

Development and validation of a scale for assessing enjoyment of rogaining activities

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Abstract:

Enjoyment is a multidimensional concept that positively influences long-term participation in sports. However, the factors that contribute to enjoyment in rogaining—an urban and wilderness navigation sport—have not been systematically investigated. This study aimed to (a) develop a scale for assessing enjoyment in rogaining activities, (b) verify its fit and validity, and (c) clarify the multidimensional structure of enjoyment in rogaining. A questionnaire survey was performed with 517 participants across four rogaining events held between 2019 and 2020, yielding 401 valid responses (193 males, 215 females; mean age 42.5 ± 13.9 years). A 21-item enjoyment scale was developed by adapting an existing orienteering scale and incorporating items based on prior qualitative findings on rogaining. Exploratory factor analysis (EFA) using maximum likelihood estimation with Promax rotation was performed, followed by confirmatory factor analysis (CFA) and Pearson correlation analyses. EFA produced a four-factor model—"Interaction with the execution environment," "Characteristics of the activity," "Competitiveness," and "Collaboration and communication"—with good internal consistency (Cronbach's $\alpha = .848$ to $.902$). CFA indicated acceptable model fit (RMSEA = $.079$, CFI = $.932$, SRMR = $.036$), confirming content, construct, and criterion-related validity. Participants rated rogaining as highly enjoyable (total factor score: 83.3 ± 9.3 out of 100; overall enjoyment: 6.3 ± 0.9 out of 7), with physical exploration in unfamiliar locations receiving stronger endorsement than competitive elements. Significant positive correlations were found among overall enjoyment, event satisfaction, and intention to participate again ($r = .643$ to $.692$, all $ps < .001$). One-way ANOVA revealed significant between-event differences in the "Interaction with the execution environment" factor ($F(3, 362) = 5.404$, $p = .001$), reflecting the influence of event-specific settings on enjoyment. The factor contribution rate of "Interaction with the execution environment" (42.59%) substantially exceeded those of the other factors, indicating that the event environment is the primary determinant of rogaining enjoyment. Therefore, the strategic organization of checkpoints to encourage regional connection, nature experiences, and local discovery is essential to enhancing participant enjoyment, satisfaction, and long-term engagement in rogaining.

Keywords: multidimensional structure, factor analysis, sports participation, sports recreation, event environment, intrinsic motivation

Introduction

In recent years, the importance of physical activity, exercise, and participation in sports has increased in the context of preventing lifestyle-related diseases, maintaining and improving social functioning, and enhancing quality of life (Ministry of Health, Labour and Welfare, 2011). In Japan, the Basic Sport Plan serves as a guideline for the comprehensive and systematic promotion of sports-related policies, as set out in the Basic Act on Sports. The third phase of this plan was formulated in 2022. The objective of this plan is to achieve, as quickly as possible, a rate of approximately 65% of adults participating in sports at least once a week and a rate of approximately 30% participating at least three times a week. However, in 2021, the rate of adults participating in sports at least once a week was 56.4%, and the rate for participation at least three times a week was 30.4%, indicating stagnant growth. Improving these rates has become an urgent priority, as stated by the Japan Sports Agency (2022b).

Enjoyment has been defined as a positive emotion experienced through intrinsic motivation when engaging in an activity (Deci & Ryan, 1985). In the field of sports, it has been shown that enjoyment has a positive effect on participation (Scanlan et al., 1993). Furthermore, enjoyment is understood as a multidimensional concept that varies among individuals (Scanlan & Simons, 1992; Murakoshi, 2001). It is essential for sports recreation instructors to understand the multifaceted nature of enjoyment inherent in each sport activity. By carefully designing activity programs, instructors can help individual participants experience enjoyment, thereby promoting their continued engagement in that sport activity. This is believed to lead to higher rates of sports participation.

Sports recreation activities are initiatives that use sports to provide opportunities for exercise (Ministry of Education, Culture, Sports, Science and Technology, 2011). The aim of sports recreation is to promote physical and mental well-being by offering activities that encourage the enjoyment of physical movement in a social setting and support ongoing participation in these activities (Japan Recreation Association, 2017). Rogaining is a form of sports recreation in which participants use a map to walk or run with teammates to visit checkpoints set up in urban areas or the wilderness in any order. Competition in Japan uses a points system in which points are awarded for successfully completing photographic tasks at designated checkpoints. Nakai et al. (2020) have also reported that rogaining provides participants with sufficient physical activity and enjoyment, thus serving as a means of promoting health.

