, and existing literature support (e.g., Fry et al., 2009; Zink & Boyse, 2006), we defined and conceptualised five factors in cognitive learning outcomes (i.e., specialist knowledge, outdoor skills, application of learning to school, team bonding, and risk management) which could be implemented in the local context.

Specialist Knowledge

Martin and Ho (2009) addressed that critical thinking and problem solving can be enhanced through appreciation of the natural environment in outdoor education programme. In the Martin and Ho's (2009) survey, Singaporean outdoor educators responded that knowledge of outdoor education was one of the most significant learning outcomes. As such, one central premise is to provide students with specialist knowledge. Through a series of the lecture sections delivered by OBS before the camp, the student teachers have opportunities to learn fundamental concepts in outdoor education. The theory sections cover mainly about specialist knowledge such as key philosophical underpinnings, psychological and sociological theories, trends and issues in other countries, different pedagogical approaches, as well as principles and facilitations of land/sea expeditions. For instance, the student teachers would apply the social learning theory (Bandura, 1977) to understand interactions between individuals and their environment during adventure experiences (Prouty et al., 2007). The acquisition of these conceptual backgrounds provides students with insight to understand why and what they do and will help to guide their beliefs, attitudes, and behaviours during outdoor experiences (Ewert & Garvery, 2007).

Outdoor Skills

Specialised skill development is considered as another primary learning focus among student teachers (Timken & McNamee, 2012). Fry et al. (2009) emphasised that learning outcomes should include specific skills gained through the activities conducted in diverse adventure environments. Ho (2014) highlighted that qualification function should be one of the main purposes of outdoor education in Singapore schools, and this qualification function refers to "the acquisition of outdoor skills ranging from the specific – for example, kayaking – to the general, such as life skills" (p. 155). The outdoor education course operated by OBS offers the student teachers to develop proficiency in various activity and technical skills required for land and sea expeditions, such as navigation skills, camp planning and packing, cooking, shelter-building, knot tying, route-setting, map-reading, and execution skills. For example, during sea expeditions, participants should be able to use different canoe strokes with appropriate techniques at various circumstances. Accordingly, the student teachers are taught in such generic and specific outdoor skills and provided with opportunities for practices and applications before and during the land/sea expeditions, which is the key learning component in the outdoor camp.

Application of Learning to School

The Ministry of Education in Singapore has recently initiated the Programme for Active Learning as part of the primary school curriculum. The main purpose is to provide pupils with various hands-on experiences (e.g., outdoor education, sport, game, and performing and visual arts) for personal development and preparation for life (Ministry of Education, 2010b). Outdoor education is a key component of this practice, providing an effective platform to achieve a holistic education for the students. As a result, this new initiative has caused an increase in demand for more skilled and experienced outdoor educators in schools. To meet this demand, PE student teachers are now expected to play the dual roles as PE teachers as well as outdoor

educators. The applications and implementations of the concepts and activities they have learnt from the pre-service outdoor programmes are important. Thus, one of the key learning objectives is to provide the student teachers with experiences on how the role of outdoor education (e.g., outdoor education framework, learning outcome, assessment) can be enacted in the school PE curriculum. With this learning objective, the pre-service outdoor education course aims to prepare PE student teachers to become quality outdoor educators equipped with competence in applications on the demonstration of learned knowledge and skills in schools.

Team Bonding

Establishing teamwork is important in the camp because the students work in peer groups for most outdoor activities. Unlike other school based activities, lack of teamwork in outdoor education programmes may result in more serious consequences such as physical injuries or mentally breakdown, especially during physical demanding activities. The curriculum in the outdoor education course in the present study was designed to allow individuals to take on leadership, decision-making and planning roles, helping them understand how an effective leader inspires and motivates others to achieve team goals. The curriculum also helps individuals recognise the key factors that contribute to effective problem solving and crisis management as a team. It is also aligned with one of the six core values of OBS to develop leadership skills and strengthen team cohesion through challenging outdoor expedition (Gassner & Russell, 2008). On the same note, Gassner and Russell (2008) highlighted that individual and group decision making tasks and group problem solving skills are key elements in outdoor education programmes. Martin and Ho (2009) also noted team bonding (e.g., development of group co-operation and enhancement of critical thinking/problem solving skills) was ranked higher among Singaporean teachers and outdoor educator in their survey. Ho (2014) reaffirmed that outdoor education is an

effective vehicle to build social skills for students to appreciate interrelatedness and differences among people and enhance personal and social communication ways.

