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REACTION TIME TEST INNOVATION OF TABLE TENNIS PERFORMANCE: AIKEN VALIDITY

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ABSTRACT

Reaction time test is vital in table tennis talent identification and development. The purpose of this study was to test the reaction time test content validity of table tennis players. A mixture of qualitative and quantitative approaches was used in this study as the research method and took documents and experts as participants. The first stage of the study was conducted a qualitative approach using a literature review with narrative review techniques. The second stage was a content validation test using the Delphi technique. The study used a questionnaire with a rating scale of 1-4 (very relevant, relevant, less relevant, and irrelevant) as the research instrument. The data were analyzed using Aiken's formula to test content validity. The results of the study showed that (1) the concept definition and operation of the table tennis reaction time, as well as the construction of the table tennis reaction time test, have been compiled, (2) the Aiken's V coefficient value was above 0.76, meant that all aspects were valid, so it can be concluded that the test was quite reliable. The test of measuring the reaction time of table tennis players had a reasonably high Aiken validity.

INTRODUCTION

Table tennis is rated as one of the fastest and most complex sports requiring performance in changing environmental conditions under tremendous time pressure (Schmidt.,& Lee 2011; Woollacott.,& Shumway-Cook A 2011; Hülsdünker et al., 2019). Table tennis performance requires wide and fast movements and responds to changing conditions (Hülsdünker et al., 2019; Sève et al., 2002). Therefore, it is necessary to develop the technical skills and the ability to switch quickly to adjust the shot technique, as well as various and fast leg movements to anticipate the ball speed and direction (Ak E.,&

Koçak S., 2010; Akpinar et al., 2012), thus requiring good reaction speed abilities.

Reaction time is an essential factor in table tennis (Liskustyawati et al., 2016) as it functions to respond and anticipate ball speed, and react according to the ball direction. This factor allows the player to perform the required footwork, take the correct position, and be ready to hit the counter shot (Ak, E., & Koçak, S., 2010).

Reaction time is the time required when sensory stimulation and the response to the movement will occur next (Sini Sreenivasan.,& MS Kusumadevi., 2020). The reaction time can be divided into three parts, namely, (1) perception time, which is the time of application and stimulus perception and reaction required, (2) the decision time, the time given to respond to the stimulus, (3) the motor time, which is the time given to run the instructed stimulus (Teichner., 1954; Tripo., 1965). There are three types of reaction time (1) simple reaction time, namely one stimulus and one response (2) recognition reaction time, namely several stimuli that must be responded to and must not be responded to, (3) choice reaction time, namely multiple stimuli and multiple responses (Luce., 1986; Welford., 1980).

In developing table tennis players' reaction time skill, an assessment is needed (Faber et al., 2012; Ackerman., 2014) to determine the progress. The assessment is good if the instruments used are valid and reliable (Yudhistira, D.,& Tomoliyus., 2020; Sumaryanti et al., 2018).

Some research results found that the reaction time was measured using test instruments such as computerized software called Direct Reaction Time. The researches were performed in a place with sufficient light and a quiet atmosphere. The reaction time was measured by asking some athletes to respond to different colored stimuli that appeared on the computer screen by pressing the space key on the keyboard (Jose Shelton.,& Gideon Praveen Kumar., 2010; Mahesh et al., 2013). Besides that, reaction time was also measured using a conventional reaction speed instrument (Lafayette Instrument Co.) with two response buttons on the right or left side of the device that has to be pressed by the athletes. Besides, the test instrument used in measuring the reaction time was a drop test instrument (Liskustyawati et al., 2016).

Based on the author's observations on table tennis practitioners, it was identified that the table tennis trainers or teachers have difficulty using the test above, and the test equipment was expensive. Most trainers and teachers used the reaction time test with the rules drop test instrument because the implementation was easier and inexpensive. The only problem with the rules drops test instrument was that it had not approached the game of table tennis, where the stimulus did not move randomly, and the stimulus device was not a ball.

The authors wanted to modify the reaction time test, which would be easier to implement and affordable by the trainers, and the test suitability would also be

closer to the table tennis game. This research was fundamental to help the trainers know the athletes' reaction time ability because the test would be closer to the game, more practical, more affordable, and easier to use by the trainers. The purpose of this study was to test the content validation of the table tennis reaction time test.

METHOD

This study was a mixed study that combines two approaches, namely, qualitative and quantitative. The mixture approaches were done to obtain complete and valid data. It is called a mixed methodology when experts or researchers use a combination of qualitative and quantitative research methods with one concept, or when a study is carried out sequentially or simultaneously to examine the research in-depth. Participants in this study were several documents and seven experts with qualifications: one sports evaluation expert, three table tennis expert lecturers, and three nationally certified trainers. There were three steps in this study.

