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Dynamic balance test modifications in Karate Kata: Content validity

Wedi S[1], Andri Gemaini[2*], Fauzi[3], Trisnar Adi Prabowo[4]

[1] Department of Sports Coaching Education, Faculty of Teacher Training and Education, Riau University, Pekanbaru/Riau, Indonesia.

[2] Department Health and Recreation, Universitas Negeri Padang, Padang, Indonesia.

[3] Faculty of Sport and Health Sciences, Yogyakarta State University, Yogyakarta, Indonesia.

[4] Faculty of Education, Program Study of Physical Education, Universitas Muhammadiyah Brebes, Indonesia.

* Correspondence: Andri Gemaini; andrigemaini@fik.unp.ac.id

ABSTRACT

The aim of this study was to test the content validity of the modified Karate Kata dynamic balance test. This research employed a mixed-methods approach. The first stage involved analyzing journal documents, while the second stage focused on validating the dynamic balance test construction through expert judgment, using the Delphi technique with 10 experts. In the final stage, a qualitative analysis was carried out consisting of suggestions from expert judgment. The instrument consists of a questionnaire with a 1–4 rating scale. Data were analyzed using Aiken's V. In the first stage, the results showed differences among the tests used to measure athletes' dynamic balance abilities. Based on these findings, the dynamic balance test was modified. In the second stage, the analysis of the first test item revealed a coefficient value of 0.825 (high). The second item, which assessed conformity with the characteristics of Karate Kata movements, had a coefficient value of 0.792 (moderate). The third item, evaluating the dynamic balance test procedure, had a coefficient value of 0.819 (high). The Karate Kata dynamic balance test demonstrated high content validity (coefficient = 0.812), with all experts agreeing on the modifications. The test is now more specific and better aligned with Karate Kata movement characteristics.

KEYWORDS

Dynamic Balance Test; Karate; Kata; Content Validity

1. INTRODUCTION

Karate is one of the most popular combat sports from Japan with more than 10 million athletes and 100 million practitioners worldwide that uses only hands without weapons to defeat opponents (Danardono et al., 2022; Gauchard et al., 2018). Karate competition consists of attacking and defending using punches and kicks with high power and speed (Kabadayı et al., 2022; Najmi et al., 2018). There are two categories of matches in Karate competition, namely Kumite and Kata, where kata matches are a series of basic technical movements carried out in a certain order with defensive and offensive movements without the presence of an opponent, which are carried out individually or in groups for 60-80 seconds (Emad et al., 2020; Widyastuti et al., 2024).

Meanwhile, Kumite is a match or fight with strict rules between two athletes for 3 minutes with high intensity where they are free to move kicks and punches and make quick moves to avoid the opponent's attacks (Nedeljkovic et al., 2017). To achieve a high level of performance in karate martial arts is determined by physical fitness, basic techniques, tactics, and good mental conditions (Przybylski et al., 2021; Vveinhardt & Kaspare, 2022; Wijayanti et al., 2024; Mandan et al., 2024). In addition, functional and motor skills such as flexibility, muscle strength, agility, speed, reaction time, coordination and balance must also be at a high level (GÜLER et al., 2017; Pal, 2020; Almas et al., 2023; Hikmah et al., 2023).

Balance is a biomotor component of an important physical condition in karate (Pal et al., 2021; Zago et al., 2015). Balance is a basic motor skill in everyday life and sports that includes complex neural networks (Arias-Poblete et al., 2023; Abdel-Aziem et al., 2024). Static and dynamic balance will help athletes achieve their best performance (Zago et al., 2015). In Karate sports, especially in Kata category competition, balance is needed to be able to maintain body position so as not to fall when carrying out fast and powerful movements. To determine the ability of an athlete's dynamic balance is carried out by means of an assessment using a good test instrument. An instrument is a tool used to measure an object or measure and collect data from a variable. An instrument is said to be good if it is valid and reliable (Matondang, 2019), meaning that the instrument used must match the characteristics of the Karate Kata.