Risk Management

Various sea (e.g., canoeing, kayaking) and land (e.g., mountaineering, camping, cooking) expeditions are the key components in the outdoor education course designed for PE student teachers in the present study. Such activities are conducted in natural environment and potentially contain unpredictable dangers and hazard situations that require participants to respond, manage risk, and deal with challenges of the dynamic nature of the environment. Hunter (2009) emphasised that when planning and designing an outdoor education camp, an organisation should select a safety-oriented service provider which is able to understand the organisation's programme and safety regulations. OBS developed the Risk Analysis and Management System (RAMS) for outdoor professionals and teachers who plan, facilitate, and manage various outdoor adventure and expedition programmes (OBS, n.d.). RAMS can also be customised to the specific needs of organisations or educational institution with the intended applicability (OBS, n.d.). Prior to the camp, OBS offers the RAMS lessons during one theory section for the PE student teachers who participate in the camp, providing them the essential knowledge in safety awareness and risk management such as risk assessment, legal issues, emergency/crisis planning, and standard operating procedures. The PE student teachers are able to identify possible hazards in outdoor activities and learn proper strategies to minimise the risks to an acceptable level during the course. The OBS's new risk management practice seems to be coherent with the PE student teacher's learning objective in outdoor education.

Proposed Model of Perceived Cognitive Learning Outcomes

Combining the conceptual framework for evaluation of cognitive learning outcomes (Duque & Weeks, 2010) and services quality (Parasuraman et al., 1985), the present study proposed a model of perceived cognitive learning outcomes in outdoor education. A key premise underlying the service quality concept which is produced at the same time as service supply and consumption is the higher the service quality and the higher number of more satisfied customers (Parasuraman et al., 1985). Conceptualising student teachers as service receivers, Duque and Weeks (2010) developed a model hypothesising that student teachers' perceptions of learning outcomes and their satisfaction with the programme are good indicators to assess the quality of the programme higher education. Drawing parallel to the two conceptual foundations (Duque & Weeks, 2010; Parasuraman et al., 1985), an understanding of PE student teachers' overall perceptions of cognitive learning outcomes and their satisfaction with outdoor education is a key point in the present study. In summary, the present study proposed the model of cognitive learning outcomes with their two antecedents (quality of support resource and involvement) and one consequence (satisfaction).

Quality of Support Resource and Involvement as Antecedents

Duque and Weeks (2010) highlighted quality of support resource as one of the important service attributes to evaluate the supportive physical environment for learning in educational settings. Carlson and McKenna (2000) defined such supportive environment as "the articulated need for an encouraging and positive class atmosphere" (p. 20). Similarly a positive learning atmosphere in outdoor education may be derived from various service quality attributes such as camp facilities, transportation, accommodations, and food.

To provide quality service under a better learning environment, recently the Singapore government **has decided** to invest S\$250 million (approximately US\$175 million) to build a new

OBS outdoor camp (Yang, 2016). The government holds a premise that high quality of support resource would help students, as being co-producers of the service, actively participate in learning (production) process and eventually achieve the desired learning outcomes. This assumption claims that students' perceived quality can be thus utilised as an indicator of service performance (Duque & Weeks, 2010). Thus, it is important for outdoor educators to recognise the role and function of service design in the enhancement and delivery of quality **curricula** and programmes. Lizzo et al. (2002) found that students' perceptions about their learning environment had significant impact on students learning outcomes. Duque and Weeks (2010) also reaffirmed that students' perceived quality of support resource was a positive predictor of perceived cognitive learning outcomes in their model implemented in a higher education setting. Given the conceptual and empirical support, the following hypothesis was established:

Hypothesis 1: A participant's perceived quality of support resource will positively influence his/her cognitive learning outcomes in outdoor education.

