The method of expert evaluation of specific abilities to practice judo – proposition of Japanese top level university judo coaches

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Abstract

Background & Study Aim: This study's aim was a rating scale that assists managers in determining judo practitioners' abilities absent information derived from competition outcomes. This was carried out by gathering and analyzing factors considered important by judo coaches when evaluating such abilities.

Material & Methods: Investigation I: seven judo experts, all currently active in judo instruction and ranked 4th dan or greater by the Kodokan Judo Institute of Japan, conferred to produce a list of 20 markers that indicate how an individual will perform in competition. Each item was rated with a score from between 1 (least important) and 10 (most important) by the 48 judo coaches that were to participate in the 2011 Japan Nationwide University Weight Categorized Judo Championships. Investigation II: the criteria assembled in Investigation I were applied to a university intramural judo tournament to assess their validity and reliability.

Results: Eleven of the criteria identified in Investigation I were eliminated, narrowing the rating scale factors to the following nine items: general motor ability, mental toughness, attention to form, stamina, tactics, assertiveness of the athlete in applying kumi-te, proper kumi-te style, standing defense, and mat skills. High correlation coefficients between the predicted and actual competition rank, predicted competition rank and rank derived from the rating form, and actual competition rank and rank derived from the rating form were confirmed (r = 0.807, 0.821 and 0.705, respectively, p < 0.001 for all; Spearman's Rank Test).

Conclusions: The nine rating items selected in this study met specified standards of validity and reliability. The results suggested that the approaches taken by judo coaches in assessing practitioners' ability are appropriate and contribute to the quality of judo not only in Japan.

Keywords: combat sports · direct confrontation · judo coaching · reliability · selection for tournament · subjective evaluation · validity

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INTRODUCTION

Skill level in competitive games and races is generally determined by a win or a loss. However, determination of individual competitors' abilities varies according to the nature of the sport. For example, in some sports such as track and field events or swimming, performance is measurable in terms of completion time of a specific distance travelled. In performance sports, such gymnastics and figure skating, scores are awarded through judges' subjective evaluation of the competitors' skill level. In various ball sports, which are predominantly team oriented, outcomes can be considered an evaluation of the team's ability, but not of the individual athletes. Athletes in team sports are evaluated and selected to the team based on the criteria deemed important by the coaches. In direct confrontation, such as judo or kendo, the relative skill level of an athlete can be determined by head-to-head competition, but to ascertain skill level in the absence of competition is difficult. Judo athletes in particular do not compete regularly because of increasing incidence of injuries resulting from differences in physical strength among athletes. Consequently, as with the evaluation of players in team sports, the abilities of individual judo practitioners are determined and their relative skill levels decided based on their coaches' subjective evaluation. (The bolded words put to the glossary, explaining them in max. 40 words)

Sato et al. noted that in applied disciplines, where the objective is to provide an advantage in actual competition, the incorporation of sport experts' experiential knowledge into the science of the sport is fundamental [1]. The number of medals won by Japanese competitors in judo competitions and Olympic Games indicates their relatively high skill level. However, the approaches used by judo coaches in Japan to evaluate and guide their athletes are not clearly understood. Clarifying these would assist in the betterment of coaching methods in Japan and beyond.

Matsumoto describes judo ability as being a synergy among the practitioner's physical strength, mental strength, and preparation applied to both of these areas [2]. However, the study does not provide a detailed explanation of the fundamental elements from which these areas are comprised. Thus, the evaluation techniques used by coaches remain obscure.

Nakamura et al. found a comparatively higher level of trunk torsion power in high-torsion positions among a group of high level judo competitors [3]. Maekawa et al. administered the Diagnostic Inventory of Psychological Competitive Ability for Athletes (DIPCA) and the Taikyo Sport Motivation Inventory (TSMI) to university judo athletes to determine psychological aptitude and found it to be higher among athletes who compete at higher levels [4]. Sanchez et al. clarified that handgrip strength of the different podium placement winners was statistically different in females (p=0.001) but not in males (p=0.198) among the 102 judokas (71 male and 31 female) in the 15 to 19 age class competing in the Junior Championship of Galicia 2008 in Spain [5]. However, all of these studies examined only a single variable and so were too narrowly focused.