Surveys of non-exercisers and those who exercise infrequently indicate that walking and marathon running are the exercise/sport activities respondents most want to try in the future (Japan Sports Agency, 2022a). Moreover, invitations from acquaintances have been documented as catalysts for initiating physical activity or sports participation. The presence of companions has also been shown to increase the frequency of exercise and sports engagement. Activities pursued with a goal are thought to promote motivation and lead to an attitude of voluntarily engaging in that activity (Duda & Hall, 2001).

Therefore, the practice of rogaining, which involves walking or running with team members toward a shared objective, may be particularly appealing to individuals who are not regular exercisers or who exercise only infrequently. This activity could serve as a valuable first sporting experience for such individuals. However, the factors from which enjoyment is derived in rogaining activities have not been thoroughly examined. Clarifying these aspects is expected to contribute to the promotion of rogaining, encourage participation, support the provision of effective programs, and thereby help increase adult sports participation rates. Therefore, this study aimed to (a) develop a scale for assessing enjoyment in rogaining activities; (b) verify the fit and validity of the constructed scale; and (c) understand the multidimensional structure of enjoyment in rogaining activities. Part of this paper was presented orally at the 51st Annual Conference of the Japan Society of Leisure and Recreation Studies (November 2021) (Nakai et al., 2021). This paper is a revised version that incorporates new analyses and the insights derived from them.

Materials and methods

Participants

The study participants included 517 individuals from four rogaining events held between 2019 and 2020 (see Table 1). The 410 respondents were distributed across various subjects, including 193 males, 215 females, and two subjects whose gender was not recorded, with an average age of 42.5 ± 13.9 years (mean $\pm$ standard deviation). All participants entered the events voluntarily.

Procedure

A questionnaire or web-based survey was administered to participants at each event. The survey included questions about participants' characteristics, their overall enjoyment of rogaining events, their satisfaction with the specific event, and their intention to participate in that event again. The survey also included items assessing enjoyment of rogaining activities, which were developed using the procedure described later. Only participants who provided informed consent participated in the survey. The Research Ethics Committee at Osaka Electro-Communication University, Japan approved the study design and investigative protocols of the present study (No. 19-008), which conformed to the 1975 Declaration of Helsinki (revised in 2013).

Murakoshi (2001) reported that orienteering competitors gain enjoyment not only from the sport itself but also from its associated activities. This finding suggests that both the activity itself and the associated activities in rogaining, a sport in the same category, may offer enjoyment to participants. The questionnaire items used to assess enjoyment in rogaining activities (see Table 2) were developed by first extracting three factors and 10 items, "Experiences by nature," "Competitiveness," and "Physical activity," from a scale measuring enjoyment in orienteering (Murakoshi, 2001), a competitive sport similar to rogaining, which was originally created from a survey of university student orienteering competitors.

The wording of the questionnaire items was then revised to better align with rogaining. Subsequently, based on reports by Miyake et al. (2018) indicating that enjoyment in rogaining stems from characteristics of the activity as well as collaboration and communication during participation, and on the results of a survey on awareness of rogaining (Japan Photo Rogaining Association, 2019), the following items were added: "Collaboration and communication" (three items), "Features of rogaining activities" (five items), and "Understanding of the region" (three items), resulting in a total of 21 survey items.

The content of all questionnaire items was then reviewed by rogaining event organizers, course designers, and sports recreation researchers to ensure content validity. Immediately after the competition ended, participants were asked to assess their enjoyment of rogaining activities using a 21-item questionnaire. Responses were collected in a multiple-choice, single-answer format ranging from "Very enjoyable" (5 points) to "Not enjoyable at all" (1 point).

Participants rated their overall enjoyment of the rogaining event on a 7-point scale, from "Very enjoyable" (7 points) to "Not enjoyable at all" (1 point), and their satisfaction with the event and intention to participate again on a 7-point scale, from "Strongly agree" (7 points) to "Strongly disagree" (1 point).

