Validity of the sports emotional intelligence scale among taekwondo players.

Kuam Hyung[1], Jung-Hoon Nam[2*], Jong-Hwan Park[3], Sun-Kyoung Lee[4]

[1]Department of Sport for All, Jang-An University, Republic of Korea

[2]Department of Sport Health Care Science, Sang Myung University, Republic of Korea

[3]Institute of Convergence Bio-Health, Dong-A University, Republic of Korea

[4]Department of Life Physical Education, Myongji University, Republic of Korea

Abstract

The purpose of this study was to explore the factor structure of the Sports Emotional Intelligence Scale to develop a revised scale of sports emotional intelligence using a sample of taekwondo players by analyzing its validity and reliability. Before administering the Sports Emotional Intelligence Scale, translation/back-translation procedures and content validity checks were done to assess its cultural appropriateness for use in the Korean context. Data were collected (N=923) by random sampling. These data were analyzed using descriptive statistics, comprehensive exploratory factor analysis, confirmatory factor analysis, and the measurement invariance test. The significance level was set at .05. The factor structure of the Sports Emotional Intelligence Scale revealed four factors (appraisal of others emotions, social skills, utilization of emotion, and appraisal of own emotions) and thirteen items. The model's fit satisfied the criteria for acceptability, and the factor showed satisfactory/good convergent and discriminant validity. The validity of the Sports Emotional Intelligence Scale was adequate, and the measurement invariance test by gender showed that there was a cross validation. The scope of research investigations on emotional intelligence should be broadened to include athletes from other sporting events to examine the role of emotional intelligence in the performance of athletes in various competitive situations.

Introduction

The emotions that players in competitive situations experience is the organized response to events that occur inside or outside of oneself, and is a means to increasing the individual's tangible/intangible resources [1,2]. Recently, emotion has been highly regarded as a strategy for performance enhancement [3]. However, viewpoints about the concept of emotion and its importance have changed over time. The earlier studies on emotion have regarded it as a source of hindrance or disturbance, suggesting the biological viewpoint that defines emotion as a biological reaction to environmental surroundings. However, research findings have indicated a relationship between emotion and cognition [4,5]; and interesting studies on this relationship have generated knowledge and new approaches to emotion. Studies on the relationship between cognition and emotion can be broadly divided into three viewpoints: (1) emotion promotes cognitive activity [5]; (2) cognition can control and regulate emotional experience [4]; and (3) emotional capabilities can perform cognitive functions that effectively treat information about the surroundings and correlate with cognition and activity [6].

Recent studies on emotion have focused on emotional intelligence, which is considered a dynamic concept, based on the theory of multiple intelligences, which means that even emotion has a cognitive function.

In the field of sports, emotion is used as a criterion to predict behavioral tendencies or the performance of athletes [7]. Athletes may experience various emotions during their training or events, and their emotional control, emotional regulation, and the characteristics of their experience will determine their behavioral tendencies and performance [8,9]. Strategies to maximize their capacity for emotional control are needed in addition to skills training for optimal performance. Therefore, athletes' performance is closely related to EI, considering that EI can maximize the individual's capacity for emotional self-control [10]. Studies on the athletic performance of taekwondo players [11], have found that the players with high levels of athletic performance evaluate other players' emotional situations quickly, and are able to control and use their emotions. They have to evaluate other players' emotional situations quickly because changes in emotion, which players must recognize, are diverse, and victory in this sport depends

Special Section: Health Science and Bio Convergence Technology

on competing against other players. However, as mentioned earlier, the studies on EI, specifically, on emotional self-control, have examined only the importance of athletic performance.

Only a study conducted by Yoo [12] proposed a concept and structure of EI for Korean players. Yoo [12] renamed "players' EI" as "sports EI," based on his exploratory research findings on athletes' EI, and proposed that the construct or factors for "sports EI" are cognition, management, and utilization of emotion, which are the same construct factors proposed by Lane et al. [13], and based on Korean and international studies of EI [13-16]. In addition, Lane et al. [13] emphasized the need to develop a scale to measure sports EI in follow-up studies. Therefore, this study will develop an EI scale for taekwondo players, based on the conceptual construct and the EI scale proposed [12,13].