In addition to quality of support, students' involvement with the programme is likely to contribute to the improvement of the quality of instructions and learning experiences (Duque & Weeks, 2010). Participants can achieve a better learning outcome if they are motivated to be involved in the education process (Duque & Weeks, 2010). Involvement is defined as "the strength or extent of the cognitive linkage between the self and stimulus object" which is addressed by "expressions stressing the extent of an object's relatedness, connections, or engagement to an individual's self-concept, needs, and values" (Kyle et al., 2007, p. 399). It can be thus concluded that a participant's involvement with an outdoor camp is enhanced when the individual's goals, needs, and values is fully met with the camp's characteristics and attributes (Kyle et al., 2007).

Hastie (1995) conducted a qualitative research exploring the ecology of outdoor education and the possible lessons for PE. One interesting finding from the interview with 10th-grade boys showed that high levels of involvement were evidenced as most outdoor tasks were performed in group work. Different from school-based PE settings with formal accountability, outdoor adventure settings generate more active participation in tasks conducted in live-in and group situations to achieve the learning objective (Hastie, 1995). In addition, a plethora of empirical evidence from past literature (e.g., Iwasaki & Havitz, 2004) supported that involvement in the activity played a significant role in increasing commitment to specific service providers (e.g., institutes, instructors) and products (e.g., **curricula**, facilities). **In outdoor education, past literature** supported the notion that involvement with outdoor education programmes could increase participant's ability to overcome challenges (Davison, 2001), improve decision making/problem solving skills **and** academic achievement (Marsh and Richards, 1988), and interpersonal skills (Hattie et al., 1997). Similarly, Astin et al. (1999) postulated students who **were** more involved in outdoor education programmes not only **exhibited** better performance in academic studies, but also **appreciated** more in learning and personal development. Duque and Weeks (2010) also showed that students' involvement significantly influenced their cognitive learning outcomes. Thus, the following hypothesis was posited:

Hypothesis 2: A participant's involvement with the camp will positively influence his/her cognitive learning outcomes in outdoor education.

Satisfaction as a Consequence

Satisfaction is defined as “a summary and affective response of variable intensity that is centered on the specific aspects of the acquisition and/or the consumption and that takes place at the exact

moment when an individual evaluate the object” (Marzo-Navarro et al., 2005, p. 55). Many higher education institutes use student evaluation of teaching and their satisfaction with the teaching as the most popularly utilised indicators of teaching effectiveness. Wiers-Jenssen et al. (2002) found the academic and pedagogic quality of teaching was a significant indicator of student satisfaction with teaching. In Duque and Weeks's (2010) model for ‘assessing perceived student learning outcomes and satisfaction’, the proposed relationship between cognitive learning outcomes and satisfaction of the learners was supported. Drawing a parallel to outdoor education, it is highlighted that achievement of cognitive learning outcomes could provide students with meaningful rationales and values of outdoor camp. The following proposition is thus presented:

Hypothesis 3: A participant's cognitive learning outcomes will positively influence his/her satisfaction with outdoor camp.

Additionally, it is worthwhile to examine a direct impact of perceived quality of support resource on satisfaction, where the both constructs are being considered as the crucial indicators of service performance in the marketing concept of “customer orientation” (Duque & Weeks, 2010, p. 85). Customer's satisfaction is a combination of emotional and cognitive responses, where service quality plays an important role to explain cognitive responses (Howat et al., 2008). This explains why customers are satisfied when the service provided meets their expectation (perceived service = expected service), or very satisfied when the service exceeds their expectation (perceived service > expected service; Petruzzellis et al., 2006).

With regard to service quality and student satisfaction in university teaching, several studies showed that students' perceived service quality was a significant predictor of their satisfaction (Browne et al., 1998; Guolla, 1999; Marzo-Navarro et al., 2005). Applying this to outdoor education, it is regarded that students' satisfaction with the camp could be judged by

various aspects of the service delivery process (e.g., relationships with staff, food, accommodation, facilities, transport) as well as the outcomes of the experience (Williams & Buswell, 2003). Understanding how such quality is evaluated by customers is critical for service providers as they may be able to allocate resources more effectively to increase the effectiveness of the camp. Thus, the last hypothesis posited the linkage between quality of support resource and student satisfaction:

Hypothesis 4: A participant's perceived quality of support resource will positively influence his/her satisfaction with outdoor camp.