Data analysis/statistical analysis

Each response to the questionnaire items was treated as an interval scale, scored, and used to calculate the mean and standard deviation. This confirmed the distribution of responses and identified any response bias. An item-total (I-T) correlation analysis was performed to determine the extent to which each questionnaire item's score influenced the overall score of the other items. Subsequently, exploratory factor analysis (EFA) was performed using the maximum likelihood method with Promax rotation to extract factors. Cronbach's alpha coefficient was then calculated for each factor to confirm the internal consistency of the scale. The construct validity of the subscale items in the extracted factors was confirmed by comparing them with the findings of the abovementioned report.

The model fit derived from the EFA was then verified using confirmatory factor analysis (CFA) with maximum likelihood estimation. Next, Pearson's correlation coefficients were calculated for the total factor score, the overall enjoyment score of the rogaining event, the event satisfaction score, and the score indicating the intention to participate in the event again. The criterion-related validity of the resulting factor analysis model was assessed using Pearson correlation coefficients between the total factor score and the enjoyment score for the overall rogaining activity.

To further confirm the validity of the model, a one-way analysis of variance (ANOVA) without corresponding factors was performed for each factor score, and the total factor score was calculated for each event using the abovementioned procedure. When main effects were found, multiple comparisons were performed using the Holm method. All statistical analyses were performed using statistical software (IBM SPSS Statistics and Amos 26, IBM Corporation), with the statistical significance level set at 5%.

Table 1

Survey method, number of questionnaires distributed, number collected, and number of valid responses for each event

Event name	Survey methods	Number distributed	Number collected	Number of valid responses
2019 Kameoka	Questionnaire	97	95	94
2019 Hokusetsu	Questionnaire	189	179	175
2019 Fuefuki	Questionnaire	76	75	71
2020 Shinshiro	Web-based questionnaire survey	117	61	61
Total		479	410	401

Table 2

Questionnaire item scores and I-T correlation analysis results

Subscale groups		Subscale items	<i>M</i>	<i>SD</i>	<i>r</i>	
Original factors	Competitiveness	Compete with other teams	3.8	0.9	.595	***
		Aim to win or place well	3.7	0.9	.582	***
		Meet the goals set by the team	4.2	0.8	.681	***
		Enjoy the excitement of competing in the event	3.7	0.9	.619	***
	Experiences by nature	Visit an unfamiliar place	4.5	0.7	.682	***
		Participate in activities in natural environments away from everyday life	4.4	0.7	.718	***
		Reconnect with nature	4.3	0.7	.693	***
		Admire the stunning scenery and cityscape	4.4	0.7	.695	***
	Physical activity	Move your body	4.6	0.6	.710	***
		Get a good workout	4.4	0.8	.672	***
	Collaboration and communication	Discuss various matters with the team members	4.3	0.8	.611	***
		Collaborate with team members	4.4	0.7	.665	***
		Interact with other teams	3.7	0.9	.663	***
Further elements	Features of rogaining activities	Act according to the map	4.4	0.7	.617	***
		Act at your own pace	4.4	0.7	.648	***
		Find checkpoints and collect points	4.6	0.6	.659	***
		Take a photo at the checkpoint	4.4	0.7	.620	***
		Walk or run for extended periods	4.3	0.8	.686	***
	Understanding of the region	Connect with local people	3.7	1.0	.686	***
		Visit numerous local tourist attractions	4.4	0.8	.739	***
		Become well acquainted with the local area	4.1	0.8	.694	***
	All items		4.2	0.8		

Note. *N* = 401. *M*: mean; *SD*: standard deviation; *r*: Pearson's correlation coefficient; *** *p* < .001. The I-T correlation was evaluated using a criterion of *r* > .20. Items under "Original factors" were based on Murakoshi's (2001) scale of enjoyment in orienteering. Items under "Further elements" were developed based on reports by Miyake et al. (2018) and the Japan Photogaining Association (2019).

Results

A total of 479 questionnaires were distributed in this study, of which 410 were returned, resulting in a response rate of 85.6%. The total number of valid responses received was 401, as shown in Table 1. The mean and standard deviation of the scores for responses to each questionnaire item are presented in Table 2. After confirming the distribution of responses, means, and standard deviations for each questionnaire item, it was found that no significant skewness was observed in the responses to any item. Furthermore, neither a ceiling effect nor a floor effect was detected. The I-T correlation analysis revealed no items with low overall relevance or correlation coefficients below .20 ($r = .582$ to $.739$, all $ps < .001$; Table 2). Therefore, excluding items was considered unnecessary. Subsequently, all 21 items were included in the analysis.