However, in reality, the instruments used for dynamic balance are less valid and reliable. This is reinforced by the results of previous studies to measure dynamic balance in karate, namely by using modified instruments, Star Excursion Balance Test, Y dynamic balance, quiet standing and LOS test, One-Leg Standing Balance, Bass Test and Bass Stick static balance (Molinaro et al., 2020;

Pal et al., 2021; Słomka et al., 2019; Turkeri et al., 2019). So far, dynamic balance instruments have not specifically focused on the movement characteristics of Karate Kata. Therefore, a valid test is needed to measure dynamic balance in the Karate Kata (Kovacikova & Zemková, 2021). This study aims to test and analyze the content validity of the Karate Kata dynamic balance test, with the expectation that this research will help measure dynamic balance in Karate Kata.

2. METHODS

This study used mixed methods, namely qualitative and quantitative methods, which mean combining quantitative and qualitative research method becomes a research concept that is carried out sequentially and simultaneously for a more in-depth study (Kovacikova & Zemková, 2021; Susiono et al., 2024; Putro et al., 2025). This research has several stages, namely the first stage was to design and develop a draft of a dynamic balance test construction hypothetically or conceptually with a qualitative approach using the literature review method with the type of narrative review (Ferrari, 2015) with the subject of articles, journals and reference books related to dynamic balance test instruments on existing Karate Kata. This is used to develop conceptual and operational definitions of the Karate Kata dynamic balance test instrument.

The second stage is the content validity using the Delphi technique (Cox et al., 2016; Green, 2014; Qowiyyuridho et al., 2021; Putro et al., 2025). This technique is an assessment of expert judgment (Ilham & Tomoliyus, 2021) without meeting each other when assessing the construction of the dynamic balance test design in Kata karate until accepted without further improvement (Frankel et al., 2011) dynamic balance test instrument by providing a coefficient value. This research subjects were ten experts with qualifications: 4 academic experts, and 6 professional experts, namely nationally certified Karate Kata trainers. Then, the experts were presented with the dynamic balance instrument test, a short video and a questionnaire about the dynamic balance test procedure. Then, the experts will assess the content validity of the dynamic balance Karate Kata as a dynamic balance test for Karatean Kata athletes using the questionnaire scale 1 to 4, namely score 1 = not relevant, 2 = quite relevant, 3 = relevant, and 4 = higly relevant and for data collection using Google Forms.

The results will be analyzed using Aiken's V (Aiken, 1985) as follows:

$$\text{V Aiken's: } \frac{\sum S}{n\,(c-1)}$$

S : r – lo
Lo : lowest rating score
C : highest rating score
r : the score given by the assessor

3. RESULTS

The first stage results from the literature review and analyzed documents form 9 articles from international journals found that the definition of dynamic balance karate is the body's ability to keep a stand and not fall when it changes in the direction of each movement or when performing high-speed movements. There is different instrument of tests used to measure the dynamic balance abilities of karate athletes. The article can be seen in Table 1:

Table 1. Article review source

No	Title	Journal
1	Balance ability and athletic performance	Sports Medicine (2015)
2	The Evaluation of balance performance for elite male karate athletes after fatigue	International Journal of Sport, Exercise & Training Sciences (2017)
3	Ikarate: Karate Kata guidance system	Procedia Computer Science (2020)
4	Assessing the effects of kata and kumite techniques on physical performance in elite karatekas	Sensors (Switzerland 2020)
5	Effect of Plyometrics and Pilates Training on Dynamic Balance and Core Strength of Karate Players	Journal of Clinical and Diagnostic Research (2021)
6	Morphological and motor fitness determinants of shotokan karate performance	International Journal of Environmental Research and Public Health (2021)
7	Dynamic balance in elite karateka	Journal of Electromyography and Kinesiology (2015)
8	Assessment of Anaerobic Power and Balance among Elite Indian Under-19 Football Players	International Journal of Science and Research (2015)
9	Comparison of Balance, Reaction Time, Attention and Bmi Values in Individual and Team Sports	Journal of Education and Learning (2019)

Based on previous research, a dynamic balance Karate Kata test was modified which required supporting equipment, namely a large space or mattress, 5 cones, a whistle, and a stopwatch and also needed 3 tester with their respective duties, namely one person as the giver of instructions, one person as the holder of the stopwatch, and one person as the recorder and and the reporter of the test

results. The modified Karate Kata dynamic balance instrument construction as shown in Figure 1 below.

