Confirmatory Factor Analysis of the Self-Confidence Scale among Beginner Badminton Child-Athletes

A Pilot Study

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Abstract: This study aims to determine the factorial validity and reliability of the self-confidence scale (SCS) in learning or training badminton context. The study was conducted on 304 beginner badminton child-athletes aged 10-12 (M_{age} =11.24; SD_{years} =2.8) in West Java. SCS developed as an adaptation of the Multidimensional Model of Sport Confidence (MMSC), consisting of cognitive efficiency dimension (CE-D), physical skill and training dimension (PST-D), and resilience dimension (R-D). All data analysed using internal consistency reliability estimates of Cronbachs alpha and Confirmatory factor analysis (CFA) for the factorial validity. In accordance with the results of the analysis, there are 41 items that build construct of SCS and those items that valid and reliable to measure the self confidence of the beginner badminton child-athletes in training or learning badminton.

1 INTRODUCTION

Self-confidence is "individuals' beliefs about their abilities or their expectations about achieving success based on those abilities" (Vealey and Chase, 2008). In the context of sport activities in beginner child-athletes group, self-confidence means the child-athletes' beliefs in their abilities to achieve goals set based on their capabilities (Hidayat, 2016). Self-confidence belongs one of important psychological parameters of participation in sport (Adegbesan, 2007), it holds an important part of success in sport performance and proven to influent sport behavior, attitude and achievement (Cox et al., 2010).

In accordance with self-efficacy theory in social cognitive perspective, self-confidence can be seen as a dynamic property, rather than static default (Hidayat and Budiman, 2014), therefore self-confidence which at first was an undimentional construct (Vealey, 1986; Fogarty et al., 2016) has developed to become multidimentional construct known as The Multidimensional Model of Sport Confidence or MMSC (Vealey and Chase, 2008; Thomas et al., 2011a). Within the model, there are nine sources of confidence; mastery, demonstration of ability (domains of achievement), physical and mental preparation and physical self-presentation (domains of self-regulation), social support, vicarious experience, coach's leadership, environmental comfort, and situational favorableness (domains of social climate).

Moreover, three kinds of self-confidences are also described, i.e. cognitive efficiency dimension (CE-D), physical skill and training dimension (PST-D), and resilience dimension (R-D). CE-D relates to the athletes' level of beliefs toward their ability to being able to mentally focus and concentrate, to take right decision, and to maintain their minds for the success of their performance. Meanwhile R-D relates to the athletes' level of beliefs toward their ability to being able to focus on correcting error after unsatisfied performance, being able to overcome doubts and being able to display their best performances. The sources and kinds of self-confidence are influenced by the athletes' different individuals' characteristics (value, attitude, personality), demographic characteristics (age, gender, ethnic, culture), sport organization culture and community (competition level, motivation climate, and aim of program).

Up to this moment, the measurement of self confidence in sport activities has been performed by many studies, especially those that relate to the exploration of sources of confidence, while the measurement of the three kinds and dimensions of

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self confidence is still limited, unless the study conducted by Vealey and Knight (2002), Hidayat and Sukadiyanto (2012), and Frischknecht et al. (2016). In addition, this measurement was limitly performed to adult-elite athletes and unspecific sport branch. To that point, it is a strategic need to develop instrument that measures beginner child-athletes' level of self confidence in certain sport, including badminton. It is based on two main considerations; first, the relevance between instrument which developed with the phases of subject cognition ability, both in language or used format (Whaley, 2007) and the existence of children's skill limitation in understanding terminologies and concept used in instrument for adults. As a result, a valid and reliable instrument for adults or adult-elite athletes will not be valid and reliable for beginner child-athletes (Stadulist et al., 2002).

In accordance with the main ideas of the discussion above, therefore this pilot study is based on the aim to arrange and develop self-confidence scale (SCS) for beginner child-athletes in badminton. Not only owing the fact of the two reasons above, but also this SCS arrangement and development is based on beliefs and empiric evidences that self-confidence as a psychological parameter covaried with other psychological parameters in relation to the improvement of study and performance (Hidayat and Budiman, 2014).