The sample size for the data used in the EFA in this study was 401, and the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was .919. In the initial EFA, Bartlett's test of sphericity ($\chi^2(190) = 5042.895$, $p < .001$) indicated correlations among the observed variables. Accordingly, Promax rotation was applied in the subsequent exploratory factor analyses. In accordance with Kaiser's (1960) criteria, which specify a commonality of $\geq .20$, factor loadings of $\geq .40$, and eigenvalues of ≥ 1.0 , the EFA was repeated. In the fourth analysis, one item, "Take a photo at the checkpoint," did not meet the factor loading criterion and was excluded from further analyses.

Table 3

Factor loadings of subscale items and contribution rates of extracted factors obtained from the fifth exploratory factor analysis, correlations among extracted factors, and alpha coefficients for each factor

Resultant factors	Original factors	Subscale items	Factor loading			
			1	2	3	4
Interaction with the execution environment	Experience by nature	Admire the stunning scenery and cityscape	.973	-.140	-.071	.035
		Reconnect with nature	.902	-.040	-.045	-.030
		Participate in activities in natural environments away from everyday life	.720	.159	-.020	-.048
		Visit an unfamiliar place	.608	.191	-.099	.061
	Understanding of the region	Visit numerous local tourist attractions	.818	.011	-.011	.019
		Become well acquainted with the local area	.622	.089	.116	-.080
		Connect with local people	.485	.010	.249	.013
Characteristics of the activity	Physical activity	Get a good workout	-.022	.917	-.004	-.131
		Move your body	-.041	.912	-.105	.068
	Features of rogaining activities	Walk or run for extended periods	.058	.752	.025	-.058
		Act according to the map	.034	.541	.072	.045
		Act at your own pace	.112	.464	-.033	.188
		Find checkpoints and collect points	.110	.417	.211	.013
Competitiveness	Competitiveness	Aim to win or place well	-.038	-.121	.965	-.026
		Compete with other teams	-.064	.029	.898	-.088
		Enjoy the excitement of competing in the event	-.024	.102	.668	.014
		Meet the goals set by the team	.006	.114	.418	.314
		Interact with other teams	.286	-.030	.454	.054
Collaboration and communication	Collaboration and communication	Discuss various matters with the team members	.026	-.049	-.072	.911
		Collaborate with team members	-.043	.021	.036	.895
		Factor contribution ratio	42.59	8.11	4.97	4.84
		Cumulative contribution rate		50.70	55.67	60.51
		1	---	.680	.490	.568
		2		---	.535	.590
		3			---	.491
		4				---
		Cronbach's alpha	.902	.867	.848	.871

In the fifth subsequent EFA, communality ranged from .448 to .723, the inverse image matrix ranged from .839 to .965, and residuals above .05 in the reproduced correlation coefficients accounted for 9.0%. The items comprising the factors extracted in this analysis were as follows: Factor 1 with seven items (factor contribution rate: 42.59%), Factor 2 with six items (8.11%), Factor 3 with five items (4.97%), and Factor 4 with two items (4.84%) (see Table 3). Based on the content of the subscales, the factors in the resulting factor analysis model were named as follows: Factor 1 was labeled "Interaction with the execution environment," Factor 2 was labeled "Characteristics of the activity," Factor 3 was labeled "Competitiveness," and Factor 4 was labeled "Collaboration and communication." A substantial positive correlation was found among all factors ($r = .490$ to

.680), and the Cronbach's alpha coefficients for each factor ranged from .848 to .902. However, the chi-square test results for the resulting factor analysis model were significant ($\chi^2(116) = 446.518, p < .001$).

Subsequently, the model's adequacy was established through CFA. Among the fit indices, the goodness of fit index (GFI) was .889, the adjusted goodness of fit index (AGFI) was .830, and the standardized root mean square residual (SRMR) was .036. The root mean square error of approximation (RMSEA), an indicator of absolute model fit, was .079, and the comparative fit index (CFI), an indicator of comparative fit, was .932.

The mean total factor score for the entire sample was 83.3 ± 9.3 points, the mean enjoyment score for rogaining overall was 6.3 ± 0.9 points, the mean satisfaction score with the event was 6.2 ± 0.9 points, and the mean score for intention to participate in the event again was 6.1 ± 1.1 points. A significant correlation was found between the overall rogaining enjoyment score and the total factor score ($r = .555, p < .001$). The overall enjoyment score for rogaining showed a significant correlation with both the event satisfaction score and the intention to participate again score ($r = .692, p < .001$; $r = .656, p < .001$). A strong correlation was also found between the satisfaction score and the intention-to-participate-again score ($r = .643, p < .001$).

