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Cognitive Analysis Using Rasch Modeling As an Assessment for Physical Fitness Knowledge for College Students

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Abstract

Having good physical fitness is the foundation for carrying out daily activities. Maintaining physical fitness requires knowledge and understanding for performing meaningful physical activities. This study aimed to analyze the physical fitness knowledge test instrument for college students using the Rasch modelling data analysis technique. The design, development, and research method employed the product model and research tool that consisted of four stages, including analysis, design, development, and evaluation. The samples involved in the instrument trial were 70 students from one university in Indonesia. The analysis used was the content validity ratio for testing content validity and the item response theory/Rasch model test employing Winstep software to determine the validity and reliability of the test instrument. The results of the data analysis showed a match between the students and the test instruments with very good quality items. It concludes that the test instrument development using the Rasch model can detect student misconceptions on physical fitness knowledge material.

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INTRODUCTION

Health and physical fitness development has become a concern in the last few decades. Interest in developing physical fitness results from expertise that strongly links physical activity and life expectancy (Gunter et al., 2012; Baird et al., 2019: Faienza et al., 2020). Although there are still estimates on the intensity and duration of physical activity for physical fitness, some experts agree that various forms of physical activity will benefit the body (Sun et al., 2020; Soriano-Maldonado et al., 2022). For example, regular physical activity is the best way to avoid cardiovascular disease and lower blood pressure during submaximal exercise (Cheng et al., 2018; Lacombe et al., 2019; LaCroix et al., 2019). In addition, lifestyle can increase passion for life and reduce mortality. Physical fitness is also associated with a reduced risk of coronary heart disease, diabetes, obesity and osteoporosis (Wei et al., 2000; Katzmarzyk et al., 2007; Liao et al., 2013; Babiuch et al., 2021). On the other hand, good physical fitness can increase cardiovascular endurance, muscle strength, endurance and flexibility (Wilmore & Knuttgen, 2003; Sillanpää et al., 2008; Gäbler et al., 2018;).

Given the clear benefits of health-related physical fitness concerns, more need to increase physical fitness knowledge levels. This raises much knowledge about health-related physical fitness from practitioners, expert questions and educators. With attention to exercise, the body's fitness determines whether they do an exercise based on what they know.

One of the goals of physical education at the university level is to provide knowledge and skills and maintain fitness levels so that students can apply lifestyle habits (Budiman et al., 2018). For students to develop these habits, the realm of physical fitness related to health needs to be directed (Corbin, 1987; Mirzaev, A. M., 2021). Body composition, flexibility, cardiovascular endurance, strength endurance and strength are part of physical fitness related to health. An understanding of physical fitness related to health and skills can be achieved by incorporating goals and objectives in training that benefit from physical activity to achieve a healthy and active lifestyle. In some European countries, inculcating an active lifestyle is an important mission of physical education (Almond & Harris, 1998; Cardon & De Bourdeaudhuij, 2002; Harris, 2005), and there is an excellent emphasis on health-related activities related activities in the physical education curriculum (Almond & Harris, 1998; Harris, 2005). Promoting a healthy and active lifestyle is a significant goal in physical education (UNESCO, 2015). Regular physical activity is an important lifestyle component for both children and adults. There have been many programs to change healthy lifestyles based on social cognitive theory (Bandura, 2004; Budiman et al., 2018; Rovniak et al., 2022) and behaviour change based on self-regulation models (Kanfer & Gaelick-Buys, 1991; López -Gil et al., 2020). In addition, researchers have identified some specific skills, such as self-management, that can play a role in helping to change lifestyles (Cardon et al., 2009).

From previous research, there is already Health-related fitness knowledge (HRFK) which includes the concepts and skills needed to improve and maintain levels of fitness and physical activity (Corbin CB, Lindsey, 1988; Society of Health and Physical Educators, 2014). HRFK is a crucial element for health and physical education to guide one's ability to control one's movements so that they are physically independent and plan their fitness activities (Corbin CB, Lindsey, 1988; Society of Health and Physical Educators, 2014). HRFK is also believed to be a critical component in increasing students' awareness of healthy living behaviour (Demetriou et al., 2015). Other studies also state that HRFK strongly correlates with exercise intensity and physical activity (Ferguson KJ et al., 1989; Haslem L, 2016).