2 METHODS

2.1 Subject

The total of subjects was 304 people, with the ages of 10 to 12 years old (M_{age} =11.24; SD_{years} =2.8) consisting of subjects for limited trial and language compatibility (N = 26 people) and 278 people for empirical estimation (M_{age} =11.25, SD_{years} =1.8) consisting of 123 female beginner child-athletes (M_{age} = 11.22, SD_{years} = 1.4) and 155 male beginner child-athletes (M_{age} = 11.32, SD_{years} = 1.6) came from 21 badminton clubs/schools spread in 14 Cities/Regencies in West Java. The subjects were selected and determined using purposive sampling technique (Johnshon and Christensen, 2012) in accordance with inclusive criteria of male and female beginner child-athletes, with the ages of 10 to 12 years old, registered and actively engaged in the badminton club's or school's exercises in West Java and actively participated in the exercise within 1 to 2 years.

2.2 Procedure

Determining measured domain area. The developed SCS referred to the conceptual model of self confidence in sport which was proposed by Vealey and Chase (2008) and pilot study of Hidayat and Sukadiyanto (2012), built by three kinds of self-confidence (dimension); CE-D, PST-D, and R-D. CE-D consisted of the indicator of attentional focus (AF-I), making the right decision (MRD-I), and managing mind to achieve success (MMAS-I). PST-D consisted of the indicator of mastering physical ability (MPA-I) and mastering technique skills(MTS-I). While R-D related to the level of athletes' beliefs in their abilities to stay focus / focusing (F-I), correcting errors after unsatisfied performances (CE-I), being able to overcome doubts (OD-I) and being able to display best performance (DBP-I).

Item Recording. The total of developed items were 48 items from three dimensions and eight indicators. CE-D consisted of three indicators (18 items), PST-D consisted of two indicators (12 items), and R-D consisted of three indicators (18 items). SCS items were recorded in the form of declarative statement format which displayed subjects' feeling condition after exercising within certain period of time. The format of the response was displayed in the form of alternative choices of given answers, that is (A) = Agree, (E) = Abstain, and (DA) = Disagree. Score of each motion answer was from1 to 3. While scoring for favorable items was 3 score for 'Agree,' 2 score for 'Abstain,' and 1 score for 'Disagree,' and it went conversely for unfavorable items. The higher the score achieved by the subject in each item was, the higher self confidence that the subject had, vice versa.

Item Analysis. Item Analysis was done through the phases of: (1) the analysis toward the result data of limited trial (26 beginner athletes), (2) the analysis of language validation by three Bahasa panel expert judges (PEJ), (3) the analysis of content validation by five PEJ and (4) the analysis of empirical validation toward 278 badminton beginner athletes with the age of 10 to 12 years old (123 female beginner athletes and 155 male beginner athletes) came from came from 21 badminton clubs/schools spread in 14 Cities/Regencies in West Java.

2.3 Second Section

The result data of limited trial (N = 26) and language validation test were analysed by using percentage descriptive analysis technique, content validity was

estimated by using Aiken's analysis formula technique (Thomas et al., 2011b), factorial validity was estimated by using confirmatory factor analysis technique/CFA (Goodwin, 1999; Gregory, 2007; Sporis et al., 2010), and internal reliability consistency was estimated by using Alpha Cronbach coefficient analysis technique (Lacy, 2011; Azwar, 2012).

3 RESULT

Table 1: Descriptive Statistic and The Analysis Result of Content and Language Validation of SCS.