Hirose et al. examined judo teams' strength in competitive context using the Analytic Hierarchy Process (AHP) model [6, 7] and Kinoshita used the AHP to estimate the judo athletes' strength [8]. Although the AHP model is effective for estimating athletic ability based on the scores awarded in competition, its reliance on data derived from competitions makes it unsuitable for routine athletic evaluation. It is recommended that a rating scale be developed to enable athletes' ability to be monitored in the context of routine training and coaching activities. This study attempted to create such a scale by assembling indicators used by coaches in their competition selection processes. After the rating scale's development, its validity was confirmed by examining the following correlation coefficients: rank predicted in advance of the competition and actual competition rank, rank predicted in advance of the competition and rank derived from the rating form, and actual competition rank and rank derived from the rating form.

This study's aim was a rating scale that assists managers in determining judo practitioners' abilities absent information derived from competition outcomes.

MATERIAL AND METHODS

Investigation I
Participants and evaluative factors
Seven judo experts, all currently active in judo instruction and ranked ≥ 4th dan (degree of black belt) by the Kodokan Judo Institute of Japan (men's7th dan, n = 1; 6th dan, n = 2 ; women's 6th dan, n = 1; 5th dan, n = 2; 4th dan, n = 1) conferred to produce a list of 20 evaluative factors for university judo practitioners: years of university attended, height, weight, current practice environment, high school alma mater, high school athletic career, university athletic career, regional preliminary results, preferred technique, dan grade, years as an athlete, general motor ability (muscular strength, endurance, and speed), mental toughness, attention

to form, stamina, tactics, assertiveness of the athlete in applying kumi-te, proper kumi-te style, standing defense, and mat skills. (Bold two words above for glossary)

Participants and questionnaire (response method)

The purpose of this part of study was explained to 48 university judo coaches (whose teams participated in the 2011 Japan Nationwide University Weight Categorized Judo Championships) the aim and methods of this research project. They were provided with questionnaires, and written consent to participate in the study was attained. Participants were assured that utmost consideration would be given to protecting their identity so that they would remain anonymous. The completed questionnaires were subsequently collected by mail.

The questionnaire asked the coaches how important each factor was to them when assessing a judo practitioner's ability. Each item was rated with a score from between 1 (least important) and 10 (most important) by the coaches. The coaches were asked to provide absolute ratings for all of the items.

The 48 coaches were then assigned to upper (n = 12) and lower (n = 12) quartiles based on their total scores for all items and a good-poor analysis was performed.

Investigation II

The coaches rated 128 male and 26 female athletes who participated in intramural tournaments on a 5-point scale for each of the nine items selected in Investigation I, and the total score was calculated for each athlete. General motor ability, mental toughness, attention to form, stamina, tactics, assertiveness of the athlete in applying kumi-te, proper kumi-te style, standing defense, and mat skills were the factors assessed. Because competitions are comprised of individual weight classes at each organization, ranks were assigned based on the total score for each weight class and organization.

The accuracy of the factors in determining ability as outlined in Investigation I was assessed in the context of an actual intramural judo tournament.

Survey participants

The questionnaire was distributed to 1 coach from J university men's judo club and 2 coaches from K university, one from the men's judo club and the other from the women's judo club. Each held intramural tournaments used to select athletes that would compete in the 2012 All Japan University Weight Categorized Judo Championship district playoffs.

Procedure

(1) Tournament outcomes predicted by coaches
The coaches' predictions in regard to each weight class' outcomes (order of finals) were collected by mail.

(2) Ranking according to rating total
One week after the coaches' predictions regarding the tournament outcomes were submitted, they rated the athletes to determine who would participate in the intramural tournament (128 male and 26 female athletes) using a 5-point scale for each item selected in Investigation I, with the total score calculated for each athlete. Athletes in each weight class were then ranked in descending order by this score. The ratings were completed for all athletes before the start of the tournament.

(3) Actual tournament outcomes
Ranks were assigned according to the actual outcomes for each weight class in the tournament.

Statistical analysis

Data from the questionnaires were entered into an Excel spreadsheet (Microsoft Corporation, Redmond, WA, USA) and then means, standard deviations, frequencies, relative frequencies, item-total correlation and goodness-of-fit tests were calculated.

The correlation coefficients from the three data sets were analyzed. Specifically, rank predicted by the coaches, actual tournament rank, and rank derived from the total rating scores were statistically analyzed using Spearman's rank correlation coefficient by SPSS Statistics 21 for Windows (IBM, San Jose, CA, USA). The level of statistical significance was set at $p < 0.05$ for all analyses. Tokunaga's criterion of ≥ 0.3 or 0.4 [9].

