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Place- and activity-related antecedents of challenge perception in adventure tourism

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ABSTRACT

This study developed a formation model of challenge perception for adventure tourists by considering site conditions and activity attributes. Data were collected from tourists who participated in high-altitude mountaineering, scuba diving, and whitewater rafting activities by using a self-administered questionnaire. Responses were analyzed using structural equation modeling and the findings demonstrated that the site-related antecedents (i.e., site wilderness and site difficulty) and the activity-related antecedents (i.e., skill utilization, demands, and interaction) positively affected the tourists' perceptions of challenge, whereas personal factors exhibited negative effects. This study contributes to tourism literature by including place- and activity-related factors as antecedent variables of perceived challenge and quantifying their influences on challenge perception among adventure tourists. Implications and future research directions are provided.

Management implications

- Understanding the factors that increase perceived challenge could aid in planning recreation sites and activities.
- Recreation managers should preserve the wilderness of recreation sites and expand the opportunities for tourists to interact with wilderness environments in a safe manner.
- Recreation organizations should design tours with various levels of challenge to ensure that all tourists can be challenged.
- Organizations should estimate the required skill levels, physical and mental demands, and frequency of interaction with peers when designing activities for tourists.
- Offering activity-related information can assist tourists in selecting the most suitable tour that can provide them a challenging experience.

1. Introduction

Adventure tourism can be challenging (Schmidt & Little, 2007). Challenge perception refers to an individual's perception of using their abilities to the fullest in an activity and the feelings of excitement and involvement (Tsaur, Lin, & Cheng, 2015). Adventure tourism encompasses various adventure activities that are participated in for fun, and it now forms a thriving part of the tourism industry as a whole (Hansen, Rogers, Fyall, Spyriadis, & Brander-Brown, 2019; Sand & Gross, 2019). Adventure activities are arranged outdoors and involve participants intentionally pursuing challenges and excitement while interacting with nature (Houge-Mackenzie & Hodge, 2020; Nelson, 2015). Studies on wilderness and high-risk recreation have demonstrated that adventure tourists consider challenging experiences to be one of their primary motivators (Houge-Mackenzie & Hodge, 2020; Pomfret, 2019). Adventure tourism provides challenges for tourists to seek out.

Challenge plays a crucial role in activity experiences and is determined by stress estimation made on the basis of an assessment between a person and their environment from a social psychological perspective (Lazarus & Folkman, 1984). The "flow experience" proposed by Csikszentmihalyi (1975) is a state in which an individual's perception of challenge accords with their perceived personal skills. Challenges increase the burden on an individual's resources but can also lead to personal growth (Ventura, Salanova, & Llorens, 2015). Studies have demonstrated that participating in adventure tourism is beneficial for promoting flow experiences (Ayazlar & Yüksel, 2018; Pomfret, 2019).

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The perception of challenge can trigger spiritual experiences and reduce boredom (Schmidt & Little, 2007; Vodanovich & Watt, 2016). Tsaur et al. (2015) confirmed that a challenge can positively affect adventure recreationists' psychological well-being, satisfaction, and flow experiences.

Several studies on leisure (Alonso, Alexander, & O'Brien, 2018), workplace (Al-Asfour, Tlaiss, Khan, & Rajasekar, 2017), and education (Strati, Schmidt, & Maier, 2017) have discussed the factors that create the perception of a challenge. Adventure tourism researchers have reported that perception of a challenge is closely correlated with the activities in which tourists participate as well as the sites of these activities (Jones, Hollenhorst, & Perna, 2003; Tsaur, Lin, & Liu, 2013; Wu & Liang, 2011). However, empirical studies have yet to identify the factors that pose challenges for tourists (Tsaur et al., 2015). Accordingly, this study was inspired by the following research question: How do site- and activity-related factors affect challenge perception among adventure tourists? To answer this question, the purpose of this study was to investigate the effects of site- and activity-related antecedents on challenge perception among adventure tourists. From an academic perspective, verifying the causes of perceived challenges could elaborate on existing theories. For tourism managers, understanding the factors that result in challenges can help them plan sites and activities with the appropriate level of challenge in experiencescape management.

2. Literature review

2.1. Definition of challenge

Stress appraisal theory of Lazarus and Folkman (1984) stipulates that a challenge arises after stress evaluation. Stress itself affects well-being because it is taxing on an individual's personal resources. According to stress appraisal theory, individuals adopt an appraisal process to determine whether a stressful event is a threat or challenge (Lazarus & Folkman, 1984). Threats harm individuals or elicit negative emotions, whereas challenges facilitate the mastery of skills and personal growth (LePine, Podsakoff, & LePine, 2005). When the individual values stressful situations because they perceive it as an opportunity for self-growth and they can identify available adjusting strategies, stress will transform into challenge perception (Drach-Zahavy & Erez, 2002). Challenges typically exist in stressful conditions (Gerich, 2017) that can motivate a person to solve problems, develop personal competence, and adapt to situations (Brendtro & Strother, 2007). Perceiving stressful conditions as challenges can increase the sense of control an individual possesses over a specific situation, by increasing or maintaining their level of arousal, acuity, and confidence (Anshel, 2001). Therefore, people benefit from the experience of overcoming a stressful situation when they face a challenge.