A one-way ANOVA of factor scores and total factor scores by event showed main effects for total factor scores, the factor score for "Interaction with the execution environment," the score for "Experience by nature" among the original factors, and the score for "Understanding of the region" ($F(3, 362) = 3.103, p = .027$; $F(3, 362) = 5.404, p = .001$; $F(3, 362) = 4.888, p = .002$; $F(3, 362) = 5.347, p = .001$; see Table 4). Subsequent multiple comparison tests showed significant differences between the 2019 Kameoka and 2019 Hokusetsu events in the total factor scores, the factor score for "Interaction with the execution environment," and the scores for "Experiences by nature" and "Understanding of the region" ($t(362) = 3.005, p = .003$; $t(362) = 3.873, p < .001$; $t(362) = 3.403, p = .001$; $t(362) = 3.680, p < .001$), and between the "Experiences by nature" scores at the 2019 Kameoka and 2020 Shinshiro events ($t(362) = 2.919, p = .004$).

Table 4

Results of one-way ANOVA and multiple comparisons for factor scores and total factor scores across each competition

Factors	(a) 2019		(b) 2019		(c) 2019		(d) 2020		ANOVA	
	Kameoka		Hokusetsu		Fuefuki		Shinshiro		<i>F</i> (3, 362)	Several comparisons
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Interaction with the execution environment	30.7	3.8	28.6	4.1	29.9	3.3	29.2	5.1	5.404	** b < a***
Experiences by nature	18.2	2.2	17.1	2.4	17.8	1.9	17.0	2.9	4.888	** b < a***, d < a**
Understanding of the region	12.5	1.9	11.4	2.1	12.1	1.8	12.2	2.5	5.347	** b < a***
Characteristics of the activity	26.9	2.8	26.2	2.9	26.8	2.6	26.1	4.2	1.645	
Physical activity	9.0	1.3	8.8	1.2	8.9	1.1	8.9	1.6	0.897	
Features of rogaining activities	17.9	1.8	17.4	2.0	17.9	1.7	17.2	2.7	2.116	
Competitiveness	19.0	3.0	18.6	3.1	18.3	3.0	19.1	4.0	0.937	
Collaboration and communication	8.9	1.4	8.5	1.5	8.7	1.4	8.9	1.5	2.144	
All factors	85.8	7.9	81.8	9.3	83.8	7.8	83.4	12.1	3.103	* b < a**

Note. *N* = 366. *M*: mean; *SD*: standard deviation; * $p < .05$, ** $p < .01$, *** $p < .001$.

Discussion

A total of 13,450 individuals participated in rogaining events in Japan during fiscal year 2019 (Japan Photo Rogaining Association, 2020). Accordingly, the required sample size, as determined using Cochran's (1977) formula for categorical variables (5% margin of error, 95% confidence level, 50% response rate), was 374. The number of valid responses obtained in this study (401) exceeds this value (Table 1), indicating that a necessary and sufficient sample was obtained for the analysis when the total number of participants in rogaining events in Japan was used as the population.

The average score for the 21-item questionnaire developed in this study to assess enjoyment of rogaining activities was 4.2 ± 0.8 points (Table 2). This result indicates that the survey participants found rogaining, including both the competition itself and related activities, enjoyable, thereby supporting Murakoshi's (2001) findings on orienteering. Items with scores of 4.5 or higher included three related to participation in rogaining: "Move your body," "Find checkpoints and collect points," and "Visit an unfamiliar place." In contrast, items related to the competitive nature of rogaining, such as "Compete against other teams," "Aim to win or place well," and "Enjoy the excitement of competing in the event," as well as items related to interaction with others, such as "Interact with other teams" and "Connect with local people," received low scores. Therefore, it was found that participants in rogaining events do not place strong emphasis on the competitive aspect of the event; rather, they derive considerable enjoyment from participating in the event itself, moving their bodies while searching for checkpoints in unfamiliar locations.