####Insert Figure 1 around here####

Method

Research Participants

A total of 343 participants (261 males and 82 females) were drawn from a pool of pre-service PE student teachers from the 2-year diploma, 4-year degree, and 2-year post-graduate diploma programmes. The current samples were well representative of PE student teachers in Singapore they were recruited from the sole teacher education institute that produces PE teachers in the nation. The current male-to-female ratio in the sample was identical with that in the entire PE programme which was male dominant. **This research design did not involve any treatments, interventions, or certain experimental manipulations. Rather, this research is more concerned with the camp participants' overall perceptions, experience, and satisfaction across the 5-day outdoor education camps. Thus, the post-camp survey was carried out after the completion of all camp activities.** The average response rate was 98 percent.

Instrument Development

A questionnaire consisted of 25 items measuring the four constructs (cognitive learning outcomes, satisfaction, involvement, and quality of support resource). For cognitive learning outcomes, the outcome attributes were self-developed on the basis of the Churchill's (1999) recommendations for scale development. First, the researchers specified five dimensions of the construct (specialty knowledge, outdoor skills, application of learning to school, team bonding, and risk management). Second, a large pool of prospective scale items relevant to each dimension was generated through focus group discussions with experts. Third, the initial draft of the items was examined by a panel of experts to establish content validity. The panel consisted of four academic researchers in PE and outdoor education and two practitioners from OBS. Lastly, the researchers modified the initial questionnaire by reflecting the panel's comments pertaining to clarifying sentences, using appropriate word, relocating items to appropriate dimensions, removing unnecessary items, and generating new items. As a result, 15 items representing the five outcome dimensions was prepared for further purifications (see Table 1 for individual items). The items were measured using a 7-point Likert scale, anchored with strongly disagree (1) to strongly agree (7).

Items measuring service quality were adapted from the past literature (Lee et al., 2007) and modified accordingly for the outdoor camp setting. Four performance-only items were prepared to measure perceived quality of support resource in the four attributes (i.e., the quality of camp facilities was..., the quality of accommodation was..., the quality of transportation was..., and the quality of food provided was...) using a 7-point Likert scale, anchored with very poor (1) to very good (7). Another construct, students' involvement with the camp was measured by three items, which were borrowed from the Consumer Involvement Profiles (Laurent & Kapferer, 1985). The three items were (a) the camp is very important to me, (b) for me, this camp does not

matter, and (c) this camp is an important part of my life. A 7-point Likert scale, anchored with strongly disagree (1) and strongly agree (7), was used.

Lastly, three items were used for the measurement of satisfaction with the camp. The items (i.e., satisfied vs. dissatisfied, pleased vs. displeased, and favorable vs. unfavorable) were adapted from the past literature (Crosby & Stephens, 1987) and measured using a 7-point semantic differential scale. In addition, three items were included to measure demographic information of the participants, such as gender, school year, and types of programme (i.e., diploma, degree, and post-graduate diploma).

Data Analysis

Data analyses were completed in three phases. Since the construct of perceived cognitive learning outcomes was multi-dimensional with the newly developed measures, Phase One and Two were devoted to scale development of this construct, following the Churchill's (1999) procedures. Phase Three was designed for testing the proposed relationships among quality of support resource, involvement, cognitive learning outcomes, and satisfaction.

In Phase One, the first year data set ($n = 129$) were utilised for the purification of perceived cognitive learning outcome measures using internal consistency tests and exploratory factor analysis (EFA). Given the number of the items (15 items) observed, the sample size ($n = 129$) for the factor analysis met the minimum subjects per item ratio of 5 to 1 (Hair et al., 2005). An EFA using a principal component analysis with varimax rotation was employed to determine whether the prospective outcome items would load on their conceptualised dimensions. A loading value of .50 was set as a cut-off because loadings above .50 were deemed even practically significant (Hair et al., 2005).