Item	Mean ± SD	SE	Item	Mean ± SD	SE	Item	Mean ± SD	SE
Item_1	4.71 ± 0.49	.18	Item_17	4.71 ±0.49	.18	Item_33	4.14 ±1.07	.40
Item_2	4.57 ± 0.53	.20	Item_18	4.43 ± 0.53	.20	Item_34	4.57 ± 0.53	.20
Item_3	4.29 ± 0.49	.18	Item_19	4.29 ± 0.49	.18	Item_35	4.29 ± 0.49	.18
Item_4	4.43 ± 0.53	.20	Item_20	4.43 ± 0.53	.20	Item_36	4.29 ± 1.11	.42
Item_5	4.71 ± 0.49	.18	Item_21	4.57 ± 0.53	.20	Item_37	4.57 ± 0.53	.20
Item_6	4.71 ± 0.49	.18	Item_22	4.57 ± 0.53	.20	Item_38	4.71 ± 0.49	.18
Item_7	4.29 ± 0.49	.18	Item_23	4.71 ±0.49	.18	Item_39	4.29 ± 0.49	.18
Item_8	4.43 ± 0.53	.20	Item_24	4.43 ± 0.53	.20	Item_40	4.43 ± 0.53	.20
Item_9	4.71 ± 0.49	.18	Item_25	4.00±1.00	.38	Item_41	4.57 ±0.53	.20
Item_10	4.57 ± 0.53	.20	Item_26	4.57 ± 0.53	.20	Item_42	4.29 ± 0.49	.18
Item_11	4.29 ± 0.49	.18	Item_27	4.29 ± 0.49	.18	Item_43	4.43 ± 0.53	.20
Item_12	4.29 ± 0.49	.18	Item_28	4.29 ± 0.49	.18	Item_44	4.14 ± 1.07	.40
Item_13	4.71 ± 0.49	.18	Item_29	4.43 ± 0.53	.20	Item_45	4.43 ± 0.53	.20
Item_14	4.57 ± 0.53	.20	Item_30	4.71 ± 0.49	.18	Item_46	4.71 ± 0.49	.18
Item_15	4.43 ± 0.53	.20	Item_31	4.71 ±0.49	.18	Item_47	4.43 ± 0.53	.20
Item_16	4.43 ± 0.53	.20	Item_32	4.43 ± 0.53	.20	Item_48	4.71 ± 0.49	.18

Note: M = Mean; SD=Standard deviation; SE=Standard error; CVCI= Content validity coefficient index.

For the analysis result of limited trial (N=26), the level of subjects' understanding toward word and sentence used reached 83.09%. The result of language validation by three PEJ resulted conforming range from 53.33% to 100% and the achievement of overall compatibility = 83.89%. The result of scale content validation using Aiken V formula was CVCI = .75 to.93, .86 for CE-D (F-I = .87; MRD-I = .88; MMAS-I = .83),.86 for PST-D (MPA-I = .83,MTS-I = .89), and .88 for R-D (CE-I = .92; OD-I = .87, and DBP-I = .87). The analysis of estimated internal reliability consistency resulted the Alpha Cronbach coefficient index of SCS = .90 (48 items), CE-D =.75 (18 items), PST-D =.70 (12 items), and R-D=.78 (18 items).

From the analysis result of matrix correlation, KMO MSA value was obtained =.79 >.50 (sig. = .00) on the value of Bartlett's Test of Sphericity = 8814.79, df = 1128, and alpha = .05 (5%), however on the value of anti-image correlation, it was found that four items that had the value of MSA < 0.5 was item 19, 31, 34 and 42. The four items were not valid to be used in the factorial analysis and had to be eliminated from the next analysis. After eliminating these four items, the result of KMO MSA was obtained = .81(sig.= .00) on the value of Bartlett's Test of Sphericity with Chi-Square approach = 8014.41, df = 946, alpha = .05 (5%), and all items had the value of anti-image > 5.0. Therefore, the assumption of analysis factor was achieved and no item was necessary to eliminate

The next step was performing extraction factor using principle components analysis method. The result showed that all items of SCS were formed into eight significant components (factor) with the value of initial total of eigenvalues >1 (λ= 10.296), and the percentage of total variant was 23.401 %. The result of item selection on table 2 showed the spread of loading factor (FL) of each item after rotation, and there were three items that had the FL value <.50, that is item 7, 22, and 44, as a result, there were 41 items which had FL value > .50 (.51 to .81) and therefore they were valid

According to the selection result and item spread of each dimension and indicator on table 2, SCS was constructed by 15 items of CE-D (6 items of F-I, 4 items of MRD-I, and 5 items of MMAS-I), 11 items of PST-D (5 items of MPA-I and 6 items of MTS-I), as well as 15 items of R-D (5 items of CE-I, 4 items of OD-I, and 6 items of DBP-I).