Challenge has also been defined from numerous perspectives in leisure and tourism. Wu and Liang (2011) defined a challenge in the context of activity characteristics as an activity's complexity based on flow theory. Concordantly, challenge in flow theory emphasizes the "challenge of activities". In flow channel models, the construct of flow is conceptualized as a state of affairs where one's challenges are congruent with one's skills (Csikszentmihalyi, 1975). According to the four-channel model (Csikszentmihalyi & Csikszentmihalyi, 1988), flow is when such congruence occur at a high level. However, the majority of studies have used personal experiences to define a challenge as an individual's desire to reach beyond their limits and participate in a novel and thrilling recreational experience (Barnett, 2005; Caldwell, Smith, & Weissinger, 1992). Challenge is also related to self-efficacy (Bandura, 1997). Specifically, individuals with high self-efficacy can master challenges, are willing to accept difficult activities, and do not consider challenges as a threat to avoid (Widmer, Duerden, & Taniguchi, 2014). Rather than flow theory, which defines challenge based on activity. The present study was based on stress appraisal theory (Lazarus & Folkman, 1984), which defines challenge based on an individual's evaluation of an activity. The degree of challenge perception is dependent on individuals' evaluation of the external environment and their internal resources. Therefore, challenge perception in this study was defined as tourists' perception of the fulfillment of personal capabilities in activities as well as involvement and excitement.

2.2. Sources of challenges in adventure tourism

Adventure tourism can include many challenging situations, such as rough trails and rapid currents, exacerbated by insufficient personal experience, wet equipment, and competition (Csikszentmihalyi, 1990; Jones et al., 2003; Pomfret & Bramwell, 2016). Furthermore, challenges can be either physical or mental, push participants' physical abilities and emotions, and require that technical skills be performed in a state of physical exertion (Schmidt & Little, 2007). However, few studies have examined the possible sources of challenge in adventure tourism. Intrapersonal factors arise from the interaction between situations and an individual's resources. A challenging experience can result from insufficient competence or skill (Barnett, 2005; Lepp, 2018). Weber (2001) argued that a first-time tourist to Rome would perceive the trip to be more challenging and risky than experienced mountaineers would consider their fiftieth journey to the Himalayas. Priest (1992) proposed the Adventure Experience Paradigm, which states that challenges are correlated with personal competence and that participants try to gauge the inherent risks according to their competence. For instance, the knowledge and skills canoeists possess affect their perception of challenge (Wu & Liang, 2011). Thus, personal factors, such as competence, skills, knowledge, and experience, affect an individual's perception of challenge.

People who participate together in a recreation activity can be called "partners," and they can have either a competitive or a cooperative relationship. Partnership is a source of challenge (Csikszentmihalyi, 1990). Partners can be friends, team members, or strangers. The natural environment and set of adventure activities pose numerous challenges that may cause physical injury or psychological pressure, and participants must cooperate to overcome them (Houge-Mackenzie & Brymer, 2020). For scuba diving or high-altitude mountaineering, a lack of teamwork can make the activities more challenging, and team members' lack of experience or skill may also increase the difficulty of physical challenges (Tsaur et al., 2013). Additionally, the group's interdependence can make an outdoor adventure program more challenging (Bunting, Tolson, Kuhn, Suarez, & Williams, 2000). Competing with a more competent or evenly matched peer can be challenging (Ali-Haapala, Moyle, & Kerr, 2019). For instance, rafters will experience psychosocial challenges when paddling independently on white-water rapids while their peers watch, but joining a partner may lead to additional challenges (Bunting et al., 2000). Additional challenges may emerge because teammates in the same boat must negotiate and collaborate to succeed. Therefore, adventure activities require team members to work together to overcome challenges, and close communication and coordination are necessary before and during the activities (Decloe, Kaczynski, & Havitz, 2009).

In addition to the aforementioned intrapersonal and interpersonal factors, adventure tourists and adventure tourism activities are affected by two key antecedents of challenge: activity-related and place-related factors. These factors are as follows.

2.2.1. Activity-related factors

Different adventure activities have different skill, knowledge, and equipment requirements. These activities often require high degrees of skill utilization, interaction, variety, pressure, and autonomy (Kabanoff & O'Brien, 1980). An activity's attributes determine a tourist's perception of challenge. *A priori* assumptions would suggest that more challenging activities would result in greater stress, caused by a lack of the skills or capacities required. On this basis, rock climbing would be considered more of a challenge than jogging because of the differences

in these two activities' attributes. Therefore, we propose that the attributes associated with an adventure activity were the determinant factors of perception of challenge.

2.2.2. Place-related factors

Location can influence tourists' perceived level of challenge. According to Ford and Blanchard (1993), the pursuit of adventure is entwined with an individual's relationship with the environment. Csikszentmihalyi (1975) also asserted that a different environment can affect a person's perception of challenge and performance. Moneta and Csikszentmihalyi's (1996) findings indicated that the hazardousness of a location can alter challenge perceptions. Before participating in a scuba diving activity, participants must have a clear understanding of the site conditions of the diving area (Neto, Lohmann, Scott, & Dimmock, 2017). Mountain climbing, performed in remote locations, is considered a challenging, high-risk activity (Beedie & Hudson, 2003). To overcome challenges, alpine climbers must master all potential risk factors when in a high-altitude environment (Crockett, Murray, & Kime, 2020). Jones et al. (2003) demonstrated that during whitewater rafting, the rafters' challenge perceptions varied based on the difficulty level of the site. Furthermore, changes in climate may have an effect on the comfort and enjoyment of tourists, thereby increasing the difficulty of an activity (Bristow & Jenkins, 2018). These findings suggest that the location of a recreation site can be considered a source of challenge.

3. Conceptual model and hypotheses

This study investigated how the perceived challenge in adventure tourism was affected by the recreation site and activity. The antecedents of perceived challenge regarding recreation sites include the perceived wilderness and difficulty levels of the site (Lee, Graefe, & Li, 2007). The antecedents of perceived challenge regarding activities include the required skill utilization, demands, and interaction of the activity (Kabanoff & O'Brien, 1980). To elucidate the connections between these antecedents and perceived challenge, this study employed familiarity and personal skill and experience as two control variables because personal factors may also affect the perception of challenge. Fig. 1 displays the conceptual model of the study.