The sample size (401) used in the EFA for this study met the criterion proposed by Cattell (1978), which states that the sample size should be at least three times the number of observed variables (21 items in this study), and was therefore adequate for conducting factor analysis. The KMO measure of sampling adequacy (.919) exceeded .90, which is considered very high according to Kaiser's (1974) criteria, indicating that the

subsequent EFA extracted reliable factors. Considering the correlations among the observed variables in Bartlett's sphericity test (Bartlett, 1950), it was determined that the data sampled were necessary and valid for the analysis, and EFA using Promax rotation was subsequently performed.

In the fourth EFA, the item "Take a photo at checkpoint" was excluded based on factor-loading criteria. During rogaining competitions, participants are required to take a photo at each checkpoint to confirm that they passed through it. Typically, one team member acts as a representative and promptly takes the photo at the checkpoint. The fact that not all participants are involved in taking the photo, and that the act of taking the photo itself serves as a means of earning points, is considered one reason for the exclusion of this item.

In the fifth subsequent EFA, the criteria proposed by Field (2013)—namely, a communality of $\geq .16$, an oblique matrix of $\geq .50$, and a reconstruction correlation coefficient residual of $\leq 50\%$ —were met. This demonstrated the validity of the analyses performed thus far, the adequate relationship of all observed variables to the extracted factors, and the development of a good factor model. Given the substantial positive correlations observed among all factors (see Table 3), it can be concluded that applying Promax rotation to the sample data was an appropriate analytical approach. Cronbach's alpha coefficients for each factor met the threshold of .80 or higher, which Field (2013) identifies as an indicator of good reliability. Thus, the resulting factor analysis model was considered to have good internal consistency. The results of the chi-square test, used to assess the model fit of the factor analysis model, were significant. It has been noted that this test is sensitive to sample size and tends to produce significant results with large samples (Field, 2013). On the other hand, all the other indicators mentioned above met the criteria, and the fit of the resulting factor analysis model was judged to be within a practically acceptable range. Therefore, a four-factor factor analysis model was adopted in this study as a scale for assessing the enjoyment of rogaining activities.

In the subsequent CFA, the fit indices GFI (.889) and AGFI (.830) did not satisfy the generally accepted criterion of .90 or higher for good model fit (Hair et al., 2010). However, the SRMR (.036) satisfied the criterion of $\leq .08$ for a very good fit proposed by Hu and Bentler (1999), thereby confirming the validity of the obtained factor analysis model. Furthermore, among the criteria for frugality-corrected indices (Browne & Cudeck, 1993; Hu & Bentler, 1999), the RMSEA (.079) satisfied the criterion of $\leq .08$, and the CFI (.932) satisfied the criterion of $\geq .90$. Thus, the fit of the resulting model was judged to be within an acceptable range. The preceding analyses confirmed the validity of the four-factor factor analysis model.

The "Interaction with the execution environment" factor among the resultant factors of the factor analysis model (see Table 3) included all items from the "Experiences by nature" and "Understanding of the region" factors in the original set of factors. Likewise, the "Characteristics of the activity" factor among the resultant factors included all items from the "Physical activity" and "Features of rogaining activities" factors in the original set. The "Competitiveness" factor among the resultant factors consisted of all items from the "Competitiveness" factor in the original set, along with one additional item, "Interact with other teams," taken from the "Collaboration and communication" factor. Although the original factors included "Interact with other teams" under the "Collaboration and communication" factor, it is hypothesized that this factor structure emerged because the activity took place during the competition. The subscale items and factors in the obtained factor analysis model were considered conceptually valid based on the earlier reports by Miyake et al. (2018) and the Japan Photo-Rogaining Association (2019). These items were interpreted as successfully explaining the construct of enjoyment in rogaining. This study's findings indicate that, among all survey participants, higher overall enjoyment scores for rogaining were associated with higher total scores on the subscale items. This suggests that the factor analysis model developed in this study is a valid scale for assessing the enjoyment of rogaining in terms of content, construct, and criterion-related validity. As shown above, enjoyment of rogaining activities consists of four factors: "Interaction with the execution environment," "Characteristics of the activity," "Competitiveness," and "Collaboration and communication." These findings align with the perspectives of Scanlan and Simons (1992) and Murakoshi (2001) that enjoyment of sports activities is multidimensional.

