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An Analysis of the Distribution Map of Physical Education Learning Motivation through Rasch Modeling in Elementary School

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The distribution map of physical education learning motivation could provide information about the electability of motivational items (questionnaires) distributed to several elementary school students. In more detail, this study would analyze the grouping of the electability level of physical education learning motivation items in elementary schools through a combination of standard deviation (SD) values and logit mean scores. Twenty-one students aged 13-14 years participated in this study by filling out a motivation to learn physical education questionnaire. The data analysis technique was performed through Rasch modeling assisted by the Winsteps 3.75 application. The results indicated that there were variations in the level of electability of physical education learning motivation items. The grouping was based on several item categories, including extremely difficult to get elected item category with a logit value greater than + 1SD; difficult to get elected item category with a value of 0.0 logit +1 SD; easy to get elected item category with a value of 0.0 logit -1 SD; and extremely easy to get elected item category with a value smaller than –SD. An ideal set of motivation items could identify the various motivations of students with diverse levels of motivation.

Keywords: validation, learning motivation, Rasch model, physical education, learning

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INTRODUCTION

Physical education helps students develop their physical skills, integrates their mind and body, provides an understanding of the importance of physical activity for maintaining health, and develops self-confidence and self-esteem (Bailey, 2006; Perlman & Webster, 2011). Physical education and sports goals are divided into five domains: physical, lifestyle, affective, social, and cognitive (Bailey, 2006; Perlman & Webster, 2011). Furthermore, Suherman explained that physical education aims to develop aspects of physical fitness, movement skills, critical thinking skills, social skills, reasoning, emotional stability, moral action, aspects of a healthy lifestyle, and the introduction of a clean environment through physical activity, sports, and health selected which are planned systematically in order to achieve national education goals (Suherman, 2011). In achieving these goals, motivation becomes a psychological construct that directs people towards the achievement of goals and considers the psychological forces used to strengthen actions (In'am & Sutrisno, 2020; Bice et al., 2016).

Students can be involved in physical education and sports, either encouraging motivational factors or discouraging motivational factors (Cortes et al., 2017). In physical education, children are often motivated by an opportunity to explore (Nur et al., 2019; Rokhayati et al, 2017). Their desire to explore in certain situations motivates them to be persistent in problem-solving, understanding movement skills, and continuing performance (Chen et al, 2014). According to self-determination theory (SDT), motivation is divided into two dimensions, namely intrinsic and extrinsic motivation (Deci et al., 1991; Vallerand, 2007). Intrinsic motivation is the involvement in activities for pleasure and excitement (Jaakkola, 2017). Meanwhile, extrinsic motivation is characterized by a close identification with social recognition, gifts, and rewards (Cortes et al., 2017). Extrinsic motivation explains how external variables and rewards stimulate behavior performance.

Questionnaires on the motivation to learn physical education were distributed to measure student motivation in participating in physical education learning. The results of the questionnaire filling were then analyzed for every item using Rasch modeling. The analysis through Rasch modeling would provide adequate information for teachers to assist students in carrying out learning (Nur et al., 2020). This measurement explains the interaction between the subject and the questionnaire item, making the measurement have more precise and objective results (Sumintono & Widhiarso, 2014). In addition, the Rasch model is a well-studied measurement approach that models the relationship between item difficulty, a person's ability, and the probability of a given response (Andrich, 1981). The analysis of this questionnaire instrument using the Rasch model is included in the theory of item response measurement. Meanwhile, according to Brogden (1977), the Rasch model is usually applied to measuring items and subjects of people. In this context, it discusses its relationship to the law of comparative valuation and the addition of other combined measures.

Rasch modeling can be employed for various observation formats including models for computational analysis, repeated experiments, and rating scales (Masters, 1982). It should be noted that the Rasch model is written as a probability model of individual

responses to an item and is therefore not explicitly a response model itself (Brogden, 1977). Georg Rasch developed an analytical model of Item Response Theory (IRT) in the 1960s, later popularized by Ben Wright (Misbach & Sumintoni, 2014). With raw data in the form of dichotomous data (correct and incorrect) that indicate student ability, Rasch formulated this into a model that connects students and items (Sumintono & Widhiarso, 2014). In addition to dichotomous data, Rasch modeling can also perform analysis for politomic data such as that developed by Andrich, which is still based on two basic theorems, namely the level of one's ability and the level of difficulty of items. The Rasch model assumes that item difficulty is a trait that is influenced by the respondent's answer, and that one's ability is a trait that is influenced by the estimation of item difficulty (Linacre, 1999; Olsen, 2003).