There were two stages in this study. The first stage was the qualitative approach using the literature reviews method with the type of narrative review of (Rossella., 2015) articles, journals, and textbooks related to the existing reaction time measurement instruments. This stage aimed to develop conceptual and operational definitions of reaction time and compile the construction of table tennis players' reaction time test instruments.

The second stage was to test the content validity using the Delphi technique (Chia-Chien Hsu., & Brian A. Sandford., 2007; Cox et al., 2016; Green., 2014), where each expert judgment did not meet in assessing the reaction time construction design. Followed by the qualitative analysis, the inputs from the expert judgments were then used to revise the results of the analysis before returned it back again to the experts. This process happened several times until the experts accepted without any further improvement (Fraenkel., 2012) needed for the table tennis reaction time's instrument construction, and the experts gave a mark for the results. This research instrument used a questionnaire with a rating scale of one to four, namely very relevant, relevant, less relevant, irrelevant. The data were analyzed using Aiken's V (Aiken., 1985) with a significance level of 5%. Aiken's V formula is as follows:

$V = (\sum(\ ) / [n(c-1)]$

Where,

V = rater agreement index regarding item validity

r = number given by the assessor

l_0 = the lowest number of validity ratings (1 for a scale of 1-4)

c = the highest validity score (4 for a scale of 1-4)

n = number of experts who made the assessment

Result

Qualitative Analysis Results

From the qualitative analysis using literature review techniques and the expert judgment inputs, the construction of the reaction time test instrument for table tennis has resulted as shown in Figure 1 below:

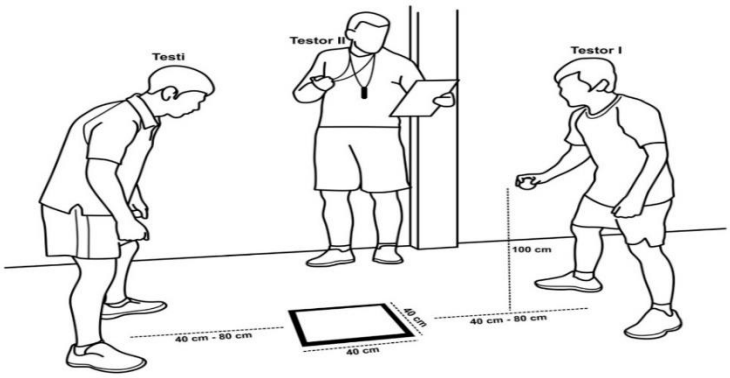

Figure 1 1 Construction of Table Tennis Reaction Time Test

The distance measure of the table tennis reaction time test instrument:
A 40cm x 40cm box

The distance between the testee and tester 1 with a box is 40cm-80cm.

The high to throw the ball is 100cm.

Equipment used for reaction time tests:

A flat field

A hexagonal ball or reaction ball

A stopwatch

To make a target box: a tape/ribbon, a glue, and scissors

Three testers: tester 1 drops the ball for one meter high, tester 2 holds the stopwatch, tester 3 records the time. After the tester threw the ball and the ball bounces, the second tester presses the start button, and after the ball is caught, the second tester presses the stop button.
The procedure of the table tennis reaction time test:

The testee does a sufficient warm-up.

The testee prepares to catch the ball from the ball's bounce dropped one meter high by the tester.

The testee catches the ball as fast as possible when the ball has bounced in the box. Together with the tester turns on the stopwatch

The testee catches the ball. Simultaneously with the catch of the ball, the tester turns off the stopwatch.

The speed of time to catch the ball is calculated from the bounce until the ball is caught.

The score is recorded by choosing the fastest of five repetitions. Each testicular repetition is given a 2-minute break.

The testers provide examples of how to perform the tests.

The testee is required to try twice.

Content Validity Test Results

The instrument aspects of the table tennis reaction time assessed by the experts include (1) conformity aspects of conceptual definition, (2) operational definition aspects, (3) distance suitability aspects, (4) suitability aspects of the stimulus amount for the respondents, (5) aspects of the test procedures clarity, and (6) the image clarity aspect of the test construction.The expert judgments used a range of 1-4. The closer to number 1, the more irrelevant the assessment was. The closer to number 4, the more relevant it was. The expert judgment data were then analyzed quantitatively with Aiken's formula, the results of Aiken's validity test were as follows.