In addition to the mean score for all 21 items shown in Table 2 (4 out of 5 points), the overall factor score (83.3 out of 100 points) and the enjoyment rating for the rogaining activity as a whole (6.3 out of 7 points) were high, as were the scores for satisfaction with the event (6.2 out of 7 points) and intention to participate again (6.1 out of 7 points). These results indicate that participants rated the rogaining event highly overall. The strong positive correlation among scores for enjoyment of the overall rogaining activity, satisfaction with the event, and intention to participate again, along with the inferred causal relationship among them, suggests that enjoying the rogaining activity at a given event leads to satisfaction with that event and a desire to participate in it again. This finding is consistent with the self-determination theory proposed by Ryan and Deci (2000).

In the context of rogaining events, courses and checkpoints are carefully designed to reflect the distinctive characteristics of each host region, and the competition is performed in accordance with established guidelines. Therefore, it was expected that the "Interaction with the execution environment" factor in the resulting model would differ across events. A one-way ANOVA of factor scores and total factor scores across events revealed differences between events in the total factor score, the factor score for "Interaction with the execution environment," the score for "Experience by nature," and the score for "Understanding of the region" (Table 4). The findings suggest that, in events performed in accordance with the established guidelines, activities intrinsic to participation itself, such as "Characteristics of the activity," "Competitiveness," and "Collaboration

and communication," were assessed by participants as equally enjoyable across events. However, enjoyment ratings related to the event's execution environment, such as "Experiences by nature" and "Understanding of the region," suggested that "Interaction with the execution environment" influenced overall enjoyment of the event. Furthermore, the results confirmed this study's hypothesis that "Interaction with the execution environment" differs across events, thereby demonstrating the validity of the derived model. Among the model factors obtained through this study's analysis, the contribution rate of the factor "Interaction with the execution environment" (42.59%; Table 3) was markedly higher than that of the other factors, indicating that the event environment was the strongest contributor to the overall enjoyment of the rogaining activity. In light of the abovementioned findings, it was concluded that the strategic organization of events, incorporating considerations such as checkpoint placement, can foster a sense of connection to the host region among participants. This approach can also encourage experiences in nature and develop an understanding of the event region. Therefore, the events can provide participants with a deeper appreciation of the enjoyment of rogaining.

Conclusions

This study was performed to verify the fit and validity of a newly developed scale for assessing enjoyment in rogaining activities, using a questionnaire or web form, and to understand the multidimensional structure of that enjoyment. Therefore, a four-factor model was obtained through factor analysis that demonstrated content, construct, and criterion-related validity, revealing that enjoyment in rogaining consists of "Interaction with the execution environment," "Characteristics of the activity," "Competitiveness," and "Collaboration and communication." Participants in rogaining events found the activity enjoyable, including both the competition itself and the related activities, and were also characterized by not placing strong emphasis on the competitive aspect of the event, but rather by enjoying participation in the event, exploring unfamiliar areas to locate checkpoints, and physical movement. Moreover, the participants expressed a high degree of satisfaction with the event, indicating a strong desire to participate again in the future if the activities proved enjoyable. The event environment was found to have the greatest influence on the overall enjoyment of rogaining. It was suggested that the strategic placement of checkpoints, the provision of experiences in nature and opportunities to develop an understanding of the local region, and organizing the event in a way that enables participants to feel connected to the host region are crucial to helping them fully appreciate the enjoyment of rogaining.

Conflict of interest

The authors have no conflicts of interest that are directly relevant to the content of this article.