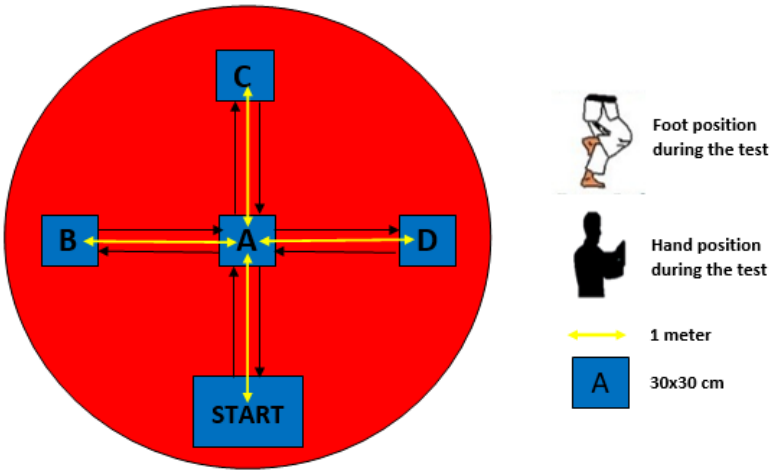

Figure 1. Dynamic balance Karate Kata instrument construction

To measure the dynamic balance of Karate Kata with the instruments that have been developed are as follows: 1) Testee stands with two feet in the Start Position; 2) When the Tester gives the command "Start", Testee steps to Position A with the right foot and maintains the Position for 5 seconds which is counted by the Tester; 3) From Position A Testee steps to Position B with the left foot and maintains the position for 5 seconds; 4) From Position B Testee steps back to Position A with Right foot as support and maintains position for 5 seconds; 5) From Position A Testee steps to Position C with left foot as support and maintains position for 5 seconds; 6) From Position C Testee steps back to Position A with Right foot as support and maintains position for 5 seconds; 7) From Position A Testee steps to Position D with left foot as support and maintains position for 5 seconds; 8) From Position D Testee steps back to Position A with Right foot as support and maintains position for 5 seconds; 9) From Position A Testee steps back to the START line with both feet as support; 10) The total time of the test is the time to maintain the body in each position plus 1 second for locking each position = 42 seconds. The athlete will perform three attempts and the best time of the three attempts will be recorded.

3.1. Content Validation Test Results with Aiken Formula

The second stage is to test the content validity of the modified dynamic balance test using the Delphi technique (Cox et al., 2016; Green, 2014. The research subjects were ten experts with qualifications: 4 academic experts, and 6 professional experts, namely nationally certified Karate

Kata trainers. Then the data collected will be analyzed using Aiken's calculation analysis with the results shown in Table 2.

Table 2. Aspects of image design display content validity results

		Evaluator													
Aspect 1		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**∑s**	**n(c-1)**	**V**	**Value**
Item 1	Score	3	4	3	4	4	4	4	3	4	4	27	30	0,9	High
	s	2	3	2	3	3	3	3	2	3	3				
Item 2	Score	3	4	3	3	3	4	4	3	3	3	23	30	0,767	Moderate
	s	2	3	2	2	2	3	3	2	2	2				
Item 3	Score	3	4	3	4	3	4	4	4	3	4	26	30	0,867	High
	s	2	3	2	3	2	3	3	3	2	3				
Item 4	Score	3	4	3	4	4	3	3	3	3	3	23	30	0,767	Moderate
	s	2	3	2	3	3	2	2	2	2	2				
Item 1-4	**Score**	**12**	**16**	**12**	**15**	**14**	**15**	**15**	**13**	**13**	**14**	**99**		**0,825**	**High**
	s	**8**	**12**	**8**	**11**	**10**	**11**	**11**	**9**	**9**	**10**				

Based on Table 2, content validity results of ten experts on the first aspect, namely dynamic balance test image design, it was found that this aspect has a coefficient value, 0,825 (High). Then, the aspect of suitability of the test with the characteristics of the movement of the Karate Kata can be seen in Table 3.