The item analysis was assessed using item-total correlation (I-T) analyse to determine the discrimination power of each item by calculating the coefficient of correlations between each item's score and the total score. Discrimination power indicates how accurately each item represents the participants' attributes [10].

RESULTS

A ceiling or floor effect was not found for the mean and SD of any of the items. Each item's normality of distribution was assessed using a goodness-of-fit test. Only height and weight were normally distributed (Table 1).

Table 1. Means, variability (SD), Frequencies, and Relative Frequencies for Each Evaluating Indicators

Evaluation Indicators	M	SD	Frequencies										Relative frequencies									
			1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
Years of university attended	3.27	2.15	15	6	8	3	9	2	3	2	0	0	0.31	0.13	0.17	0.06	0.19	0.04	0.06	0.04	0.00	0.00
Height	4.73	2.28	7	1	6	8	8	5	7	5	1	0	0.15	0.02	0.13	0.17	0.17	0.10	0.15	0.10	0.02	0.00
Weight	5.02	2.56	7	3	5	4	6	7	7	5	4	0	0.15	0.06	0.10	0.08	0.13	0.15	0.15	0.10	0.08	0.00
Current practice environment	6.35	2.50	5	1	0	4	3	6	11	11	4	3	0.10	0.02	0.00	0.08	0.06	0.13	0.23	0.23	0.08	0.06
High school alma mater	5.08	2.35	6	2	5	5	7	6	9	7	1	0	0.13	0.04	0.10	0.10	0.15	0.13	0.19	0.15	0.02	0.00
High school athletic career	6.46	2.25	3	0	2	3	7	7	5	13	7	1	0.06	0.00	0.04	0.06	0.15	0.15	0.10	0.27	0.15	0.02
University athletic career	7.56	2.14	2	0	1	0	4	4	8	11	10	8	0.04	0.00	0.02	0.00	0.08	0.08	0.17	0.23	0.21	0.17
Regional preliminary results	7.00	1.95	1	1	1	0	7	8	5	15	8	2	0.02	0.02	0.02	0.00	0.15	0.17	0.10	0.31	0.17	0.04
Preferred Techniques	5.31	2.64	6	4	5	1	5	9	6	9	1	2	0.13	0.08	0.10	0.02	0.10	0.19	0.13	0.19	0.02	0.04
Dan grade	2.81	1.95	20	4	10	1	7	4	2	0	0	0	0.42	0.08	0.21	0.02	0.15	0.08	0.04	0.00	0.00	0.00
Years as an athlete	3.96	2.10	9	6	7	2	10	8	6	0	0	0	0.19	0.13	0.15	0.04	0.21	0.17	0.13	0.00	0.00	0.00
General motor ability	8.31	1.43	0	0	0	0	1	6	6	12	10	13	0.00	0.00	0.00	0.00	0.02	0.13	0.13	0.25	0.21	0.27
Mental toughness	8.88	1.06	0	0	0	0	0	1	4	12	14	17	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.29	0.35
Attention to form	8.04	1.64	0	0	0	1	3	4	9	12	6	13	0.00	0.00	0.00	0.02	0.06	0.08	0.19	0.25	0.13	0.27
Stamina	8.25	1.62	0	0	1	1	1	2	7	14	9	13	0.00	0.00	0.02	0.02	0.02	0.04	0.15	0.29	0.19	0.27
Tactics	8.10	1.40	0	0	0	0	2	4	10	13	9	10	0.00	0.00	0.00	0.00	0.04	0.08	0.21	0.27	0.19	0.21
Assertiveness of the athlete in applying kumi-te	8.04	1.62	0	1	0	0	3	2	7	16	10	9	0.00	0.02	0.00	0.00	0.06	0.04	0.15	0.33	0.21	0.19
Proper kumi-te style	6.65	1.93	0	3	0	4	4	8	11	12	4	2	0.00	0.06	0.00	0.08	0.08	0.17	0.23	0.25	0.08	0.04
Standing defense	7.67	1.58	0	1	0	0	2	5	14	13	6	7	0.00	0.02	0.00	0.00	0.04	0.10	0.29	0.27	0.13	0.15
Mat skills	7.83	1.60	0	1	1	0	0	4	11	15	10	6	0.00	0.02	0.02	0.00	0.00	0.08	0.23	0.31	0.21	0.13

Significant differences were observed for all items. The item analysis was then assessed using item-total correlation (I-T) analyses to determine the discrimination power of each item by calculating the coefficient of correlations between each item's score and the total score. The correlation coefficients ranged from 0.43 to 0.79, which met Tokunaga's criterion of ≥ 0.3 or 0.4 (Table 2). These findings validated the method and showed high internal consistency.