3.1. Site-related antecedents of challenge: wilderness and difficulty

Goodrich (1977) defined setting attributes as the characteristics of a recreation site. Recreation sites can be defined by a combination of natural, social, and managerial characteristics (McCool, Stankey, & Clark, 1984). Lee et al. (2007) categorized site attributes into seven factors: facility, social skill, wilderness, convenience, difficulty, safety, and new site. They noted that tourists with more specialized skills tended to engage in challenges and favor activities located at wild and difficult sites. Wilderness and difficulty are more challenging than other attributes for tourists (Caber & Albayrak, 2016). Therefore, the present study adopted site wilderness and difficulty as the antecedents of challenge perception.

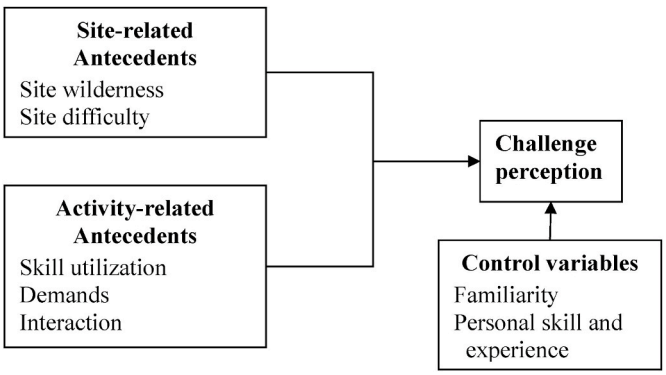

Fig. 1. Conceptual model.

McDonald, Wearing, and Ponting (2009) defined wilderness as vast uninhabited areas containing native animals and plants that are relatively unaffected by human society. Wilderness areas are remote without permanent artificial structures or objects. These areas frequently prohibit the use of mechanical transport such as motor vehicles. Lee et al. (2007) reported that several rafting sites can be considered remote wilderness areas because they are far from human settlements and feature clean water and an unpolluted environment. A wilderness environment provides opportunities for personal growth from facing and conquering physical and mental challenges (Lai, Hsu, & Wearing, 2016). Furthermore, traveling or camping in wilderness recreation areas requires reliance on personal skills rather than facilities or external assistance (Roggenbuck, 2004). Thus, the wilder a site is, the more skills tourists require.

Difficulty refers to situations that place greater demands on an individual (Orvis, Horn, & Belanich, 2008). Lee et al. (2007) investigated site difficulty in rafting, which is caused by the numerous rocks in the river and the large volume of water. Higher levels of difficulty at the whitewater rafting site led to a greater challenge perceived by the rafters (Jones et al., 2003). Van Velsor and McCauley (2004) proposed that individuals perceive challenges in situations where the required skills, knowledge, or behavior exceeded their ability; high-difficulty sites required more skill and attention from tourists, and this produced the perception of challenge. Denisova, Cairns, Guckelsberger, and Zendle (2020) indicated that in digital games the difficulty increases with time, and thus players can improve and acquire related skills. If the increase in game difficulty accords with the enhancement of players' skills and abilities, challenge perception should be maintained. Accordingly, the following hypotheses were proposed:

Hypothesis 1. Higher site wilderness leads to a higher level of challenge perception.

Hypothesis 2. Higher site difficulty leads to a higher level of challenge perception.

3.2. Activity-related antecedents of challenge: skill utilization, demands, and interaction

Task-attribute analyses can objectively describe and measure personal leisure behaviors (Kabanoff & O'Brien, 1980). O'Brien (1981) reported that leisure attributes have a positive correlation with retirement satisfaction. Studies have revealed that various leisure attributes lead to different levels of challenge (Delespaul, Reis, & deVries, 2004; Kleiber, Larson, & Csikszentmihalyi, 1986). Studies related to leisure motivations and experiences have characterized challenges as novel stimuli that encourage people to expand their personal limits. Participants who possess a high intrinsic motivation favor activities that slightly exceed their capabilities (Barnett, 2005; Houge-Mackenzie & Hodge, 2020). For instance, the challenge of reading or participating in a sporting activity is greater than that of listening to the radio or watching TV (Delespaul et al., 2004).

Kabanoff and O'Brien (1980) defined skill utilization, a leisure attribute, as the extent to which an individual uses their personal skills and capacities to engage in an activity. Adventure tourism generally requires using highly specialized skills. Pomfret (2006) proposed that mountaineering requires various skills, such as scrambling, rope knotting, ice axing, and navigation. Rafters' skills and capabilities also affect their perceptions of challenges (Wu & Liang, 2011). Therefore, if an activity requires adventure tourists to use their personal skills and capacities more frequently, they are likely to perceive it as more challenging.

Demands refer to the physical and mental effort caused by expectations, role requirements, and norms (Voydanoff, 2004). Task demands

refer to the amount of physical or mental effort an individual must exert to complete a task (Kabanoff & O'Brien, 1980). According to the theory of challenge, the demands of a situation, including the amount of effort required, can influence the level of perceived challenge (Mendes, Blascovich, Major, & Seery, 2001). Studies on challenges in a job or learning environment have confirmed that demands lead to higher personal perceptions of challenge (Boivin, Bunting, Koert, Ieng, & Verhaak, 2017; Boswell, Olson-Buchanan, & LePine, 2004). Adventure tourism activities generally involve high risks and require specific skills and physical strength (Wang, Liu-Lastres, Ritchie, & Pan, 2019; Wilks & Page, 2003). Beedie and Hudson (2003) reported that participation in mountain adventure activities was physically demanding. Therefore, adventure activities involving more demands lead to a higher challenge perception because participants are required to demonstrate their capabilities and to concentrate on the activity.