Table 2: Item Selection Based on FL Value.

Item	F1	F2	F3	F4	F3	F6	F7	F8	Item	F1	F2	F3	F4	F5	F6	F7	F8
item_2	.57								item_40		.78						
item_3	.69								item_46		.64						
item_6	.74								item_45		.65						
item_10	.78								item_8		.61						
item_11	.72								item_15			.51					
item_12	.73								***item_22***			***.49***					
item_13	.67								item_27			.68					
item_16	.68								item_36			.72					
item_21	.57								***item_7***				***.23***				
item_23	.67								item_32				.79				
item_24	.57								item_33				.78				
item_28	.65								item_35				.78				
item_29	.56								***item_44***				***.38***				
item_37	.66								item_5					.52			
item_38	.69								item_9					.69			
item_41	.71								item_20					.51			
item_43	.67								item_25					.68			
item_48	.58								item_14						.77		
item_47	.63								item_17						.77		
item_1		.58							item_30							.73	
item_4		.81							item_26							.60	
item_39		.75							item_18								.68

Note: score limit FL>.5; F1-F8 = factor 1 - factor 8

4 DISCUSSION

Based on the analysis result of limited trial (N = 26), it was obtained that 83.09% subject comprehended word and sentences used in SCS. This result was emphasized by the language validation result by three PEJ, 83.89%. Along with the two results, it could be interpreted that the use of language in SCS scale was relevant with the subject's level of cognitive skill (Whaley, 2007), both from terminology aspect or used aspect (Stardulist, et al., 2002). Alternatively, the sentence used in SCS could be comprehended by the subjects, along with the aim of limited trial and language validation, which was for examining and ensuring that the sentences used in the scale were comprehended by the subjects. In the process, however, there were still ambiguous words which were uncomprehend by the subjects. It was recommended for the words to be changed or eliminated, including to correct the structure of the sentences. This compatibility was critical, owing the fact that an instrument (including psychological scale) was only valid and reliable if it was relevant with the subject's level of cognitive skill.

The analysis result of content validity from five PEJ was obtained all scales of CVCI > .50 as well as for the entire, each dimension and each indicator of SCS. Along with the analysis result, all validity coefficient scale was >.5, and according to Thomas, et al., (2011b), an instrument fulfills the criteria of content validity, if CVCI>.5. Therefore, the items of SCS were valid entirely, on each dimension, or on each indicator. These whole scales of CVCI verified the relevance among behavior items which were developed with the measurement aim of developed scale. It was also relevant with the aim of content validation result, which was to estimate the level of relevance among behavior items which were developed with the measurement aim of scale. Alternatively, the behavior items developed in SCS could reflect measured behavior.

Based on the analysis result of internal consistency reliability estimation, Alpha Cronbach coefficient index was obtaining; SCS = .90 (48 items), CE-D =.75 (18 items), PST-D = .70 (12 items), and R-D= .78 (18 items). The entire scale of reliability coefficient index was ≥ .70 (.70 to .90), and along with the criteria of reliability proposed by Lam and Zang (2002) and Azwar (2012), that an instrument is reliable if it has reliability coefficient index >.7, therefore SCS was proven to be reliable, both entirely or for each dimension, owing the fact that the entire reliability estimation scales was ≥.70(.70 to .90), Fleiss (1981) categorized it into instrument that has ideal reliability.