As expected, the distribution of many items was skewed rightwards, because the items were those considered important by the seven judo experts conducting the study, and the data were therefore unlikely to be normally distributed. Leftward skewing of distribution would indicate that the item was not important when considering judo ability. Because this study aimed to determine important factors in judging judo ability, these items were re-examined. They included years of university attended and dan grade, with means of around 3.00. Items that scored 1 out of 10, (that is, considered least important) included years of university attended, height, weight, current practice environment, high school alma mater, years as an athlete, high school athletic career, university athletic career, regional preliminary results, preferred techniques and dan grade. The items that received the lowest importance ratings were considered unlikely to be effective indicators of ability and were therefore excluded. This narrowed the number of items to general motor ability, mental toughness, attention to form, stamina, tactics, assertiveness of the athlete in applying kumi-te, proper kumi-te style , standing defense, and mat skills (Figure 1).

The high correlation coefficients between the predicted and actual competition ranks, predicted competition rank and rank derived from the rating form,

Table 2. Indicators evaluating by couches from upper (UQ) and lower (LQ) quartiles

| Evaluation Indicators	UQ Mean	UQ SD	LQ Mean	LQ SD	Good-poor Analysis	I-T Analysis
	(n = 12)		(n = 12)			
Years of university attended	4.58	1.93	1.75	0.87	p<0.001	0.523
Height	6.83	1.40	2.33	1.67	p<0.001	0.794
Weight	6.67	1.61	2.08	1.56	p<0.001	0.723
Current practice environment	8.00	1.60	4.17	2.52	p<0.001	0.596
High school alma mater	6.83	1.11	2.92	1.88	p<0.001	0.627
High school athletic career	7.83	1.11	4.33	2.10	p<0.001	0.611
University athletic career	9.17	1.03	6.50	1.83	p<0.001	0.564
Regional preliminary results	8.42	1.08	5.50	1.78	p<0.001	0.582
Preferred Techniques	6.92	1.31	2.17	1.19	p<0.001	0.665
Dan grade	3.58	2.35	1.67	1.50	p<0.05	0.442
Years as an athlete	5.67	1.44	2.67	1.83	p<0.001	0.550
General motor ability	9.58	0.67	7.42	1.78	p<0.01	0.585
Mental toughness	9.58	0.51	8.42	1.44	p<0.05	0.431
Attention to form	9.42	0.67	6.83	1.59	p<0.001	0.648
Stamina	9.58	0.51	7.33	2.27	p<0.01	0.529
Tactics	9.33	0.78	6.92	1.44	p<0.001	0.611
Assertiveness of the athlete in applying kumi-te	9.42	0.79	6.58	1.88	p<0.001	0.627
Proper kumi-te style	8.50	0.90	4.92	2.11	p<0.001	0.689
Standing defense	9.17	0.94	6.83	1.75	p<0.001	0.556
Mat skills	9.17	0.83	6.33	1.92	p<0.001	0.651
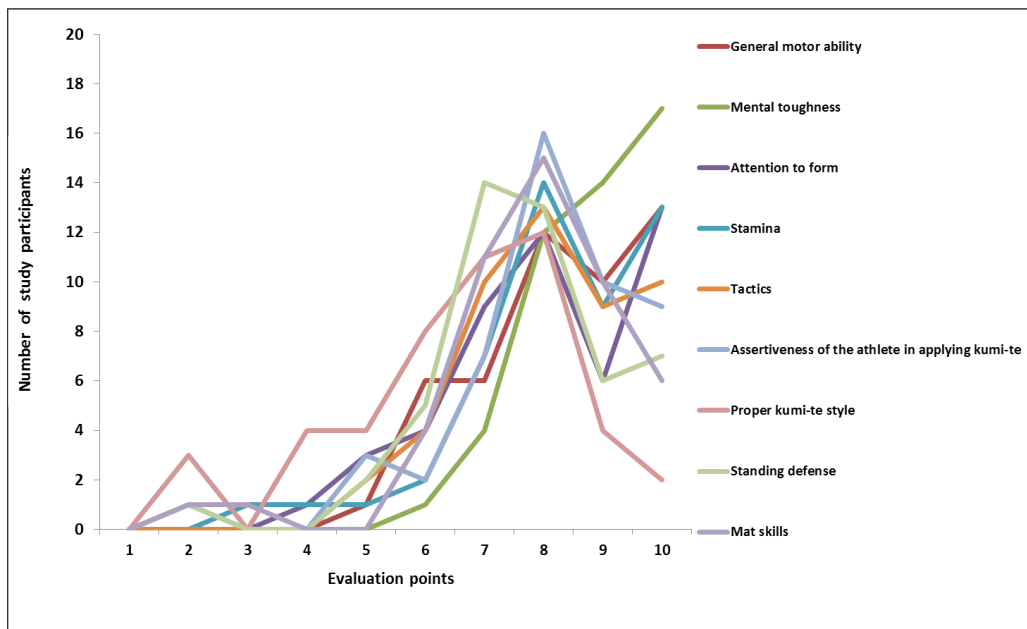
Figure1. Frequencies of each factor on rating scale