Methods

Participants

The participants of this study were 25 persons in a specialists group (ages: 21–46 years; males: 17, females: 8) and 898 persons in the taekwondo players group (ages: 15–28 years; males: 603, females: 295) (Table 1). The specialists group comprised researchers with published work (e.g., peer-reviewed journals and presentations at academic conferences) in the fields of psychological skills or emotions related to sports, language specialists with a good command of English and Korean, and players and coaches on the national team. The taekwondo players' group comprised players from middle school, high school, university, business, and national teams. After obtaining ethical approval from the first author's institution, athletes were recruited using different approaches (e.g., e-mail invitations, invitations at lectures). Student-athletes could complete either an online version or a pencil-paper version of the Sports Emotional Intelligence Scale [13]. They completed the measure either before or after formal lectures while the other participants (national team players) completed the measure at their respective training sessions. Evidence shows that online surveys have become a popular method of data collection in psychology, and it has been suggested that online research is equivalent to traditional research conducted offline (i.e., paper-pencil [PP] methods) [13,17].

Table 1. Participants.

item	career	Number		total
		Male	Female	
Experts' conference	Researcher, athlete, coach	17	8	25
	Translator			
Pilot study	Middle/High School, University, Business team	57	18	75
CEFA	Middle/High School, University, Business team	224	131	355
CFA	Middle/High School, University, Business team	155	111	266
Measurement equivalence test	Middle/High School, University, Business team	167	35	202

Twenty-five specialists, including researchers on emotion, taekwondo athletes, coaches, and translators participated in a specialist conference. A pilot test was completed by 75 athletes to verify the normality and reliability of the items. In order to verify the construct validity of the SEIS, CEFA (n=355) and CFA (n=266) were performed and 202 athletes participated in the measurement invariance test to analyze the verification on measurement instrument. CEFA: Comprehensive Exploratory Factor Analysis; CFA: Confirmatory Factor Analysis.

Instrument

The present study tested the validity of the SEIS among taekwondo athletes. The SEIS, developed by Lane [13], was a revised version of the Emotional Intelligence Scale (EIS) [18]. The validity of the SEIS was verified among athletes and sports participants. A preliminary version of the Korean translation of the scale, using the translation and review procedures, was developed, and then the final version was completed to examine its construct validity with taekwondo athletes. This scale consists of five factors (appraisal of others' emotions, social skills, utilization of emotions, appraisal of own emotions, and regulation), with 19 items that use a 7-point Likert-type scale.

Procedures

For verifying the validity of the SEIS among taekwondo players, its content validity, factor structure, and validity were examined in this order. First, the content validity was assessed using translation and back-translation procedures by language specialists with a good command of the two languages. Content validity was appraised by the specialists group, using the five-factor structure (appraisal of others' emotions, appraisal of own emotions, regulation, social skills, and utilization of emotion) outlined by Lane et al. [13] to check each item's content with each factor and the ability explained by each factor. Item normality and reliability were analyzed using descriptive statistics and reliability analysis. The questionnaires used in the exploratory factor analysis after the pilot-test; following which, the survey was conducted. After the pilot-test, an exploratory factor analysis using comprehensive exploratory factor analysis (CEFA) was performed to examine the factor structure of the SEIS among the taekwondo players. Thereafter, confirmatory factor analysis (CFA) was performed to verify the suitability of the factors of the SEIS that were extracted in the exploratory factor analysis. Finally, a measurement equivalence test was conducted to examine the validity of the SEIS of the taekwondo players that were extracted by the CEFA and CFA.

Statistical analysis

The data were analyzed using SPSS 21.0 and CefaTool 3.04. The normality and reliability of the data were examined by descriptive statistics and reliability analysis, using SPSS 21.0. The factor structure of the SEIS was explored using exploratory factor analysis performed with CefaTool 3.04, and the suitability of the explored factor structure of the SEIS was verified using AMOS 21.0. Furthermore, the validity of the SEIS was analyzed by the measurement equivalence test, using AMOS 21.0.

Results

Content validity

The content validity of the scale was examined by appraising each translated item's ability to explain EI well. Athletes' and coaches' abilities to understand the contents of each item also were assessed. The explanatory power of the items on each factor of EI was evaluated by the researchers from the specialists group and coaches from the national teams; and the contents of the items and the degree to which they were understandable, were appraised by all the members of the specialists group. These results are presented in Table 2, which shows that the explanatory power was acceptable. None of the players had problems understanding the contents of the items.