Along with the increasing awareness of the importance of physical fitness for a person, there is also a growing need for tests that can determine the amount of knowledge about the practice desired and mastered by students; This research was conducted based on this view. With an understanding of physical fitness, students' ability to choose the most desired exercise in their physical fitness will increase. Physical fitness knowledge tests are expected to reflect students' habits, knowledge, and experiences in physical activity. Since physical education is an integral part of habituation to a healthy and active lifestyle (Harris, J., 2014), students should know not only games and activities but also the general psychological and physiological implications of various types of physical activity. To determine the effectiveness of learning physical education, sports and health, educators must have several measuring tools to

determine the level of student knowledge and whether they can apply their knowledge in practice. This test will assist educators and students in determining the desired practical knowledge in physical fitness.

Based on the description above, understanding physical fitness is fundamental to staying active in their daily lives, especially for adults. Previous research found instruments to evaluate the understanding of physical fitness in middle and high schools. However, it is limited to understanding Health-related fitness knowledge. While understanding the Skills-related fitness knowledge, the authors have not found the results of studies investigating these fitness components. The purpose of the research developed in this study was to develop Physical Fitness Knowledge items for students. The questions compiled are the content of teaching materials related to physical fitness to develop and promote a healthy and active lifestyle.

METHODS

The research method used is Design, Development, Research (Richey & Klein, 2007) with the category Product model and research tool; this model is product development. The stages in the Product and tool research model are; Analysis, design, development, and evaluation. The variable to be studied is the student's ability, as seen from the computer-based test results for the Final Semester Examination in the Physical Education class. The instrument of the study is in the form of items using a dichotomous model in the form of multiple choices. Data was collected through a computer-based test in the Physical Education class.

Before the computer-based test in the physical education class, content validity and face validity were tested. Face validity is checked by checking the content of the questions in the form of the validity of the word or sentence so that it has a clear understanding and is not misinterpreted on each test item. The instrument has good face validity if the instrument is easy to understand and students do not experience difficulties answering questions. Content validity is carried out in two stages: (1) determining the content of the definition used and (b) developing indicators that cover all the things contained in the definition. Content validity and face validity in this study were carried out by asking for experts who were competent in their fields and were the material given to students.

Furthermore, the computer-based test questions in the physical education class were tested on students who took this PE class. The test results data were analyzed to determine the questions' characteristics empirically. The approach used in the data analysis of the test results is the item response theory/Rasch model with the help of the Winstep software.

Validity and Reliability Analysis

To test the validity of the items, the Rasch was used based on the following criteria Model (Sumintono & Widhiarso, 2015):

Accepted Outfit Mean Square value (MNSQ): 0,5 MNSQ <1,5

Accepted Z-Standard Outfit Value (ZTSD) : -2,0 < 2STD < + 2,0

Measure Correlation of Valued Point (Pt Mean Corr) : 0,4 < Pt Mean Corr < 0,85

If a computer-based test item in the physical education class meets at least the two criteria above, then the item is declared usable; in other words, the item is valid. Reliability is the consistency of test results. The measurement results must be the same (relatively the same) if the measurements are given to the same subject, even though different people carry them out at different times and places. .

Data Source

The types of data collected in this study are classified into two, namely :

a.Primary data

Data on students taking physical education classes that meet the sample inclusion requirements is obtained through computer-based tets physical education classes using the items that have been provided.

b.Secondary data

Data on the list of the number of students who are taking physical education class

Data Analysis Technique

The test insrument data was analyzed using the Rasch item response theory approach using the WINSTEPS program. The steps taken are :

1. Assumption test

a. Unidimensional Assumption Test

The unidimensional assumption test aims to determine whether the test is proven only to measure one dominant dimension. The unidimensional assumption test is carried out by performing factor analysis.

b. Local Independence Assumption

Test The local independence assumption test is carried out to determine if the ability to answer the test questions conducted by students is not influenced by whether or not the answers from other test participants are correct. The local independence assumption test is met if the covariance value is close to zero.

c. Parameter Invariance Assumption Test

The parameter invariance assumption test was conducted to determine the consistency of the characteristics of the items answered even though the items varied. The test results are carried out by looking at the scree plot. The parameter invariance assumption is achieved if the plot spreads and approaches the normal line.

2. Item Fit to Model

The item fits the model if it has an outfit Mean Square (MNSQ) value of 0.5 < MNSQ <1.5 and the Point Measure Correlation (PT Mean Corr) value is not negative.

RESULT

This research was carried out at the University of Education Indonesia, and data collection was in August 2021. The research subjects are students taking physical education classes according to the inclusion and exclusion criteria set. Before taking the data, a study of the material related to physical fitness knowledge was carried out. The material analyzed is the curriculum material for physical education and sports. Furthermore, the questions are by the level of thinking ability based on Bloom's theory. The preparation of the difficulty level is divided into 25 questions consisting of 5% or 1 question C1, 5% or 2 questions C2, 45% or 12 questions C3, 25% or 6 questions C4, 10% or 3 questions C5 and 5% or 1 question C6. The distribution of questions can be seen in table 1.