METHOD

This study used a quantitative approach with a survey design aimed at elementary school students as a population with a simple random sampling to determine the research sample. A questionnaire regarding the motivation to learn physical education was distributed to 21 students aged 13-14 years. Furthermore, an analysis was carried out to reveal the level of electability and suitability of physical education learning motivation items through modified stages of the analysis flow of Rasch modeling (Hamdu et al., 2020). The Rasch model is an excellent method of constructing an instrument/measurement (Ramdani et al., 2020; Wright, 1977). Through the Rasch model, it can be seen the relationship between people and the way they answer items (Jackson et al., 2002), and can convert non-linear raw data into the linear scale (Timofte & Siminiciuc, 2018), so that various data with different scale formats can be analyzed easily (Nur et al., 2020). The stages of the analysis are as shown in figure 1.

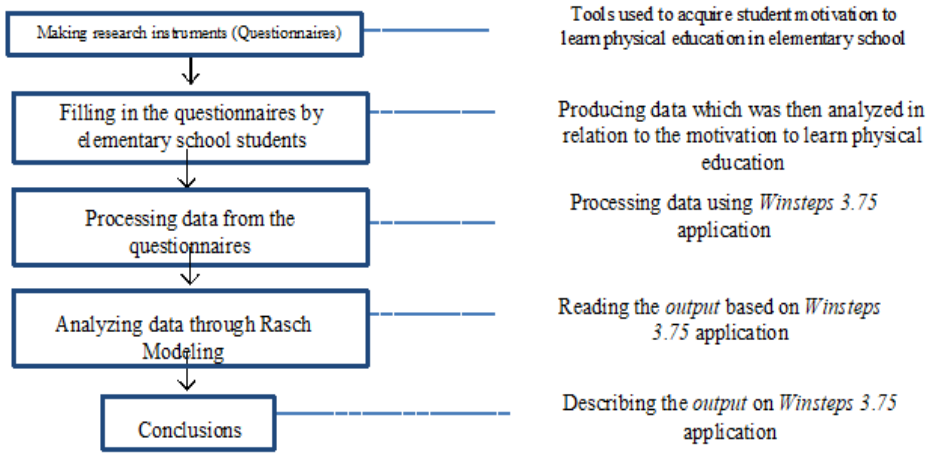


Figure 1
Analysis stages

FINDINGS AND DISCUSSION

The Rasch analysis employed principal component analysis of the residuals. This statement implies that unidimensionality analysis will find out the extent of the diversity measured by an instrument so that it can be known whether the instrument can measure what it should measure (Andrich, 2010; Hassan & Miller, 2020; Higgins, 2007). Unidimensionality analysis was done by looking at the dimensionality table output on Winstep. Table 1 shows the dimensionality of the instrument.

Table 1
Dimensionality

Table of Standardized Residual Variance (in Eigenvalue Units)				
	Empirical			Modeled
Total raw variance in observations	42.3	100.0%		100.0%
Raw variance explained by measures	6.3	14.9%		15.0%
Raw variance explained by persons	1.4	3.2%		3.3%
Raw variance explained by items	4.9	11.6%		11.8%
Raw unexplained variance (total)	36.0	85.1%	100.0%	85.0%
Unexplned variance in 1st contrast	4.4	10.4%	12.2%	
Unexplned variance in 2nd contrast	4.2	9.9%	11.6%	
Unexplned variance in 3rd contrast	3.6	8.4%	9.9%	
Unexplned variance in 4th contrast	3.1	7.4%	8.7%	
Unexplned variance in 5th contrast	2.8	6.6%	7.8%	

Based on the table 1, it can be seen that the value of the raw variance explained by measures has a value of 14.9%. The minimum requirement for unidimensionality analysis is 20% (Andrich, 2010), so it can be seen that the instrument is still unable to measure a single attribute. However, the unexplained variance value is 6.6%-10.4%, indicating that the value has met the requirements. The unexplained variance value does not exceed 15%; hence, the instrument's level of independence can be said to be ideal (Boone et al., 2014).