In Phase Two, a confirmatory factor analysis (CFA) was employed to examine the psychometric properties of a modified measurement model of cognitive learning outcomes, which was re-specified based on the previous EFA results. A new sample set ($n = 214$) was used. Kelloway (1998) suggested that at least a minimum sample size of 200 is needed for the operation of CFA. Overall goodness-of-fit, reliability, and construct validity (convergent and discriminant) of the measures were tested. For testing of the global fit, the researchers computed several indexes such as χ^2/df ratio, comparative fit index (CFI), normed fit index (NFI), incremental fit index (IFI), and root mean squared error of approximation (RMSEA). For testing of reliability and validity, the average variance extracted (AVE), standardised factor loadings, and correlations among the dimensions were computed.

In Phase Three, the second data set ($n = 214$) were reutilised. A structural equation modeling (SEM) incorporating the four constructs was employed to assess the hypothesised paths as well as the overall model fit in the structural model. All analyses employed in Phase Two and Three were performed using LISREL 8.8.

Results

Exploratory Factor Analysis for Perceived Cognitive Learning Outcomes

For the identification of the underlying factor structure of the cognitive learning outcome items, an EFA was employed in Phase One ($n = 129$). A preliminary test was conducted to screen individual observations and violation of the normality assumption. Descriptive statistics showed no outlier or invalid data. Skewness statistics ranging from -1.25 to 0.05 and kurtosis statistics ranging from -0.66 to 1.21 met the suggested cut-offs of ± 2.00 and ± 7.00 , respectively (West et al., 1995). The data distributions in the five dimensions were deemed normal. Internal consistency of the measures was tested using Cronbach's alphas and item-to-total correlations.

The reliability tests showed that all alpha coefficients for the five dimensions ranged from .79 to .88, satisfying the .70 cut-off (Hair et al., 2005). All corrected item-to-total correlation coefficients of the 15 items ranging from .52 to .82 were also higher than the .50 cut-off (Bearden et al., 1989).

For the exploratory factor analysis, a principal component solution with **varimax** rotation was used because the five factors were assumed to be uncorrelated conceptually. Any item having a factor loading less than .50 was not considered to be acceptable. Rather than the five-factor model, the principal component analysis suggested a four-factor model, accounting for 73.95% of the total variance with eigenvalues more than 1.00 (see Table 1). This was mainly due to lack of discrimination between specialist knowledge and outdoor skills components. According to Table 1, all items in specialist knowledge and outdoor skills were merged together on one factor, ranging from .55 to .84. In addition, one risk management item (rm1) loaded on both risk management ($\lambda = .53$) and team bonding ($\lambda = .60$). The other items in team bonding, application of learning, and risk management properly loaded on their proposed factors. Based on the EFA results, the researchers renamed the converged factor to ‘knowledge/skill acquisition’, including six items (ka1 to sa3) and removed one problematic risk management item (rm1) from the pool. Accordingly, the four-factor structure with 14 items was purified for the further measurement tests of the scale.

###Insert Table 1 around here###

Confirmatory Factor Analysis for Perceived Cognitive Learning Outcomes

The purpose of Phase Two ($n = 214$) was to test the psychometric properties of the four-dimensional model (e.g., overall goodness-of-fit, reliability, and validity) of the measures using a **CFA**. Descriptive statistics confirmed that there was no problematic observation. The skewness

and kurtosis values of the indicators were all within ± 2.00 and ± 7.00 , respectively (West et al., 1995; see Table 2). For the CFA, a maximum likelihood technique was utilised for assessment of the model fit and estimation of the parameters. First, the goodness-of-fit tests examining the overall adequacy of the model were conducted. The tests showed acceptable model fit to the data: $\chi^2(71) = 243.92$, $p < .10$, $\chi^2/df = 3.44$, NFI = .96, IFI = .97, CFI = .97, RMSEA = .10. Although the ratio of χ^2 statistic to the degrees of freedom was slightly higher than the 3.0 criterion (Kline, 1998), the other indexes met the suggested criteria of .90 for NFI, IFI, and CFI (Hair et al., 2005; Kline, 1998) and .10 for RMSEA (Steiger, 1990).