Twenty-five items were then tested on students. Sixty-seven students are the samples in this study. The following is data from an objective test of 25 questions for students taking physical education and sports classes. To examine the assessment result sheet to find suggestions for improvement related to aspects of material content with the suitability of problem-solving indicators and problem-solving indicators with question indicators. Furthermore, data analysis was carried out to determine the level of validity and reliability of the instrument.

Furthermore, the computer-based test questions in the Physical Education class were tested on students taking physical education classes. The test results data were analyzed to determine the questions' characteristics empirically. The approach used in the data analysis of the test results is the Response Theory/Rasch Model with the Winstep software.

The reliability analysis results can be seen using the Winsteps program in the Summary Statistics table. The validity results can be seen and analyzed with the Winsteps program in the Outfit table to see the suitability of the items that function in the normal category to be used as a measurement of student misconceptions by requirements in table 2.

Characteristics of Items and Respondents

The analysis using the Winsteps program provides information, both in terms of items and respondents, showing differences in the items and students analyzed using the Rasch model, indicating the occurrence of misconceptions for some students. According to Arikunto (2019), a question that can be answered correctly by smart students and students who are less intelligent is a question that is not good because it does not have distinguishing power. The description of the distribution of the ability of 67 students and the distribution of the difficulty of the items on the same scale. The results of data analysis in Figure 1 show that the average student is in medium ability with a logit value of +1 (011, 021, 031, 040, 041, 011, 021, 031, 040, 041, 010, 013, 029, 033, 036, 048, and there are also two students with low abilities with a logit value of -1 which means that there are still some students who still have misconceptions about the concept of the material being tested.

From Figure 1, we can also see that two questions have a high difficulty value, namely, questions num-

bered Q19, Q24, and Q16, and also, most of the students understand the concepts listed in questions Q19, Q24, and Q16. Some questions have a medium difficulty value, such as questions Q6, Q12, Q11 & Q2, with a logit value between -0 and +0, and some have a low level of difficulty with a logit value below -1. Logit below -1 is what must be revised again. This result is by Boopathiraj and Chellamani (2013), who say that questions that have high discriminating power are questions that students who have low test scores cannot answer the questions correctly. The previous explanation proves that some students still have misconceptions about physical fitness material.

question. For example, students get a value of 0.58, and the question is obtained at 4.08. Therefore, it can be said that the greater the value of separation, the greater the quality of the instrument used is very good. This is because it can identify groups of questions with groups of respondents.

Table 2. Item Validity Criteria

No	Reference	Limit Value
1	OutfitMean Square (MNSQ)	0,5 < MNSQ < 1,5
2	Outfi Z-Standard (ZSTD)	-2,0 < ZSTD < +2,0
3	Point Measure Correlation (Pt Mean Corr)	0,4 < Pt Mean Corr < 0,85

Table 1. The composition of the difficulty level Question

No	Material	C1	C2	C3	C4	C5	C6	TOTAL
1	Active and healthy lifestyle	1						1
2	Benefits health and active lifestyle		1					1
3	Components of health and skills related fitness		1	1				2
4	Physical activity and classification of physical activity levels			2				2
5	Physical fitness test (adult fitness test; cardiorespiratory, muscular strength, muscular strength endurance, flexibility, body composition)			1				1
6	Endurance activities			1				1
7	Rest, exercise and maximum heart-rate			1				1
8	Body Mass Index			1	1			2
9	muscular endurance activities				1			1
10	Benefits of warming-up and cooling down			1	1			2
11	Types and functions of carbohydrates, fats, proteins, vitamins, minerals, water			1				1
12	muscular strength activities			1	1			2
13	Fleksibilitas: static, dynamic and PNF			1				1
14	Calories and physical activity			1		1		2
15	Components of Skills- related fitness : Agility, speed and reaction				2			2
16	Principles of fitness activity program · Overload · Progression · Spesificity · Reversibility · Recovery · Individual					1		1
17	F.I.T.T formula in fitness activities - Frequency - Intensity - Time - Type					1	1	2
	TOTAL	1	2	12	6	3	1	25

From the analysis results, it was found that the average value of all students working on the questions given was 2.5 logit. This value is greater than the average difficulty value, meaning that there is a tendency for students to be higher than the difficulty level of the

Item Validity

The data analysis results show that there is a valid level on the instrument construct of the questions developed to obtain a level of conformity between student responses and the test instrument. The following table

shows how the items developed are normal or not in measuring students' misconceptions about physical fitness material.