and actual competition rank and rank derived from the rating form were confirmed (Table 3).

Table 3. Spearman's Rank Correlation between Actual Competition Outcomes and Those Predicted by Coaches (each p<0.001)

Variable	1	2
1. Rank derived from the rating form	-	-
2. Actual competition rank	0.705	-
3. Predicted competition rank	0.821	0.807

These findings indicated that the reliability and validity of the rating scale used in this study were high. They also indicate that the approaches taken by judo coaches in Japan to rate ability are appropriate.

DISCUSSION

The nine items selected by the study conductors accurately reflected variables considered important by coaches in their evaluation of athletes and could act as a framework for evaluation of judo ability in the absence of data derived from competition.

Hirose et al. stated that tactical maneuvers aimed at gaining an advantage in kumi-te are important for increasing technique effectiveness and significantly influence competition outcomes [11, 12]. The present findings lend support to this viewpoint and also support previous findings that mental and physical factors are important in determining competition outcomes [1].

Based on these considerations, it was concluded that the nine items could be used to assess university judo competitors in the absence of competition results.

The high correlation coefficient between the predicted and actual competition outcomes suggests that the approaches taken by coaches to select their athletes for competition are correct and that experiential knowledge is important. Coaching not only requires extensive knowledge of the sport in question, but the approaches used to gauge athletic ability are also important.

The coefficient of correlation between the predicted outcomes and rank derived from the rating form was high even though the outcomes were predicted one week before the intermural tournament, despite the fact that injury and mental changes altered performance during that time. In addition, the outcomes predicted one week before the event and the rank

derived from the rating form suggest that the coaches' assessments were highly stable.

The high correlation between the rank derived from the rating form and the actual outcome of competition indicated that the rating scale provided specific levels of validity and reliability.

It was inferred that coaches in Japan accurately assess ability using the rating items and thus are appropriate. Training that focuses on the items identified as judo ability criteria herein can be expected to improve the judo ability of those who partake in such training. Specifically, these findings will enable more effective judo coaching through creation of training methods derived from the nine rating items identified in this study.

Although the study showed that the rating scale provided specific levels of reliability and validity, it did not address its practicality. Therefore, its usefulness and practicality should be considered along with other scales such as the International Judo Federation rankings.

Evaluation of the factors determining the success of sports in judo is considered from different perspectives, especially in the articles published in the Archives of Budo. We emphasize this fact, because results of studies Peset et al. [13] provide evidence that the Archives of Budo (first published in 2005), among academic journals qualified for a homogeneous group of sports sciences and sports medicine, is a leader in terms of number of papers on judo (published over the last 55 years). What is more, the dominating topic in this journal is judo (33% of the articles in the period 2005-2013) [15]. A similar trend can be seen in articles published in the new branch journal Archives of Budo Science of Martial Arts and Extreme Sports [16, 17]. Thus, results presented in this article and in these two journals can be inspiring for researchers dealing with these issues in relation to other combat sports.

CONCLUSION

The nine rating items selected in this study met specific standards of validity and reliability. The results suggested that the approaches taken by judo coaches in assessing practitioners' ability are appropriate and contribute to the quality of judo not only in Japan. Consequently, training programs should focus on improving the abilities upon which the rating scale variables are based. This will contribute to new and improved methods in judo coaching.

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