In terms of the adequacy of internal structural of the model, reliability and validity of the measures were assessed. Table 2 shows that AVEs ranged from .60 to .83; all values were above the .50 cut-off, showing evidence of reliability (Fornell & Larcker, 1981). To determine whether the measures of the specified dimensions were valid, the researchers tested convergent and discriminant validity. Convergent validity was assessed by factor loadings. When an indicator's loading is higher than .70, then its convergent validity can be achieved because it has more common variance captured by its factor than unique variance (Fornell & Larcker, 1981). All factor loadings reported in Table 2 were higher than .70, satisfying convergent validity. Lastly, discriminant validity was assessed by the correlation coefficients among the factor and the AVE scores. Fornell and Larcker (1981) also indicated that when an AVE value for a factor is higher than squared correlations between the factor and the other factors, the factor is discriminate. A range of correlations among the four factors was from .52 to .80 (a range of squared correlations was from .27 to .64). Among them, the correlation coefficient (.80) between knowledge/skill acquisition and application of learning seemed high. However, their squared correlation (.64) was still lower than the AVEs of the respective factors (.73 for knowledge/skill acquisition and .75

for application of learning). Thus, it was deemed that all factors were discriminate in the model.

In conclusion, the CFA confirmed that the four-dimensional model of cognitive learning outcomes provided good global and internal model fit to the data

####Insert Table 2 around here####

Structural Equation Modeling

Phase Three ($n = 214$) proceeded to test the four hypothetical causal relationships (H_1 to H_4) among quality of support resource, involvement, perceived cognitive learning outcomes, satisfaction, as well as the overall fit of the full latent variable model (see Figure 1). The SEM revealed that the goodness-of-fit in the structural model was adequate to represent the proposed relationships among the latent variables: $\chi^2(72) = 146.45.48, p < .01, \chi^2/df = 2.03, NFI = .97, IFI = .99, CFI = .99, RMSEA = .08$. Table 3 presents the standardised coefficient estimates implied by the structural model. For testing of H_1 and H_2 , the analysis showed the effects of quality of support resource ($\beta = .18$) and involvement with the camp ($\beta = .71$) on cognitive learning outcomes were significant at the .05 probability level. For testing of H_3 and H_4 , the test also supported that students' perceived cognitive learning outcomes ($\beta = .68$) and quality of support resource ($\beta = .26$) significantly influenced their overall satisfaction with the camp. The equation of the model indicated that 71% of the variance of satisfaction was directly (.26 for quality of support resource $\rightarrow$ satisfaction) and indirectly (.12 for quality of support resource $\rightarrow$ cognitive learning outcomes $\rightarrow$ satisfaction and .48 for involvement $\rightarrow$ cognitive learning outcomes $\rightarrow$ satisfaction) explained by its predictors.

####Insert Table 3 around here####

Discussion and Conclusions

Building on the earlier framework developed by Duque and Weeks (2010) in assessing cognitive learning outcomes in higher education, the present study extended their work by applying this concept in outdoor education. From the Singapore PE student teachers' view point, this research explored the effectiveness of outdoor education during their pre-service training by testing the proposed relationships among quality of support resources, involvement, cognitive learning outcomes of the learners, and satisfaction. In addition, the PETE version of the scale measuring cognitive learning outcomes (i.e., skill/knowledge, risk management, application to school, and team bonding) was conceptualised. Ho (2012) raised a question of whether adventure programmes which were developed in an individualist culture (e.g., USA, UK) would be still appropriate for a Singapore society where community and interdependence are more emphasised. Understanding Singapore students' perceptions about cognitive learning outcomes may help teacher educators evaluate the locally tailored curriculum, its design, and its delivery method. It is also believed that a comprehensive recognition of the relationships among different psychological domains within cognitive development outcomes may help develop more effective teaching strategies to benefit PE student teachers.