Interaction refers to the degree to which any activity involves other individuals (Kabanoff & O'Brien, 1980). Competing with a peer is a factor that generally constitutes a challenge (Ali-Haapala et al., 2019). However, both cooperative and competitive relationships with partners can lead to a personal perception of challenge. When cooperation among peers is required to achieve a goal, participants may perceive challenges because of the increasing complexity of the task. As Decloe et al. (2009) revealed that adventure tourists working in co-partnership perceived higher levels of challenge than those working individually because efficient cooperation requires communication and negotiation, and cooperative activity tends to be more complex. A higher level of interaction in adventure tourism requires more personal effort in collaboration, which increases the challenge perceived by tourists. The following hypotheses were thus proposed:

Hypothesis 3. Activities requiring a relatively high level of skill utilization lead to a relatively high level of challenge perception.

Hypothesis 4. Activities requiring a relatively high level of demand lead to a relatively high level of challenge perception.

Hypothesis 5. Activities requiring a relatively high level of peer interaction lead to a relatively high level of challenge perception.

4. Methodology

Research has provided a clear operational definition and measurement of challenge perception (Tsaur et al., 2015), which may involve subjectivity and emotion. Constructs are required for theory construction because causal relationships can be determined. In this study, the nature of the research problem focus on establishing a theory of knowledge based on the casual relationship. Therefore, epistemology is relevant to quantitative methodology.

4.1. Sample design and data collection

Swarbrooke, Beard, Leckie, and Pomfret (2003) posited a continuum ranging from soft to hard activities. Soft activities refer to those with negligible actual risks but some perceived risk. Such activities, which include scuba diving and whitewater rafting, are taught by experienced coaches (Mu & Nepal, 2016; UNWTO, 2014). Hard adventure activities refer to those with high perceived risks and high actual risks that require intense commitment and high levels of skill (Mu & Nepal, 2016), such as high-altitude mountaineering (Pomfret, 2006). To generalize the research findings to other adventure activities and increase this study's external validity, we selected both soft adventure activities and hard adventure activities, which can be performed in both land-based and water-based environments. Participants were tourists who engaged in three types of adventure tourism: whitewater rafting, scuba diving, and high-altitude mountaineering (Bentley, Page, & Laird, 2001). These three types of adventure activities are tourism commodities. Scuba diving and whitewater rafting are guided by experienced coaches, and high-altitude mountaineering is a self-administered or teamwork activity for hikers. All three activities are suitable for all skill levels, whether beginners or experienced participants. Data were combined for analysis to ensure that the results could be generalized to other activities.

4.1.1. Scuba diving

As an island nation, Taiwan is surrounded by ocean, making it suitable for scuba diving activities. Kenting National Park, located in Southern Taiwan, is one of the most popular areas for both foreign and domestic divers to visit on the Taiwanese coast. It is known for its abundance of marine resources (Kenting National Park, 2020). However, even for experienced divers, people unfamiliar with the sea conditions around Kenting should rely on the guidance of local tour guides when performing diving activities. A field investigation was conducted at Houbihu, which is a popular location for diving activities in Kenting National Park.

4.1.2. High-altitude mountaineering

Yushan (also known as Jade Mountain) is situated in Yushan National Park, Taiwan, and reaches a height of 3952 m, which is the highest peak in Northeast Asia (Yushan National Park, 2020). Climbing Yushan is a popular activity for mountaineers from all over the world. The mountain attracts 40,000 to 50,000 tourists a year. Mountaineers who intend to climb Yushan can undertake solo expeditions or group expeditions organized by mountaineering associations. Reaching the summit of Yushan requires at least 2 days, with a minimum of 10 h of hiking a day, and thus requiring that tourists possess both endurance and mountaineering skills.

4.1.3. Whitewater rafting

Taiwan's first and most popular whitewater rafting site for tourists is located on the Xiuguluan River in Hualien County. Based on the American Whitewater Affiliation's difficulty rating, the Tourism Bureau of Taiwan rates the Xiuguluan River as Class II (Wet Plant Whitewater, 2020). Tourists cannot raft by themselves at the site due to safety concerns and must be in tour groups with a licensed lifeguard. The total rafting time is 4–5 h, with rushing streams along the route. Whitewater rafting requires physical strength.

We conducted a questionnaire survey of domestic tourists in Taiwan to determine their level of participation in the three aforementioned adventure tourism activities; the questionnaire was written in traditional Chinese. Convenience sampling was performed by administering questionnaires. The researchers waited at activity venues and invited adventure tourists to participate in the questionnaire survey immediately after an activity had ended. Each respondent required approximately 10 min to complete the questionnaire. Moreover, only one person per group was approached to complete the survey to avoid sampling errors because of high homogeneity. Interviewers focused on the group member they first encountered, invited them to fill in the questionnaire, and eliminated their partners by inquiry. We distributed 1050 questionnaires, of which 995 were returned. After discarding 46 incomplete questionnaires, 949 valid responses were collected. The numbers of questionnaires for the three types of adventure activities were 326 for scuba diving, 302 for high-altitude mountaineering, and 321 for whitewater rafting.

4.2. Measurement

Challenge perception was measured based on the five items of challenge scale from Tsaur et al. (2015). Site wilderness and site difficulty were used to measure the subdimensions of the site attributes based on Lee et al. (2007). The evaluation items were adapted from Lee et al. (2007) to make them applicable to the three types of adventure tourism because they were originally designed for rafting only. Skill utilization, demands, and interaction were derived from the leisure attributes proposed by Kabanoff and O'Brien (1980). Two evaluation

items were used for each construct. For each item, participants indicated their degrees of agreement using a 5-point Likert scale, with the corresponding anchors ranging from *strongly disagree* (1) to *strongly agree* (5).