References

- Bartlett, M. S. (1950). Tests of significance in factor analysis. *British Journal of Statistical Psychology*, 3, 77-85. <https://doi.org/10.1111/j.2044-8317.1950.tb00285.x>
- Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136-162). Sage.
- Cattell, R. B. (1978). *The scientific use of factor analysis in behavioral and life science*. Plenum.
- Cochran, W. G. (1977). *Sampling techniques* (3rd ed.). John Wiley & Sons.
- Deci, E. L., & Ryan, R. M. (1985). Conceptualizations of intrinsic motivation and self-determination. In E. L. Deci, & R. M. Ryan (Eds.), *Perspectives in social psychology: Intrinsic motivation and self-determination in human behavior* (pp. 11-12). Springer. https://doi.org/10.1007/978-1-4899-2271-7_2
- Duda, J. L., & Hall, H. K. (2001). Achievement goal theory in sport: Recent extensions and future directions. In R. Singer, C. Janelle, & H. Hausenblas (Eds.), *Handbook of research in sport psychology* (2nd ed., pp. 417-443). John Wiley & Sons.
- Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th ed.). Sage.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis* (7th ed.). Pearson.
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6(1), 1-55. <https://doi.org/10.1080/10705519909540118>
- Japan Photo Rogaining Association. (2019). *Photo rogaining Yamaguchi in Mine no chosakekka* [Results of the photo rogaining Yamaguchi in Mine Survey]. <https://photorogaining.com/about/characteristics/>
- Japan Photo Rogaining Association. (2020). *2019 nen no matome* [Summary of the 2019 events]. <https://photorogaining.com/1734/>
- Japan Recreation Association. (2017). *Supotsu rekurieshon shidosha yoseitekisuto: Supotsu rekurieshon katsudo wo tsujita kenkojumyo no enshin* [Sport/recreation instructor training textbook: Extending healthy life expectancy through sport/recreation activities].
- Japan Sports Agency. (2022a). *Reiwa 4 nendo Supotsu no jisshijokyoto ni kansuru yoronchosa (Reiwa 4 nen 12 gatsu tyousa)* [FY 2022 Public opinion survey on sports participation and related matters (December 2022 Survey)]. https://www.mext.go.jp/sports/content/20230323-spt_kensport01-000028572_5.pdf
- Japan Sports Agency. (2022b). *Daisanki supotsu kihonkeikaku (2022-2026)* [The third sport basic plan (2022-2026)]. https://www.mext.go.jp/sports/content/20230802-spt_sseisaku02-000021299_1.pdf

- Kaiser, H. F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement*, 20, 141-151. <https://doi.org/10.1177/001316446002000116>
- Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika*, 39(1), 31-36. <https://doi.org/10.1007/BF02291575>
- Ministry of Education, Culture, Sports, Science and Technology (2011). *Supotsu kihonho* [The basic act on sport]. http://www.mext.go.jp/a_menu/sports/kihonhou/attach/1307658.htm
- Ministry of Health, Labour and Welfare (2011). *Kenko Nippon 21 saishu hyoka* [Final evaluation of “Healthy Japan 21”]. <https://www.mhlw.go.jp/stf/houdou/2r9852000001r5gc-att/2r9852000001r5np.pdf>
- Miyake, M., Nakai, A., Tanaka, M., & Yoshinaka, Y. (2018 November 23-25). *Photo rogaining no tokusei ni kansuru shitsutekikenkyu: Daigakusei no jiyukijutsukanso no keiryotekisutobunseki kara* [A qualitative study on the characteristics of photo-rogaining: Based on quantitative text analysis of university students’ free-response comments] [Poster presentation]. The 48th Annual Conference of the Japan Society of Leisure and Recreation Studies, Tokyo, Japan.
- Murakoshi, M. (2001). *Gakusei orienteering kyogisha ni okeru tanoshisa no henka to sanyo no kankei* [Longitudinal study on enjoyment change and commitment of student orienteers]. *Bulletin of the Faculty of Education, Shizuoka University, Social and Natural Sciences and Liberal Arts Series*, 51, 243-257.
- Nakai, A., Miyake, M., Tanaka, M., & Yoshinaka, Y. (2020). *Undo ya katsudonaiyo kara mita photorogaining no supotsu rekurieshon toshitenno yukosei: Daigakusei oyobi senmongakkosei wo taishotosita oudanchosakekka kara* [Value of photorogaining as a sport-recreational activity: A cross-sectional study of university and vocational college students]. *Japanese Journal of Health Promotion for Successful Aging*, 7, 1-12.
- Nakai, A., Adachi, N., Tanaka, M., & Yoshinaka, Y. (2021 November 19-21). *Rogaining no katsudo no tanoshisa no hyokashakudo no kaiatsu* [Development of a scale to evaluate enjoyment of rogaining activities, Paper presentation]. The 51st Annual Conference of the Japan Society of Leisure and Recreation Studies, Kyoto, Japan.
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68–78. <https://doi.org/10.1037/0003-066X.55.1.68>
- Scanlan, T. K., & Simons, J. P. (1992). The construct of sport enjoyment. In G. C. Roberts (Ed.), *Motivation in sport and exercise* (pp. 199-215). Human Kinetics.
- Scanlan, T. K., Carpenter, P. J., Simons, J. P., Schmidt, G. W., & Keeler, B. (1993). An introduction to the sport commitment model. *Journal of Sport and Exercise Psychology*, 15(1), 1-15. <https://doi.org/10.1123/jsep.15.1.1>