Along with the result of CFA, there were 41 valid items and 7 (seven) invalid items, consisted of 4 items (19, 31, 34, and 42) which had MSA value of <.50 and 3 items (7, 22, and 44) which had FL value of < .50. The first four items did not meet the assumption of analysis factor and the two second invalid items were claimed as the items which were unable to measure its theoretical latent construct. While the 41 valid items were claimed as items which were able to give reliance that indicator measurement taken from the sample illustrated the actual score in the population. The 41 valid items

were formed into eight significant factors (table 2) and spread on each dimension and SCS indicator based on FL value of each indicator, as illustrated by table 3.

Table 3: The Result of Selection and Item Spread of Every Dimension and SCS Indicator Based on FL Value.

Dimension, Indicator Item	Factor loading	Dimension, Indicator Item	Factor loading
A. CE-D(15 item)			
1. F-I (6 item)		5. MTS-I (6 item)	
Item 1	.58	Item 5	.52
Item 9	.57	Item 13	.67
Item 17	.77	Item 21	.57
Item 25	.68	Item 29	.56
Item 33	.78	Item 37	.66
Item 41	.71	Item 45	.65
		C. R-D (15 item)	
2. MRD-I (4 item)		6. CE-I (5 item)	
Item 2	.57	Item 6	.74
Item 10	.78	Item 14	.77
Item 18	.68	***Item 22***	***.49***
Item 26	.60	Item 30	.77
Item 34	**.41 (MSA)**	Item 38	.67
Item 42	**.37 (MSA)**	Item 46	.64
3. MMAS-I (5 item)		7. OD-I (4 item)	
Item 3	.69	***Item 7***	***.23***
Item 11	.72	Item 15	.51
Item 19	**.29 (MSA)**	Item 23	.67
Item 27	.51	Item 31	**.31 (MSA)**
Item 35	.78	Item 39	.75
Item 43	.67	Item 47	.63
B. PST-D (11 item)			
4. MPA-I (5 item)		8. DBP-I (6 item)	
Item 4	.81	Item 8	.61
Item 12	.73	Item 16	.68
Item 20	.51	Item 24	.57
Item 28	.65	Item 32	.79
Item 36	.72	Item 40	.78
Item 44	***.38***	Item 48	.58

Along with the result of CFA on table 3, there were four items did not meet the assumption of factor analysis and three items were invalid. The seven items informed the quality of the items that has not shown the measurement of the indicator accurately or it has not been able to show its theoretical latent construct. Ghozali (2009) stated that invalid item is the item that has the scale value of construct validity still cannot give reliance perfectly that indicator that is arranged and developed from sample illustrates the actual score in population. Apart from the researcher's weakness in arranging and developing qualified items, the diversity of demographic variable condition, such as age, gender, and the duration of exercise resulted invalid items, so that the reading power and absorbing power of heterogen subject not only because of the item's uniqueness but also because of the existence of demographic variable diversity.

In the previous research, this demographic variable diversity is necessary to observe and control. Not only owing the fact that demographic variable's interaction with the measurement and treatment program (Thomas et al., 2011b), but also it guarantees the integrity of the process and the result of measurement. Furthermore, the construct of self-confidence covaries with other psychological parameters related to the improvement of study and performance (Hidayat and Budiman, 2014), it requires an early detection to its fragile characteristic (Vealey and Chase, 2008). As well as it needs to be developed as "robust sport confidence" (Thomas, et al., 2011a) through various key strategies (Beaumont et al., 2015).

5 CONCLUSIONS

There are 41 items that can be used for measuring the beginner child-athletes' level of self confidence in the process of badminton basic skill exercise. The 41SCS items are constructed by 15 items of CE-D (6 items of F-I,4 items of MRD-I, and 5 items of MMAS-I), 11 items of PST-D (5 items of MPA-I and 6 items of MTS-I), as well as 15 items of R-D (5 items of CE-I, 4 items of OD-I, and 6 items of DBP-I). The 41 items require further test in various condition and subjects, so that more valid and reliable items are obtained.

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