To clarify the relationship between the predictor variable and challenge, this study controlled for the influence of personal factors on the perception of challenge, including familiarity and personal skill and experience. Familiarity, which was proposed by Baloglu (2001), comprises experience familiarity, information familiarity, and self-evaluation familiarity. These concepts were applied to develop three evaluation items. A 5-point Likert scale was adopted with anchors ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). A higher score indicated stronger agreement with a questionnaire item. Personal skill and experience were assessed through self-reported skill level and time (in years) spent engaging in the activity, respectively (Lee et al., 2007). Participants' self-reported skill level was selected from one of four levels: *beginner* (1), *intermediate* (2), *advanced* (3), or *professional* (4). Participants' personal experience was assessed based on their report of the number of years they had been engaging in the activity. In this study, the scores of the two measures were standardized using z scores. The personal skill and experience composite score for a participant was calculated as the average of the z scores of the two measures. To test the hypotheses, all items of the eight constructs were standardized for further analysis.

5. Results

5.1. Respondent characteristics

The majority of respondents were men (69%). The most common age group was 26–35 years (38.1%), and 77.5% were college or university educated. The most common occupation was students (22%), followed by professional workers such as engineers, doctors, or lawyers (18.1%). Overall, the sample characteristics in this study were similar to those in previous adventure tourism studies (Tsaur et al., 2015; Wu & Liang, 2011).

5.2. Measurement model

A measurement model based on Anderson and Gerbing's (1988) two-step approach was tested before examining the established structural model. Confirmatory factor analysis was performed to investigate the model's reliability and validity. The measurement model, including all the constructs, is presented in Table 1. The following goodness-of-fit parameters were adopted: χ^2/df ($df = 202$) = 3.24, goodness-of-fit index (GFI) = 0.94, root mean square error of approximation (RMSEA) = 0.05, standardized root mean square residual (SRMR) = 0.04, comparative fit index (CFI) = 0.99, and normed fit index (NFI) = 0.98. The derived t values for the factor loading of all the measurement items exhibited significance ($p < 0.01$), indicating the acceptability of the measurement model (Hair, Black, Babin, & Anderson, 2010).

The confirmatory factor analysis results indicated that one item from site wilderness and one item from familiarity presented factor loadings of less than 0.5, and thus were excluded (Hair et al., 2010). The remaining items (Table 1) were determined to be significant ($p < 0.01$), with the corresponding coefficients ranging from 0.63 to 0.94. According to the reliability test results, the composite reliability (CR) values of the eight constructs ranged from 0.78 to 0.89, and all values exceeded the requisite minimum of 0.7 (Hair et al., 2010). The Cronbach's alpha values of all variables were between 0.77 and 0.88, and all values were greater than 0.7 (Nunnally, 1978), indicating that the questionnaire had acceptable reliability. Moreover, for each measurement, the average variance extracted (AVE) ranged from 0.55 to 0.78, which was higher than the recommended 0.50 (Bagozzi & Yi, 1988). These values indicate that, for all constructs, the convergent validity were acceptable. Table 2 illustrates that the square root of the AVE for each construct was higher than the correlation coefficients of the corresponding inner constructs, thus confirming discriminant validity (Fornel & Larcker, 1981).

5.3. ANOVA analysis

In this study, we conducted a statistical analysis for differences in

Table 1
Confirmatory factor analysis of the constructs and items.

Constructs and items	Mean	SD	Factor loading	t-value	AVE	CR	Cronbach's alpha
Challenge perception					0.58	0.87	0.87
I can amply use my personal abilities.	3.86	0.82	0.72	24.73			
I need to involve in the activity with full attention.	3.91	0.83	0.77	26.84			
I am willing to accept the possible uncertainty.	3.95	0.82	0.73	25.00			
I feel challenging.	3.85	0.90	0.80	28.82			
I perceive novelty and excitement.	3.96	0.90	0.78	27.77			
Site wilderness					0.66	0.89	0.88
The site has wilderness feature and nature scenery.	3.87	0.92	0.83	30.12			
The site seems close to wilderness.	3.68	0.99	0.84	31.07			
The site is in a remote area and far away from people.	3.50	1.11	0.80	28.47			
The site is clear and unpolluted.	3.60	1.01	0.78	27.56			
Site difficulty					0.55	0.83	0.83
The site has a lot of obstacles.	3.64	0.93	0.80	27.89			
The site has hostile terrain.	3.53	0.91	0.80	27.95			
The site has unpredictability.	3.18	0.91	0.63	20.43			
The site has inherent difficulties.	3.23	0.93	0.71	23.54			
Skill utilization					0.78	0.87	0.87
The activity requires high levels of skill use.	3.53	0.82	0.82	26.21			
The activity requires high levels of ability exertion.	3.64	0.80	0.94	30.44			
Demands					0.76	0.86	0.87
The activity requires a lot of physical strength.	3.71	0.88	0.88	27.05			
The activity requires a lot of mental strength.	3.81	0.89	0.86	26.44			
Interaction					0.71	0.83	0.83
The activity requires cooperation with partners.	3.98	0.88	0.84	26.08			
The activity supplies opportunities for me to interact with partners or the coach.	3.92	0.83	0.84	26.04			
Familiarity					0.77	0.87	0.87
I often engage in the activity here.	2.55	1.14	0.87	28.29			
I consider myself being familiar with the environment.	2.52	1.12	0.88	28.79			
Personal skill and experience					0.65	0.78	0.77
The number of years engaging in the activity.	2.09	0.99	0.72	21.01			
The self-reported skill level.	6.59	6.51	0.88	25.07			

Table 2
Correlations between the constructs.