Table 3. Content validity results of the Karate Kata test for movement characteristics

		Evaluator													
Aspect 2		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**∑s**	**n(c-1)**	**V**	**Value**
Item 1	Score	3	4	3	4	3	4	4	3	4	4	26	30	0,867	High
	s	2	3	2	3	2	3	3	2	3	3				
Item 2	Score	3	4	3	3	3	3	4	4	3	4	24	30	0,8	High
	s	2	3	2	2	2	2	3	3	2	3				
Item 3	Score	3	4	3	3	4	4	3	3	3	3	23	30	0,767	Moderate
	s	2	3	2	2	3	3	2	2	2	2				
Item 4	Score	3	4	3	3	3	4	3	3	3	3	22	30	0,733	Moderate
	s	2	3	2	2	2	3	2	2	2	2				
Item 1-4	**Score**	**12**	**16**	**12**	**13**	**13**	**15**	**14**	**13**	**13**	**14**	**95**		**0,792**	**Moderate**
	s	**8**	**12**	**8**	**9**	**9**	**11**	**10**	**9**	**9**	**10**				

Based on Table 3, content validity results of ten experts on the second aspect namely suitable aspects of the test with Karate Kata characteristics movements, it was found that this aspect has a coefficient value 0,792 (Moderate). Then, the aspect of test procedures can be seen in Table 4.

Table 4. Key aspects of test procedures

Aspect 3		Evaluator 1	2	3	4	5	6	7	8	9	10	∑s	n(c-1)	V	Value
Item 1	Score	4	4	4	3	3	4	4	4	3	4	27	30	0,9	High
	s	3	3	3	2	2	3	3	3	2	3				
Item 2	Score	3	4	4	3	4	4	4	4	4	4	28	30	0,933	High
	s	2	3	3	2	3	3	3	3	3	3				
Item 3	Score	4	4	4	4	4	4	4	3	4	4	29	30	0,967	High
	s	3	3	3	3	3	3	3	2	3	3				
Item 4	Score	4	4	3	4	3	4	3	4	4	4	27	30	0,9	High
	s	3	3	2	3	2	3	2	3	3	3				
Item 5	Score	4	4	4	3	3	3	4	4	4	3	26	30	0,867	High
	s	3	3	3	2	2	2	3	3	3	2				
Item 6	Score	3	4	3	4	3	4	3	4	3	3	24	30	0,8	High
	s	2	3	2	3	2	3	2	3	2	2				
Item 7	Score	3	4	3	3	3	4	3	4	3	3	23	30	0,767	Moderate
	s	2	3	2	2	2	3	2	3	2	2				
Item 8	Score	3	4	3	3	3	4	3	3	3	3	22	30	0,733	Moderate
	s	2	3	2	2	2	3	2	2	2	2				
Item 9	Score	3	4	3	3	3	3	3	4	3	3	22	30	0,733	Moderate
	s	2	3	2	2	2	2	2	3	2	2				
Item 10	Score	3	4	3	3	3	3	3	3	3	3	21	30	0,7	Moderate
	s	2	3	2	2	2	2	2	2	2	2				
Item 11	Score	3	4	3	4	4	3	3	3	3	3	23	30	0,767	Moderate
	s	2	3	2	3	3	2	2	2	2	2				
Item 12	Score	3	4	3	3	3	3	4	3	3	3	22	30	0,733	Moderate
	s	2	3	2	2	2	2	3	2	2	2				
Item 13	Score	3	4	4	3	4	3	4	3	3	3	24	30	0,8	High
	s	2	3	3	2	3	2	3	2	2	2				
Item 14	Score	4	4	3	3	4	4	3	4	3	4	26	30	0,867	High
	s	3	3	2	2	3	3	2	3	2	3				
Item 1-14	**Score**	**47**	**56**	**47**	**46**	**47**	**50**	**48**	**50**	**46**	**47**	**484**		**0,819**	**High**
	s	**33**	**42**	**33**	**32**	**33**	**36**	**34**	**36**	**32**	**33**				

Based on Table 4, content validity results of ten experts on the third aspect namely dynamic balance test procedures, it was found that this aspect has a coefficient value 0,819 (High). Last, the result from 3 aspects of dynamic balance test construction can be seen in Table 5. In the following, based on Table 5, content validity results of ten experts on the all aspect of Karate Kata dynamic balance modification test obtained the coefficient value 0,812 (High), meaning that all experts have high agreement.