Construct validity

Factor validity, as proposed in the research study by Lane et al., 2009, was evaluated using descriptive statistics, reliability analysis, EFA, CFA, and the measurement equivalence test. The normality of the items was appraised by analysing the mean, ratio of responses, kurtosis, and skewness. For the exploratory factor analysis, χ^2, df, and RMSEA on 2-5 factors were compared. For CFA, the fit index from the EFA was evaluated. The descriptive statistics of the normality of items 19, 115, and 119 showed that they violated the assumption of normality in the measurement equivalence test, showing that the ratio of the responses was greater than 50% in the measurement equivalence test. The reliability analysis showed that items 14, 110 and 114 reduced the reliability of the overall scale. Therefore, these items were excluded from the factor analysis of the SEIS. EFA was performed using CEFA, which was proposed as the most effective method of square rotation [19,20]. Regarding the results of the EFA, the number of factors was decided on the basis of the χ^2, RMSEA, and TLI indices (Table 3).

Table 2. *Assessment of content validity of items on the EIS.*

Item	Explanation power			Level of difficulty		
Appraisal of others emotion	Good	Normal	Bad	Easy	Normal	Hard
By looking at their facial expressions, I recognize the emotions people are experiencing	21	4		17	8	
When another person tells me about an important event in his or her life, I almost feel as though I have experienced this event myself	18	7		21	4	
I know what other people are feeling just by looking at them	20	5		16	9	
It is difficult for me to understand why people feel the way they do	19	6		18	7	
I can tell how people are feeling by listening to the tone of their voice	19	6		21	4	
Appraisal of own emotions	Good	Normal	Bad	Easy	Normal	Hard
I am aware of my emotions as I experience them	20	5		18	7	
I know why my emotions change	20	5		19	11	
I easily recognize my emotions as I experience them	19	6		21	11	
Regulation	Good	Normal	Bad	Easy	Normal	Hard
I have control over my emotions	18	7		24	1	
I seek out activities that make me happy	19	6		22	3	
Social Skills	Good	Normal	Bad	Easy	Normal	Hard
I like to share my emotions with others	17	8		23	2	
I arrange events others enjoy	14	11		22	3	
I help other people feel better when they are down	19	6		23	2	
Utilization of emotion	Good	Normal	Bad	Easy	Normal	Hard

When my mood changes, I see new possibilities	18	8	22	3
When I experience a positive emotion, I know how to make it last	16	9	24	1
When I am in a positive mood, solving problems is easy for me	16	9	21	4
When I am in a positive mood, I am able to come up with new ideas	15	10	24	1
When I feel a change in emotions, I tend to come up with new ideas	21	4	23	2
I use good moods to help myself keep trying in the face of obstacles	24	1	24	1

The explanation power and level of difficulty of the items were analyzed to verify their content validity. The explanation power of the items is a measure of the level of consensus of the items, and the items' level of difficulty measures the degree of understanding of the items by the taekwondo athletes. The explanation power of the items regarding emotion intelligence was favorable. The items' level of difficulty indicated that that the taekwondo athletes had an above-average understanding of the items' content. EIS: Emotional Intelligence Scale.

Table 3. *Results of the CEFA on the EIS.*

Factor	x^2	Df	TLI	RMSEA
0	4343.00	171		.263
1	1392.86	152	.665	.152
2	898.47	134	.766	.127
3	646.64	117	.814	.113
4	312.86	101	.914	.077
5	278.58	92	.917	.076

	Appraisal of others emotion	Social Skills	Utilization of emotion	Appraisal of own emotions	α
I1	.86	.01	.01	.01	.83
I2	.77	.20	-.02	-.01	
I3	.74	-.01	.02	.02	
I5	.44	.10	.05	.07	
I11	.01	.73	.02	.06	.78
I12	.01	.81	.03	-.06	
I13	.09	.53	-.01	.22	
I16	.18	-.07	.76	.02	.90
I17	.03	.03	.94	-.01	
I18	-.07	.15	.78	.01	
I6	.27	-.01	.07	.54	.86
I7	.03	.02	.01	.84	
I8	-.04	.01	-.01	.93	