Construct	Mean	SD	CP	SW	SD	SU	DE	IN	FA	PSE
CP	3.90	0.70	***0.76***							
SW	3.66	0.87	0.57**	***0.81***						
SD	3.39	0.75	0.58**	0.54**	***0.74***					
SU	3.58	0.76	0.35**	0.19**	0.25**	***0.88***				
DE	3.76	0.83	0.39**	0.25**	0.28**	0.27**	***0.87***			
IN	3.95	0.79	0.47**	0.30**	0.29**	0.25**	0.29**	***0.84***		
FA	2.53	1.06	−0.37**	−0.36**	−0.29**	0.06	−0.21**	−0.28**	***0.88***	
PSE	0.00	0.90	−0.35**	−0.35**	−0.28**	0.09**	−0.22**	−0.24**	0.39**	***0.81***

Notes: [1] CP = challenge perception; SW = site wilderness; SD = site difficulty; SU = skill utilization; DE = demands; IN = interaction; FA = familiarity; PSE = personal skill and experience.
[2] Diagonal elements are the squared roots of the average variance extracted. Off-diagonal elements are the correlations between the constructs (**$p < 0.01$).

challenge perception, site-related factors, activity-related factors, and control variables between the three types of adventure tourists. The analyses of variance (ANOVA) results (Table 3) revealed no significant difference in challenge perception between the groups. Tourists' perceptions of the three types of adventure activities differed significantly with respect to site-, activity-, and control variables. In summary, the site wilderness and difficulty of scuba diving were lower than those of other the activities. Participants were more professional, experienced, and familiar with this activity. The site wilderness and difficulty were higher for high-altitude mountaineering, and participation in this activity presented higher demands than the other activities did. The environment for whitewater rafting is wild and difficult, and participation in this activity required less skill than the other activities did. A total of 10 people were in one boat during whitewater rafting. Therefore, this activity was more interactive than the other activities, and the participants were mostly inexperienced beginners.

5.4. Structural model

To test the hypotheses, a maximum likelihood was estimated using the software LISREL 8 (Jöreskog & Sörbom, 1993). The derived GFI values of the final estimated structural model are presented in Fig. 2. The structural model was determined to fit the data well, as indicated by $\chi^2 = 654.74$, df = 202, $\chi^2/df = 3.24$, GFI = 0.94, RMSEA = 0.05, SRMR = 0.04, CFI = 0.99, and NFI = 0.98 (Jöreskog & Sörbom, 1993). When challenge perception was significantly and negatively affected by the two control variables familiarity ($\gamma = -0.09, p < 0.01$) and personal skill and experience ($\gamma = -0.12, p < 0.01$), whereas site wilderness ($\gamma = 0.24$, $p < 0.01$), and site difficulty ($\gamma = 0.29$, $p < 0.01$) significantly and positively affected challenge perception, which supported Hypotheses 1 and 2. Furthermore, activity-related skill utilization ($\gamma = 0.17, p < 0.01$), demands ($\gamma = 0.12, p < 0.01$), and interaction ($\gamma = 0.21, p < 0.01$) had significant positive effects on the tourists' challenge perceptions, which supported Hypotheses 3, 4, and 5.

6. Discussion and conclusions

The purpose of this research was to examine the place- and activity-related antecedents of adventure tourists' challenge perception. Three types of adventure activities, namely scuba diving, high-altitude mountaineering, and whitewater rafting, were analyzed together to ensure generalizability. Findings suggested that higher site wilderness and site difficulty lead to higher challenge perception. Moreover, activities requiring high levels of skill, demand, and interaction resulted in high levels of challenge perception. This responds to the recommendation of Tsaur et al. (2015) to verify the effects of site- and activity-related factors on tourists' challenge perceptions from adventure tourism activities. Focusing on the context of adventure tourism, this empirical study revealed that site- and activity-related factors are crucial antecedents to challenge perception among adventure tourists.

The results indicated the perceived challenge was higher at the wilderness site. For instance, mountain hiking in wilderness sites, which

Table 3
ANOVA results.

Constructs	Adventure activities	Mean	SD	*F-value*	*P-value*	Scheffé Test
Challenge perception	1.Scuba diving	3.88	0.70	0.65	0.52	–
	2.High-altitude mountaineering	3.90	0.76			
	3.Whitewater rafting	3.94	0.63			
Site wilderness	1.Scuba diving	3.03	0.74	183.17	0.00	2 > 1
	2.High-altitude mountaineering	4.00	0.82			3 > 1
	3.Whitewater rafting	3.98	0.66			
Site difficulty	1.Scuba diving	3.16	0.68	35.72	0.00	2 > 1
	2.High-altitude mountaineering	3.65	0.81			3 > 1
	3.Whitewater rafting	3.39	0.67			2 > 3
Skill utilization	1.Scuba diving	3.69	0.74	29.07	0.00	1 > 3
	2.High-altitude mountaineering	3.74	0.72			2 > 3
	3.Whitewater rafting	3.33	0.76			
Demands	1.Scuba diving	3.63	0.76	10.59	0.00	2 > 1
	2.High-altitude mountaineering	3.93	0.85			2 > 3
	3.Whitewater rafting	3.73	0.87			
Interaction	1.Scuba diving	3.93	0.81	8.73	0.00	3 > 1
	2.High-altitude mountaineering	3.82	0.85			3 > 2
	3.Whitewater rafting	4.08	0.67			
Familiarity	1.Scuba diving	2.85	1.28	23.91	0.00	1 > 2
	2.High-altitude mountaineering	2.34	0.87			1 > 3
	3.Whitewater rafting	2.38	0.90			
Personal skill and experience	1.Scuba diving	0.47	0.93	105.73	0.00	1 > 2
	2.High-altitude mountaineering	−0.02	0.83			1 > 3
	3.Whitewater rafting	−0.46	0.67			2 > 3