Our result suggests that quality of support resource is a key driver of both cognitive learning outcomes and satisfaction. In other words, the objectives of the outdoor education programme for PE student teachers, evaluations of service attributes of the programme, as well as how it is delivered is more likely to influence participants' satisfaction level. Drawing upon good practices from PE and sport (Camire & Trudel, 2010; Chelladurai, 2006; Koh et al., 2016), it is important to gather feedback from the participants (e.g., instructors, students) and review the programme quality regularly. Taking this small step would help promote relationship building, ensure that the programme is relevant in meeting learners' needs, which may in turn facilitate

greater involvement and commitment of the participants to the programme, and achieve higher satisfaction level (Koh et al., 2016; Kyle et al., 2007). To achieve this goal, the programme owner must work closely with established organisation (e.g., OBS) to co-create and deliver the tailored programme that will meet the specific needs of PE student teachers. In particular, the transfer of knowledge learned in outdoor camp to students in school upon graduation is likely to enhance learners' satisfaction level of the programme (Douglas et al., 2006). This indicates that the demand for PE teachers to be trained and equipped with the necessary skills and knowledge to deliver quality outdoor education programme is critical to the success of their careers. In addition, such **outdoor experience** could be "a powerful method in assisting student teachers to change their perceptions on teaching and learning and the way they, as teachers, should construct the physical education environment" (Carlson & McKenna, 2000, p. 24). The point here is to ensure that all stakeholders like the programme owners, service providers, and participants are actively engaged and involved in the whole process so as to achieve positive outcomes.

Another key finding from the present study revealed that involvement functions as a significant determinant of cognitive learning outcomes. Earlier studies have showed strong relationship between motivation and students' satisfaction in outdoor programmes (Wang et al., 2004; 2005) and academic learning (Duque & Week, 2010; Wiers-Jenssen et al., 2002). The key is to ensure that learners are fully engaged and involved in the programmes through purposeful planned activities that are aligned to learning outcomes of the programme and participants' needs. One main focus of the programme could be to create awareness and to form relationships with self (intrapersonal), with others (interpersonal), and the environment (ecological). Priest (1990) suggests that identification of the three forms of relationship will produce an environment which is conducive in learning and improve the quality of the programme. The proposed model also

recognises participants' involvement in the programme as a predictor of satisfaction with the programme experience. To enhance participants' involvement in the programme, perhaps various methods of instruction and learning options proposed by Drury et al. (2005) such as (a) student-centered learning (opposed to teacher-centered), (b) problem-centered learning (opposed to content-centered), (c) experiential learning (opposed to theoretical learning), and (d) collaborative learning (opposed to individual learning) might be useful to guide our practice. For example, using student-centered approach allows students to have greater autonomy to select and decide what activities they wish to participate and learn, leading to greater involvement. Using the experiential learning approach allows students to experience and discover knowledge through purposeful planned and engagement activities. Similarly several effective instructional methods were evidenced in the PETE course. For example, the land and sea expeditions provide trainees with various opportunities to allow them to interact and work together to overcome various challenges at group level. In sum, the variety of instructional methods provide greater options for the instructors to select and utilise appropriate methods to better engage and meet different learners' needs, which in turn may enhance service quality and increase satisfaction in the programme. Indeed, similar results have been reported in PE and sports literature whereby greater involvement and commitment of the athletes/students is likely to achieve higher level of satisfaction with the programme (Camire & Trudel, 2010; Koh et al., 2016).

Martin and Ho (2009) reviewed and compared the reports of outdoor education from Singapore to similar studies from Australia and New Zealand. They found that one important purpose of outdoor education should be to "build the knowledge and skills to enjoy, understand, respect, and learn from the natural environment" (p. 87). Rickinsson et al. (2004) highlighted that outdoor education can impact students' learning in many areas such as cognitive, affective,

1 social/interpersonal, physical, and behavioural domains. Particularly, students perceived that
2 adventure experiences in physical education programmes could enhance their physical fitness
3 and physical self-concept (Gehris et al., 2010). In Finland, the new trend in teaching focuses on
4 interactive teaching environments and learning out of school as a resource for teaching and
5 learning (Finnish National Board of Education, 2016). Taken together, the demands from
6 teachers required them to think beyond traditional subject orientated in teaching the **curricula** and
7 use 'phenomenon based learning' (e.g., natural environment) to achieve the **learning** objectives.
8 Our study only proposed four cognitive learning outcomes in outdoor education, which were
9 skill/knowledge, risk management, application to school, and team bonding. These domains may
10 not be able to address the general purpose of outdoor education programme. Future studies may
11 want to explore and test other domains of learning, for example, the relationship between
12 cognitive and affective learning (Manni et al., 2013) using mixed methods to advance our
13 knowledge.