	Appraisal of others emotion	Social Skills	Utilization of emotion	Appraisal of own emotions
Appraisal of others emotion	1.00			
Social Skills	.49	1.00		
Utilization of emotion	.52	.49	1.00	
Appraisal of own emotions	.41	.44	.47	1.00

After appraising the model's fit regarding the number of factors, the 4-factor and 5-factor structure met the criteria for acceptability, and the models' fit were similar. Thus, the factor structure of the 4-factor scale, the minimum number of factors, with 13-items was decided upon as the factor structure of the SEIS for taekwondo athletes. CEFA: Comprehensive; Exploratory Factor Analysis; SEIS: Sports Emotional Intelligence Scale.

The results showed that the RMSEA and TLI indices satisfied the criteria for being acceptable for fit [21,22]. However, there was no change in the fit between the 4-factor and 5-factor structure, considering that the difference in RMSEA between 4 and 5-factor structures was less than .01. Thus, the 4-factor and 13-item structure was chosen as the final factor structure of the SEIS. The names chosen for the factors were identical to the names to describe emotion intelligence that were used by Lane et al. [13], showing that the items comprising the factors were the same as those used to define emotional intelligence [13]. The reliability of the factors ranged from 0.78 to 0.90.

The CFA was performed in order to verify the suitability of the factor structure extracted from the exploratory factor analysis. The results of the CFA showed that the indices of the model satisfied the criteria for fit as shown in Table 4. After the convergent and discriminant validity of the construct of emotional intelligence were examined, the Average Variance Extracted (AVE) was found to be greater than 0.50, and the difference in the χ^2 values between the restricted and non-restricted model was larger than 3.84. Thus, the construct of emotional intelligence had convergent and discriminant validity.

Table 4. *Results of CFA on the EIS.*

latent variable	Route	Observed variable	Standard Estimate	S.E.	C.R.	AVE
Appraisal of others emotion	→	I4	0.65			0.86
		I3	0.79	0.13	11.08	
		I2	0.84	0.12	11.64	
		I1	0.85	0.13	11.76	
Social Skills	→	I7	0.92			0.96
		I6	0.90	0.04	22.64	

		I5	0.79	0.04	17.30	
Utilization of emotion	→	I10	0.78			0.91
		I9	0.71	0.08	10.96	
		I8	0.76	0.08	11.60	
Appraisal of own emotion	→	I13	0.83			0.95
		I12	0.94	0.06	19.97	
		I11	0.87	0.06	17.91	

CFA model	χ^2	df	RMSEA	TLI	GFI
	114.63	59	0.060	0.96	0.93

Different of χ^2

Unconstrained model		Constrained model	
χ^2	df	χ^2	df
129.42	60	114.63	59

Constrained model χ^2-Unconstrained model χ^2=14.79>3.84 (Δ df=1. χ^2, p=0.05)

The appraisal of fit on the factor structure of the Emotional Intelligence Scale was performed using CFA, and then its convergent and discriminant validity were appraised. The fit of the 4-factor and 13-item structure met the criteria for acceptance, and the convergent and discriminant validity were adequate. CFA: Confirmatory Factor Analysis.

Finally, the measurement equivalence test was conducted to assess the cross-validation of the SEIS. The measurement equivalence tests for the configural invariance, metric invariance, and scalar invariance were performed using multi-group CFA. As shown in Table 5, there was no significant difference in the χ^2 between the non-restricted and restricted model, after the multi-group CFA by gender was performed. Thus, the SEIS had a cross validation.

Table 5. *Results of the multi-group CFA.*

Model		χ^2	df	CFI	RMSEA	TLI	Δχ^2	p
1	Unconstrained	214.93	118	0.97	0.055	0.96		0.001
2	Measurement weight	224.41	127	0.97	0.053	0.96	Δχ^2(9)= 9.48	0.000
3	Measurement intercepts	226.76	128	0.97	0.053	0.96	Δχ^2(10)=11.83	0.001
4	Structural covariance	236.81	137	0.97	0.051	0.96	Δχ^2(19)=21.88	0.002
5	Measurement residuals	253.58	150	0.96	0.057	0.96	Δχ^2(32)=38.65	0.002

In order to analyze the validity of the EIS, the measurement invariance test was performed. The cross validity of the EIS was present, considering that there was no significant difference of the χ^2 values between the models. CFA: Confirmatory Factor Analysis; EIS: Emotional Intelligence Scale.