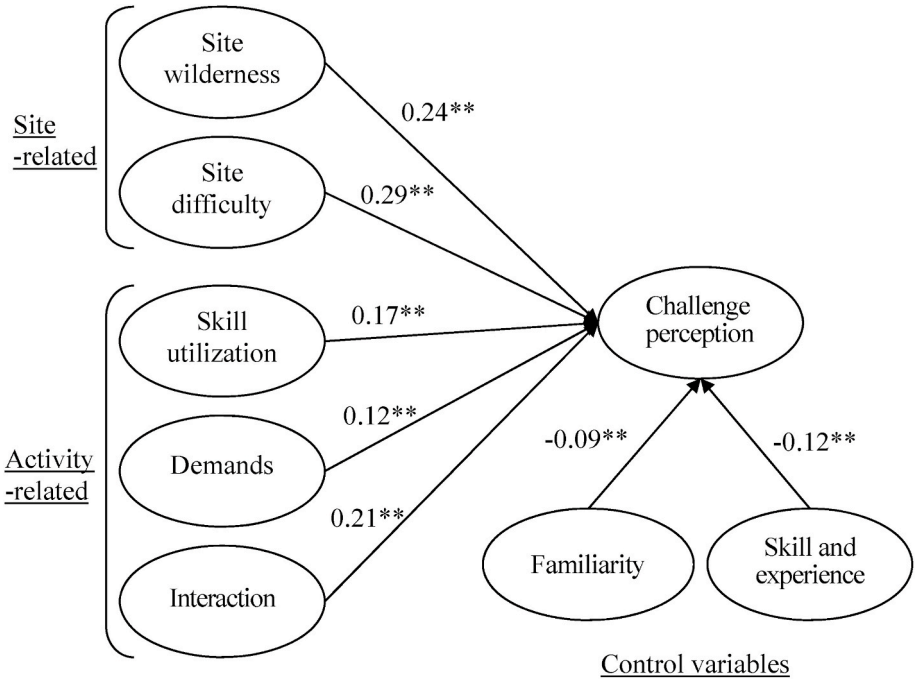

Fig. 2. Path analysis of the structural equation model.

are primitive environments that lack human-made facilities and services, impelled hikers to rely on their own capabilities, which increased challenge perception. By contrast, hiking areas with a lot of tourists and manmade facilities reduced hikers' perceptions of novelty and challenge. Many previous studies have proposed wilderness challenge programs and wilderness adventure therapy, in consideration of activity participation (Bettmann, Gillis, Speelman, Parry, & Case, 2016; McIver, Senior, & Francis, 2018). Participation in adventure activities in wilderness environments can enhance participants' challenge perception. Therefore, our finding that site wilderness enhances tourists' challenge perception in adventure tourism activities is consistent with the findings of previous studies (Bettmann et al., 2016; McIver et al., 2018).

The same principle applied to dive sites. These findings also indicated that highly difficult sites increased tourists' perceived challenge. A highly difficult rafting site possesses features such as numerous rocks, large volumes of water, and rushing currents. Rafters at such a site had to focus more and fully exert their capabilities when passing through difficult areas; therefore, a higher perceived challenge was reported. By contrast, rafters perceived a lower level of challenge at less difficult sites, such as sites with a broad riverbed and steady currents without strong stimuli. For mountain hiking, a highly difficult site with cliffy, rough trails and several steeps was more challenging and stimulating for hikers, whereas even trails caused hikers to perceive less challenge. Tsaur et al. (2013) investigated the source of challenge for adventure tourists and found environmental uncertainty to be the primary source among seven sources. Among these sources, inherent difficulties, hostile terrain, and the unpredictability of adventure activity sites were all crucial indicators. We discovered that site difficulty can affect adventure tourists' challenge perception, which is consistent with the findings of Tsaur et al. (2013).

The results indicated that the three activity-related antecedents positively influence tourists' perceptions of challenge. Bailey, Johann, and Kang (2017) proposed that adventure activities can affect the internal cognition and psychological responses of individuals, thus posing a new physical and psychological challenge to participants. Generally, adventure recreation activities require high skill utilization, high demands, and frequent peer interaction. Tourists must devote more effort when engaging in an activity requiring high skill utilization, which causes a higher perception of challenge. For example, the decompression procedure at the end of a dive can be a difficult skill for some divers. This leads to an increased sense of challenge during the decompression task. Similarly, operating hiking equipment and performing certain tasks are challenging for hikers. Tsaur et al. (2013) found that the difficulty of an activity was a source of challenge for adventure tourists, and that the skills required, difficulty in learning skills, and specialized skills required for adventure activities were crucial indicators. Additionally, we found that skill utilization also affected tourists' challenge perception, thus corroborating Tsaur et al. (2013).

Tourists who engage in demanding activities can easily perceive more challenges. Boswell et al. (2004) noted that the same principle applied in the workplace, finding that heavy workloads led to a greater perception of challenge among employees. For instance, high-altitude mountain hikers must endure strenuous conditions, marked by low pressure, low oxygen, and low temperature, which can be physically exhausting and extremely challenging. Pomfret and Bramwell (2016) found that adventure activity participants are intrinsically motivated and seek participation in demanding activities to develop their abilities and learn new skills. We observed a positive correlation between demand for participation in adventure activities and personal challenge perception, which is consistent with the findings of Pomfret and Bramwell (2016). Furthermore, the findings demonstrated that tourists perceived more challenges while participating in an activity with more interaction and cooperation. In rafting, cooperating with partners and following a coach's instructions would require more concentration, which can lead to an increase in perceived challenge. This result accords with findings by Decloe et al. (2009) that cooperation can easily create the perception of challenge while engaging in physical activities.