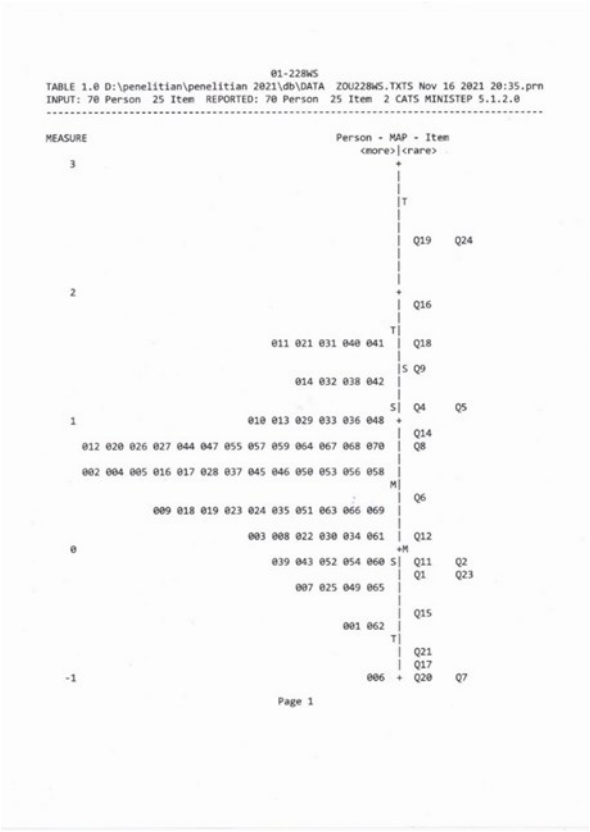

Figure 1. Variable map output

Tabel 3. Instrument Reliability

Variable	Logit average (SD)	Separation	Reliability
Student	2,5	0,58	0,25
Question	17,6	4,08	0,94

The requirement is to know whether the items can be categorized as acceptable or not by looking at the MNSQ scale with a range of 0.5 < MNSQ < 1.5. If you look at Figure 2, it shows that of the 25 items developed, they are in the good or accepted category, so it can be concluded that there are no misconceptions from students about these items. The ZSTD value scale is categorized as acceptable or not with a range of -2.0 <ZSTD < +2.0, indicating that from Figure 2, the items are included in the category of meeting the criteria for good items. The point measure correlation (Pt Mean Corr) value scale is categorized as acceptable or not with a range of 0.4 <Pt Mean Corr < 0.85, indicating that from figure 2, the questions are in the eligible category, which means that the test instrument is accepted.

Based on these data, it can be said that a good test instrument is an instrument that can be understood by respondents well so that the test instrument is feasible to use.

DISCUSSION

Various Indonesian government policies have been published to promote a healthy and active lifestyle through the Ministry of Sports and the Ministry of Health to overcome the problem of lack of activity and low physical fitness. For this reason, academics and professionals in sports and health must teach the basic concepts and principles related to health-related fitness and skills-related fitness knowledge. The results of this study indicate that health-related fitness and skills-related fitness knowledge need to be given to instill a healthy and active lifestyle.

The limitation of this study is that this study only obtained data on health-related fitness knowledge and skills-related fitness with a reasonably small sample. Larger sample size is needed in order to make better generalizations of the health-related fitness and skills-related fitness knowledge of the health professionals concerned. In other professions, such as physical education and health, students are expected to learn the concepts and principles of health-related fitness and skills-related fitness knowledge. In fact, the concepts of health-related fitness and skills-related fitness knowledge need to be mastered by physical education teachers so that students can learn the benefits of physical activity, the principles of developing physical fitness, and the importance of incorporating physical activity throughout their lives.

Research shows that an essential step toward becoming physically fit and promoting positive attitudes toward physical fitness is learning the concepts and principles of physical fitness (Fulton et al., 2004; Fedewa & Ahn, 2011). In addition, other studies have shown that teachers play an important role in developing knowledge related to students' health (Pangraz & Beighle, 2019; Griban et al., 2020). Teachers can achieve this by implementing health-related fitness cur-

ricula and skills-related fitness knowledge into their programs to equip students with the knowledge, positive attitudes, and skills that will enable them to develop healthy and active living habits.

CONCLUSION

Based on the results of the study, it can be concluded that the development of test instruments using the Rasch model can detect student misconceptions on physical fitness knowledge material, with the results of data analysis showing a match between students and the test instruments used with very good quality items so that there are only a few students with the ability low with a logit value of -2 which means that there are still some students who still have misconceptions about the concept of the material being tested.

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CONFLICT OF INTEREST

The authors declared no conflict of interest.

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