Table 5. Content validity results

Evaluator	Content Validity Dynamic Balance Test Result						Aspect 1-3	
	Aspect 1		Aspect 2		Aspect 3			
	Score	s	Score	s	Score	s	**Score**	**s**
1	12	8	12	8	47	33	**71**	**49**
2	16	12	16	12	56	42	**88**	**66**
3	12	8	12	8	47	33	**71**	**49**
4	15	11	13	9	46	32	**74**	**52**
5	14	10	13	9	47	33	**74**	**52**
6	15	11	15	11	50	36	**80**	**58**
7	15	11	14	10	48	34	**77**	**55**
8	13	9	13	9	50	36	**76**	**54**
9	13	9	13	9	46	32	**72**	**50**
10	14	10	14	10	47	33	**75**	**53**
∑s	99		95		484		**678**	
V	0,825		0,792		0,819		**0,812**	
Value	High		Moderate		High		**High**	

4. DISCUSSION

Having good physical ability is an important component that supports karate athletes to reach peak performance (McKinney et al., 2019) which is built with an appropriate and sustainable training program. In karate competition, there are two categories, namely Kumite and Kata, with different movement characteristics. The Kumite category is a real match/fight between two athletes with strict rules for 3 minutes with high intensity where they are free to move kicks and punches and make quick moves to avoid the opponent's attacks (Nedeljkovic et al., 2017). But in the Kata category, where kata matches are a series of basic technical movements carried out in a certain order with offensive and defensive movements without the presence of an opponent, which are carried out individually or in groups for 60-80 seconds (Emad et al., 2020). Kumite and Kata Karate have different competition conditions. Therefore, the coach must have a different program between the Kata and Kumite categories and apply a different approach to training and scoring activities to get maximum results. In the physical aspect, athletes in the Kumite category require physical aspects of reactive agility, but in the Karate Kata category, it focuses more on the aspects of power and strength (Shalaby, 2019), thus requiring good dynamic balance in the execution of their movements.

Dynamic balance is the body's ability to remain standing and not fall when changing the direction of each movement or when performing high-speed movements. Therefore, the Kata category optimizes dynamic balance so it doesn't fall when performing a series of Kata movements with high power. If a Kata karate athlete has good dynamic balance, then the athlete will easily

maintain his position and not fall while doing a series of Kata movements. Therefore, the ability of dynamic balance in Karate Kata needs to be measured. However, there is no instrument to measure dynamic balance which has characteristics such as movement in Karate Kata. Consequently, to find the increase in performance in karate athletes, especially in measuring dynamic balance, researchers found several studies on dynamic balance instruments that were used but were not suitable for measuring dynamic balance in Kata Karate. Based on these problems, the researcher wants to develop a Kata karate dynamic balance test construction that resembles the movement characteristics of kata karate. This is used to determine the increase in dynamic balance when performing kata movements with maximum power and strength. This instrument can be used by coaches as a guideline for measuring athletes' dynamic balance abilities and creating targeted training programs.

Dynamic balance in karate is the ability to maintain the body so that it does not fall when going sideways, forward and changing directions quickly when doing a series of kata movements. Based on the results and data analysis using Aiken, it can be concluded that dynamic balance is the body's ability to remain standing and not fall when changing the direction of each movement or when performing high-speed movements. Therefore, the Kata category optimizes dynamic balance so it doesn't fall when performing a series of Kata movements with high power. The results of the Karate Kata dynamic balance test instrument document analysis are the results of the content validity test from ten experts on the design of the Karate Kata dynamic balance test instrument. The suitability of the first item, namely the Image Design Display, has a coefficient of 0,825 (High). The second item, namely the suitability of the modified form of the dynamic balance test with the movement characteristics of the Karate Kata, has a coefficient value of 0,792 (Moderate). The last item, namely the dynamic balance test procedures, has a coefficient value of 0,819 (High).

Based on the results of these three aspects it can be concluded that the content validity value of the Kata Karate dynamic balance test has a high level of validity with a coefficient value of 0.812 (High), as explained that if the coefficient value is more than 0.78 it can be concluded that the test instrument is good. Then if the Aiken V value is 0.41 to 0.60 it is said to have moderate agreement. If the Aiken V value is 0.81 to 1.00, it can be said to have a high agreement. In other words, all experts have high agreement.

5. CONCLUSIONS

Based on the results, it can be concluded that the modification of the dynamic balance test instrument Karate Kata has high content validity with a coefficient value of 0,812 (High). The

construction document of the Dynamic Balance Karate Kata test instrument indicates that the instrument has high content validity. This can help convince readers and researchers of the reliability of this dynamic balance test for Karate Kata. In other words, the modifications to the dynamic balance test make it more specific and better adapted to the movement characteristics of Karate Kata.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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