Moreover, the results revealed that two control variables (familiarity and personal skill and experience) exerted negative effects on the tourists' perception of challenge. Weber (2001) noted that familiarity with the recreational environment and high personal skill and experience were associated with a reduced perception of challenge, because of increased control over the entire process of the activity. Therefore, the findings indicated that the recreation site has a greater effect on challenge perception than recreation activity. After the effect of personal factors on the perception of challenge were controlled, site difficulty was

identified as the strongest antecedent among all determinants, followed by site wilderness, interaction, skill utilization, and demands.

6.1. Theoretical implications

The study provides the following contributions to adventure tourism literature. This research used a quantitative method to examine the effect of the place- and activity-related attributes on challenge perception among adventure tourists. To our knowledge, although previous literature has identified that satisfaction, flow experience, and well-being are vital outcomes of challenge perception (Houge-Mackenzie, Hodge, & Boyes, 2011; Tsaur et al., 2015; Wu & Liang, 2011), no empirical research has investigated the antecedents of perceived challenge. This research builds on a study by Tsaur et al. (2015) by further examining the formative elements of challenge perception. According to stress appraisal theory, challenges are the result of individuals appraising a stressful event (Lazarus & Folkman, 1984). This study contributes to tourism literature by demonstrating that place- and activity-related factors are antecedent variables and quantifying the influences of place-factors and activity-related factors on challenge perception among adventure tourists. Therefore, this study supported stress appraisal theory (Lazarus & Folkman, 1984) and revealed that place-related and activity-related factors are two major challenge stressors of adventure tourism activities. In contrast to related studies (Tsaur et al., 2015; Wu & Liang, 2011), the novelty of this study is that it addressed and highlighted the crucial role of the place- and activity-related factors in enhancing challenge perception for adventure tourists. Explorations of the relationship between these variables will enable scholars to understand comprehensively the structural model of the antecedents and consequences of challenge perception.

6.2. Practical implications

Scuba diving, mountain hiking, and whitewater rafting are some of the popular adventure tourism activities in Taiwan. Several entrepreneurs have created businesses focused on these activities, and the results derived in this study have clear implications for the management of these businesses. The motivation for numerous adventure tourists is to seek challenges (Ewert & Hollenhorst, 1989; Lee et al., 2007). Therefore, it is crucial for adventure tourism-related businesses to satisfy tourists' desire for a challenge. The present study determined that site wilderness and site difficulty have positive effects on the perception of challenge. Numerous recreation areas in Taiwan have gradually been occupied by human-made facilities and lost the appearance of pristine wilderness. Human-made facilities, such as overly modernized mountain cabins, human-made pavilions on riverbeds, and more marine recreation activities in diving areas (e.g., snorkeling, jet-skiing, and fishing), all decrease tourists' perceptions of wilderness, which reduces their feelings of challenge. This study's findings suggest that recreation managers should preserve the wilderness of recreation sites. Moreover, recreation managers should expand opportunities for tourists to interact with wilderness environments in a safe manner. Although site difficulty causes tourists to perceive challenges, their capabilities should also be considered. Recreation organizations should design tours with various levels of challenge to ensure that all tourists can be challenged. The relationship between recreation activity and perception of challenge indicates that recreation organizations should estimate the required skill levels, physical and mental demands, and frequency of interaction with peers when designing adventure activities for tourists. The activity-related attributes, which lead to the perception of challenge, should be under the tourists' control. Therefore, offering information regarding activities can assist tourists in selecting the most suitable tour that can provide them a challenging experience.

6.3. Limitations and further studies

The current study has several limitations that warrant consideration. First, this study included tourists participating in scuba diving, mountain hiking, or rafting, but, considering the numerous types of adventure tourism activities, it is unclear if the results can truly be generalized to all adventure tourism activities. We recommend that future studies examine more types of adventure tourism to enhance generalizability. Second, the perceived and actual risks of adventure activity sites had considerable effects on tourists' adventure experience (Wang et al., 2019; Williams & Soutar, 2005). Additionally, we did not consider weather conditions on the day of adventure activities or other unforeseen situations (Tsaur et al., 2013). These are crucial site-related factors, and we did not include such risk management factors as control variables. Future studies can differentiate between and measure tourists' perceived and actual risks of adventure activity sties and incorporate these into the research model as control variables. Such incorporation will mitigate confounding relationships between the variables in the research model.

Third, most tourists who took tours designed by recreation organizations perceived less risk than solo tourists. However, risks and uncertainty simultaneously exist when tourists seek challenges. Therefore, future studies should investigate the role of challenge and risk in adventure tourism. Fourth, we focused on discussing the antecedents affecting tourists' challenge perceptions and did not investigate the effect of challenge perception on tourists' psychological responses, such as perceived flow and spirituality (Boudreau, Houge-Mackenzie, & Hodge, 2020). We recommend further research to investigate this, which allows for the construction of a more complete causal model. Finally, this study did not consider situational factors such as motivation, emotions, and the influences of others in the group. Thus, future studies can further investigate whether the relationships identified in this study are moderated by situational factors.

Author's contribution

Sheng-Hshiung Tsaur: Conceptualization, Resources, Funding acquisition, and Writing- Original draft preparation. Wei-Rong Lin: Investigation, Software, Data curation, Formal analysis. Chang-Hua Yen: Methodology, Validation, and Writing- Reviewing and editing.

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