Table 1 Content validity test results with Aiken's

Assessments	Aspect 1		Aspect 2		Aspect 3		Aspect 4		Aspect 5		Aspect 6	
	score	s	score	s	score	s	score	s	score	s	score	s
A	4	3	4	3	4	3	4	3	4	3	4	3
B	3	2	3	2	3	2	3	2	3	2	3	2
C	4	3	3	2	4	3	4	3	4	3	4	3
D	4	3	3	2	4	3	4	2	3	2	4	3
E	3	2	4	3	4	3	4	3	3	2	4	3
F	3	2	4	3	4	3	4	2	3	2	4	3
G	4	3	4	3	4	3	4	3	3	2	4	3
∑ S	18		18		20		20		16		20	
V	0,857		0,857		0,952		0,952		0,762		0,952	

Based on table 1, aspect 1 showed the Aiken's V coefficient value of 0.857, aspect 2 showed the Aiken's V coefficient value of 0.857, aspect 3 showed the Aiken's V coefficient value of 0.952, aspect 4 showed the Aiken's V

coefficient value of 0.952, aspect 5 showed the Aiken's V coefficient of 0.762, and aspect 6 showed the coefficient value of Aiken's V of 0.952. The value of Aiken's V coefficient ranges from 0 - 1. Since the minimum standard of Aiken's V coefficient for this study was 0.76, it could be said that all aspects were valid.

DISCUSSION

Validity is an essential issue in the process of developing and compiling measurement instruments. Validity describes the extent to which measuring instruments can produce data and provide accurate information (Wong et al., 2012). There are three types of validity: content validity, criterion validity, and construct validity (Yang.,& Embretson., 2007). Of the three types of validity, the content validity test is often used in the early stages of the measurement instrument development process. Content validity relates to the extent to which the instrument thoroughly assesses or measures the interested constructs. (Sangoseni.,& Hellman., 2013). The development of valid content instruments is usually achieved by rational instrument analysis by ratters (experts) (Devon et al., 2007; Polit.,& Beck., 2006). Specifically, in this study, the ratter reviewed whether or not the concept definition and operational definition relevant to the table tennis reaction time, whether or not the aspects of the instruments developed relevant to the concept definition or operational definition, whether or not the instrument aspects developed relevant to table tennis reaction time, and the last was whether the test procedure was clear or not.

The study resulted in conceptual and operational definitions of table tennis reaction time and the construction of table tennis reaction time measurement instruments. The resulting content validity (Aiken) is as follows: the conceptual definition of conformity aspect showed a value of V = 0.857, the suitability aspect of the stimulus for respondents showed a value of V = 0.857, the aspect of distance suitability showed a value of V = 0.952, the aspect of suitability of the step movement showed a value of V = 0.952, the clarity aspect of the test procedure showed a value of V = 0.762, and the clarity aspect of the test construction image shows the value of V = 0.952. When compared to the standard table value compiled by Aiken (1985), the V value using a scale of 1-4 and 7 ratter ratings, then the Aiken's V minimum standard for this study was 0.76. Therefore, it can be said that all aspects of the table tennis reaction time test were highly content valid. In other words, the table tennis reaction time measurement instrument has a high expert agreement.

CONCLUSION

Based on the results and discussion above, it can be concluded that the table tennis reaction time instrument has a sufficient Aiken validity. Therefore, this instrument can be used or tested to measure the table tennis beginners' reaction time. It is necessary to test the retest test's empirical validity and reliability to make the instrument stronger.

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REFRENCE

Ackerman, P. L. (2014). Nonsense, common sense, and science of expert performance: Talent and individual differences. Intelligence, 45, 6-17.

Aiken, L. R. (1985). Three coefficients for analyzing the reliability and validity of ratings. Educational and Psychological Measurement, 45(1), 131–142. https://doi.org/10.1177/0013164485451012

Ak E, Koçak S (2010) Coincidence-anticipation timing and reaction time in youth tennis and table tennis players. Percept Mot Skills 110: 879–887

Ak, E., & Koçak, S. (2010). Coincidence-anticipation timing and reaction time in youth tennis and table tennis players. Perceptual and motor skills, 110(3), 879-887.

Akpinar S, Devrilmez E, Kirazci S (2012) Coincidence-anticipation timing requirements are different in racket sports. Percept Mot Skills 115: 581–593

Chia-Chien Hsu & Brian A. Sandford. (2007). The Delphi Technique: Making Sense Of Consensus. Practical Assessment, Research & Evaluation, Vol 12, Art 10, 1-5.