Discussion

A prompt and accurate evaluation of one's own emotions and other's emotions, together with the ability to use emotions are important in taekwondo, a sport in which victory is determined by fighting with another player. Hence, a grasp of the degrees of emotional intelligence is essential to understand and predict the athletic performance of taekwondo players. Nevertheless, there was no scale to measure the EI of taekwondo players up to this point. For this reason, the present study was based on the concept of emotional intelligence, and the model proposed by Yoo [12] and Lane et al. [13] to develop the SEIS to understand and predict the athletic performance of Korean taekwondo players.

Prior to this study, the factor structure had mainly been explored in Korean studies on scale development using principle component analysis and Varimax rotation. These methods of examining factor structures did not consider correlations among factors, which gave rise to overestimation or underestimation of the number of factors during the exploration process [23]. In addition, there were unrealistic assumptions about which measurement error was not considered, and the fit of the explored factor structures was not examined [24-26]. Therefore, the factor structure of EI was explored in this study, by the maximum likelihood method of EFA [20,27] which is more effective than squared rotation. Therefore, the 4-factor and 13-item scale was extracted using EFA. CFA was performed in order to verify the suitability, convergent validity, and discriminant validity of the extracted factor structure. The result shows that the validity of the factor structure (4 factors and 13 items), satisfied the criteria for acceptability, and had a satisfactory/good convergent and discriminant validity. Finally, there was a cross validity in the measurement invariance test by gender that was performed to verify the validity of the scale for use among taekwondo players, and the scale was found to be valid. (i.e., the validity of the scale was shown to be adequate). For this reason, the 4-factor 13-item structure of the Emotional Intelligence Scale was chosen. The structure of the SEIS for taekwondo players in this study was slightly different from the factor structure found in the scale developed by Lane et al. [13].

A finding of this study was that emotional self-control, one of the four factors of EI (emotion appraisal, emotion utilization, emotional self-control, and social skills), presented by Lane et al. [13] was not extracted in the SEIS. These results may have occurred due to two reasons. One reason might be related to the taekwondo players' characteristics, and the other one, to their failure to consider the possibility of emotional self-control as a factor. First, the items measuring emotional self-control did not meet the criteria of normality and reliability during the process of examining the SEIS. This situation means that the taekwondo players' responses to the items on emotional self-control were an aberration, and they did not consider emotional self-control as a part of emotional intelligence. It could have also been caused by the shortage of items, which measured the factor of emotional self-control on the scale developed by Lane et al. [13]. Zwick and Velicer [23] proposed three items as a

minimum standard for the number of items that comprise the factors on a scale. They asserted that three or more items are needed to ensure the reliability and suitability of the factors. However, various opinions have been expressed about this assertion in follow-up studies regarding scale development. That is to say, the reliability and suitability of a factor structure is decided by participants' responses to the items rather than the number of items that measure the factor [28]. Therefore, it is a reasonable conjecture that the characteristics of the taekwondo players were the reason why emotional self-control was not extracted from the SEIS.

Suggestions for follow-up studies are as follows. This study is meaningful to the degree that the SEIS was developed for use among Korean athletes, although studies of EI in Korean taekwondo athletes have not been considered rigorous, compared to foreign studies. Therefore, in order to have an empirical understanding of the performance of Korean taekwondo players, further studies verifying the relationship among the psychological factors that determine EI and athletic performance should be conducted. Furthermore, the scope of research investigations on EI should be broadened to include other sports in addition to taekwondo, to examine the role of emotional intelligence in competitive situations.

Acknowledgement

References

1. Nowotny H. Women in public life in Australia, in C. Fuchs Epstein and R. Laub Coser (Eds) Access to Power: Cross-National Studies of Women and Elites. London: George Allen and Unwin, 1981.

2. Thompson RA. Emotion regulation. Biol Behav Consider 1994; 59: 25-52.

3. Lane AM, Thelwell RC, Lowther J, Devonport TJ. Emotional intelligence and psychological skills use among athletes. Social Behavior and Personality 2009; 37: 195-202.