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1 Table 1
2 *Principal Component Analysis with Varimax Rotation*

Measures for Cognitive Learning Outcomes	Pattern coefficient			
	Knowledge/ Skill	Team Bonding	Application of Learning	Risk Management
Through this camp, I had a chance to learn outdoor education (e.g., philosophy, foundations, theories, and models). (ka1)	.55	.27	.25	.24
Through this camp, I have acquired sufficient knowledge for outdoor education. (ka2)	.68	.15	.34	.16
The knowledge that I obtained was applicable to real camp experience. (ka3)	.73	.33	.32	.18
Through this camp, I have acquired sufficient skills for outdoor education. (sa1)	.68	.14	.35	.30
The skills that I learned were applicable to real camp experience. (sa2)	.84	.17	.19	.16
My basic camp craft skills have been enhanced during this camp. (sa3)	.75	.08	.05	.12
I am confident in facilitating an outdoor activity with school aged students. (as1)	.30	.15	.87	.14
I am confident in planning an outdoor activity for school aged students. (as2)	.25	.20	.83	.24
I found the expedition valuable in preparing myself to conduct future outdoor expeditions for students. (as3)	.36	.35	.59	.24
The camp allowed me to appreciate team bonding. (tb1)	.15	.77	.39	.03
I had a chance to appreciate the differences among people. (tb2)	.15	.88	.25	.09
The camp allowed me to learn how to resolve conflicts with others. (tb3)	.36	.66	-.10	.32
I can recognise the risks involved in outdoor activities. (rm1)	.19	.60	.14	.53
I can devise risk management plan for outdoor activities. (rm2)	.22	.23	.16	.85
I can take care of potential risks of outdoor activities with confidence. (rm3)	.32	.06	.31	.81
% of variance Explained	24.56	17.76	17.28	14.35
Eigenvalue	7.53	1.41	1.12	1.02

Note: Pattern coefficients larger than .50 are showed in bold face.

1 Table 2
 2 *Internal Structures of Student Perceived Cognitive Learning Outcomes*

Cognitive Learning Outcomes	Indicator	Skewness	Kurtosis	Loading	Mean	SD	AVE	α
Knowledge/skill acquisition					5.54	0.97	.73	.94
	ka1	-.81	.68	.75*				
	ka2	-.63	.26	.87*				
	ka3	-1.35	3.03	.90*				
	sa1	-.86	1.02	.89*				
	sa2	-1.34	3.44	.90*				
Risk management	sa3	-1.20	1.59	.80*				
					5.65	0.92	.83	.90
	rm2	-.61	.52	.88*				
Application of learning	rm3	-.52	.03	.94*				
					5.49	0.98	.75	.89
	as1	-.65	1.13	.90*				
	as2	-.55	.92	.92*				
Team bonding	as3	-1.21	2.38	.77*				
					5.96	0.85	.60	.79
	tb1	-1.30	2.22	.78*				
	tb2	-.85	.59	.77*				
	tb3	-.88	.80	.77*				

3 *Significant at the .05 probability level

4

1 Table 3

2 *A Summary for Direct and Indirect Effects of Quality of Support and Involvement on Satisfaction*

Hypothesis	Exogenous Variable	Endogenous Variable	Coefficient	t-value
H ₁	Quality of Support Resource	Cognitive Learning Outcomes	.18	2.62*
H ₂	Involvement	Cognitive Learning Outcomes	.71	9.38*
H ₃	Cognitive Outcomes	Satisfaction	.68	10.90*
H ₄	Quality of Support Resource	Satisfaction	.26	4.35*

3 *Significant at the .05 probability level