Cox, G. R., Bailey, E., Jorm, A. F., Reavley, N. J., Templer, K., Parker, A., … Robinson, J. (2016). Development of suicide postvention guidelines for secondary schools: a Delphi study. BMC Public Health, 16(1), 180. doi:10.1186/s12889-016-2822-6

DeVon HA, Block ME, Moyle-Wright P, Ernst DM, Hayden SJ, Lazzara DJ, et al. (2007) A psychometric toolbox for testing validity and reliability. J Nurs Scholarsh ;39:155-4

Faber, I., Nijhuis-Van der Sanden, M. W. G., & Oosterveld, F. G. J. (2012). A first step to an evidence-based talent identification program in the Netherlands; a research proposal. International Journal of Table Tennis Sciences, 7, 15-18.

Fraenkel, Jack. R., and Norman E. Wallen. 2012. How to Design and Evaluate Research in Education 8th Edition. Boston: McGraw-Hill Higher Education

Green, R. A. (2014). The Delphi Technique in Educational Research. SAGE Journals 4(2), 417-425. doi:10.1177/2158244014529773

Hülsdünker, T., Ostermann, M., & Mierau, A. (2019). The Speed of Neural Visual Motion Perception and Processing Determines the Visuomotor Reaction Time of Young Elite Table Tennis Athletes. Frontiers in Behavioral Neuroscience, 13. doi:10.3389/fnbeh.2019.00165

Jose Shelton, Gideon Praveen Kumar. Comparison between Auditory and Visual Simple Reaction Times. Neurosci Med, 2010; 1: 30–32.

Liskustyawati, H., Sulaiman, S., & Rachman, H. A. (2016). The Physical Tests for 13-15 Year Old Table Tennis Players. The Journal of Educational Development, 4(2), 192-200.

Luce RD. In: Response times: their role in inferringelementary mental organization. Oxford Psychology series8. Oxford University Pres: New York. 1986: 562.

Mahesh K. Bhabhor, Kalpesh Vidja, Priti Bhanderi, Shitai Dodhia, Rajesh Kathrotia and Varsha Joshi. (2013). A Comparative Study of Visual Reaction Time in Table Tennis Players and Healthy Controls, 57(4), 439-442

Polit DF, Beck CT. The content validity index: Are you sure you know what′s being reported? Critique and recommendations. Res Nurs Health 2006;29:489-9

Rossella Ferrari. (2015). Writing narrative style literature reviews. **Journal**Medical Writing. Volume 24, Issue 4, 230-235

Sangoseni O, Hellman M, Hill C.(2013) Development and validation of a questionnaire to assess the effect of online learning on behaviors, attitude and clinical practices of physical therapists in United States regarding of evidence-based practice. Internet J Allied Health Sci Pract2013;11:1-12.

Schmidt RA, Lee TD (2011) Motor control and learning: A behavioral emphasis (5th ed.). Champaign, IL: Human Kinetics.

Sève C, Saury J, Theureau J, Durand M (2002) Activity organization and knowledge construction during competitive interaction in table tennis. Cogn Syst Res 3: 501–522

Sini Sreenivasan, M.S. Kusumadevi (2020) .Effect of Computer Usage on Visual Reaction Time in Information Technology Professionals of Bangalore City. International Journal of Physiology, 8 (1).

Sumaryanti,, Tomoliyus,, Sujarwo,, Utama, B., Jatmika, H.M. (2018). Developing design and construction of backspin serving skill tests to assess the learning outcomes for table tennis serving skills. Issues and Trends in Interdisciplinary Behavior and Social Science - Proceedings of the 6th International Congress on Interdisciplinary Behavior and Social Sciences, ICIBSoS 2017, pp. 149-154

Teichner WH. Recent studies of simple reaction time.Psychol Bull 1954; 51: 128.

Tripo RS. How fast can you react ?Sci Dig 1965; 57: 50.

Welford AT. In: Choice reaction time: Basic concepts.Reaction times. Academic Press: New York. 1980; 73–128.

Wong KL, Ong SF, Kuek TY. Constructing a survey questionnaire to collect data on service quality of business academics. Eur J Soc Sci 2012;29:209-21

Woollacott MH, Shumway-Cook A (2011) Motor control: Translating research into clinical practice (4th ed.). Philadelphia, PA: Lippincott Williams & Wilkins.

Yang, X., & Embretson, S. E. (2007). Construct validity and cognitive diagnostic assessment. In J. P. Leighton & M. J. Gierl (Eds.), Cognitive diagnostic assessment for education: Theory and applications (p. 119–145).CambridgeUniversityPress. https://doi.org/10.1017/CBO9780511611186.005

Yudhistira, D., Tomoliyus, (2020). Content validity of agility test in karate kumite category. International Journal of Human Movement and Sports Sciences, 2020, 8(5), pp. 211-216