4. Lazarus RS. On the primacy of cognition. Am Psychologist 1984; 39: 124-129.

5. Zajonc RB. On the primacy of affect. Am Psychologists 1984; 39: 117-123.

6. Salovey P, Mayer JD. Emotional intelligence. Imaginat Cognit Personal 1990; 9: 185-211.

7. Jung HD. The Effects of Taekwondo upon Elementary School Students' Desirable Peer-Relation Formation and Emotional Intelligence. Taekwondo J Kukkiwon 2010; 1: 75-86.

8. Nam JH, Lee MS, Kim HB. Relationship Among Self Management, Sport Emotion and Sport Motivation of

Collegiate Athletes. Korean J Physical Edu 2010; 50: 111-127.

9. Park DS, Kim SM. The relationship among basic psychological need, emotional, and intention of exercise adherence of college student athletes. J Korean Soc Study Physical Edu 2011; 16: 197-209.

10. Lyons JB, Schneider TR. The influence of emotional intelligence on performance. Personality Individual Differences 2005; 39: 693-703.

11. Moon BK, Lee KY, Kim BY. The Relationships of Taekwondo Training on the Manner, Emotion Intelligence, and Sociability for the Elementary School's Student. J Sport Leisure Studies 2011; 43: 1033-1042.

12. Yoo J. Exploring the Sport Emotional Intelligence Model and Measurement. Korean J Sport Psychol 2010; 21: 1-22.

13. Lane AM, Meyer BB, Devonport TJ, Davies KA, Thelwell R, Gill GS, Diehl CD, Wilson M, Weston N. Validity of the emotional intelligence scale for use in sport. J Sports Sci Med 2009; 8: 289-295.

14. Hanin YL. Emotions in sport: current issues and perspectives. In G. Tenenbaum & R. C. Eklund (3rd Eds.), Handbook of sport psychology, 2007.

15. Ravizza K. Increasing awareness for sport performance. In J. M. Williams (Ed.), Applied sport psychology,148-155. Mountain View, CA: Mayfeild Publishing Company, 1993.

16. Mayer JD, Salovey P. What is emotional intelligence? In P. Salovey & D. J. Sluyter (Eds.), Emotional development and emotional intelligence, 3-31. New York: Basic Books, 1997.

17. Lonsdale C, Hodge K, Rose EA. Pixels vs. Paper: Comparing Online and Traditional Survey Methods in Sport Psychology. J Sport Exercise Psychol 2006; 28: 100-108.

18. Schutte NS, Malouff JM, Hall LE, Haggerty D, Cooper JT, Golden C, Dornheim L. Development and validation of a measure of emotional intelligence. Personality Individual Differences 1998; 25: 167-177.

19. Sass DA, Schmitt TA. A Comparative Investigation of Rotation Criteria Within Exploratory Factor Analysis. Multivariate Behav Res 2009; 45: 73-103.

20. Lee SM. A review of CEFA software: Comprehensive Exploratory Factor Analysis Program. Int J Testing 2010; 10: 95-103.

21. Bentler PM. Comparative Fit Indexes in Structural Models. Psychological Bulletin 1990; 107: 238-46.

22. Hu LT, Bentler PM. Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus New Alternatives. Structural Equation Modeling 1999; 6: 1-55.

23. Zwick WR, Velicer WF. Comparison of five rules for determining the number of components to retain. Psychological Bulletin 1986; 99: 432-442.

24. Fabrigar LR, Wegener DT, MacCallum RC, Strahan EJ. Evaluating the use of exploratory factor analysis in psychological research. Psychol Methods 1999; 4: 272-299.

25. Hong S, Malik ML, Lee M. Testing configural, metric, scalar, and latent mean invariance across genders in sociotropy and autonomy using a non-western sample. Edu Psychol Measure 2003; 63: 636-654.

26. Park HS, Dailey RM, Lemus D. The use of exploratory factor analysis and principle components analysis in communication research. Human Commun Res 2002; 28: 562-577.

27. https://www.va.gov/trm/ToolPage.asp?tid=8305

28. Bakeman R, Gottman, JM. Observing interation:an introduction to sequential analysis. London: Cambridge University Press, 1986.

*Correspondence to

Jung-Hoon Nam

Department of Sport Health Care Science

Sang Myung University

Republic of Korea