Wright Rasch map analysis will provide information about the distribution of items and students (Bond et al., 2007). The output table variable map on Winstep is used to find out information for Wright's map analysis. The item difficulty level is known to range between logit -3 to logit 1, with the standard deviation of the items range between -1 SD to 1 SD. Students' abilities range between logit 0 to logit 2, with the standard deviation of students ranges between 0 SD to 1 SD.

Students' abilities are said to be outliers because their abilities are very high compared to other students. Some items are said to be outliers because they exceed the extremely easy category. Students or items that are said to be outliers are marked by the position of students or items that exceed two standard deviation limits (Bond et al., 2007). For example, the student who is said to be an outlier is student 04, and items that are said to be outliers are items 2, 3, and 9.

In revealing students' motivation to learn physical education, an analysis of learning motivation items was carried out using Rasch modeling assisted by the Winsteps 3.75 application. In the analysis process, the categorization of the electability of physical education learning motivation items was carried out. In addition to the previous process,

the categorization was also reviewed from aspects of physical education learning motivation.

Table 2
Item statistics: Measure order

Ent. Numb	Total Scr.	Msr.	Infit		Outfit		Pt-Measure		Exact Obs%	Match Exp%	Item
			Mnsq	Zstd	Mnsq	Zstd	Corr.	Exp.			
33	7	1.40	1.05	.3	1.03	.2	.16	.24	66.7	67.7	Q33
32	8	1.18	.82	-1.3	.79	-1.3	.59	.24	81.0	64.3	Q32
34	8	1.18	.95	-.3	.95	-.3	.33	.24	71.4	64.3	Q34
37	8	1.18	1.23	1.5	1.21	1.3	-.17	.24	42.9	64.3	Q37
16	9	.97	1.25	1.9	1.29	2.1	-.25	.24	52.4	62.3	Q16
18	9	.97	.84	-1.3	.82	-1.4	.55	.24	71.4	62.3	Q18
30	10	.77	.87	-1.2	.85	-1.3	.50	.24	71.4	60.9	Q30
22	11	.57	1.16	1.5	1.15	1.3	-.05	.24	38.1	60.1	Q22
35	11	.57	1.00	.0	.98	-.1	.25	.24	47.6	60.1	Q35
36	11	.57	1.01	.1	1.00	.0	.23	.24	57.1	60.1	Q36
10	12	.36	1.02	.2	1.01	.1	.21	.24	52.4	60.9	Q10
11	12	.36	.98	-.1	.96	-.2	.29	.24	52.4	60.9	Q11
20	12	.36	1.16	1.3	1.22	1.6	-.09	.24	52.4	60.9	Q20
21	12	.36	1.10	.9	1.10	.8	.05	.24	52.4	60.9	Q21
23	12	.36	1.06	.6	1.06	.5	.12	.24	52.4	60.9	Q23
31	12	.36	1.03	.3	1.04	.3	.17	.24	61.9	60.9	Q31
6	13	.15	.79	-1.6	.75	-1.6	.65	.23	81.0	63.1	Q6
19	13	.15	.92	-.6	.93	-.4	.38	.23	71.4	63.1	Q19
5	14	-.07	.97	-.1	.94	-.2	.30	.22	61.9	67.0	Q5
7	14	-.07	.92	-.4	.89	-.5	.38	.22	71.4	67.0	Q7
25	14	-.07	1.04	.3	1.16	.8	.10	.22	71.4	67.0	Q25
28	14	-.07	1.02	.2	1.00	.1	.19	.22	71.4	67.0	Q28
12	15	-.30	1.01	.1	1.03	.2	.17	.21	71.4	71.4	Q12
15	15	-.30	1.01	.1	.97	.0	.21	.21	71.4	71.4	Q15
17	15	-.30	1.04	.3	1.00	.1	.16	.21	71.4	71.4	Q17
26	15	-.30	1.06	.3	1.09	.4	.08	.21	71.4	71.4	Q26
4	16	-.56	.87	-.4	.76	-.7	.49	.20	76.2	76.1	Q4
9	16	-.56	1.02	.2	1.02	.2	.16	.20	76.2	76.1	Q9
1	17	-.85	1.07	.3	1.17	.5	.01	.18	81.0	80.9	Q1
8	17	-.85	.88	-.3	.73	-.6	.46	.18	81.0	80.9	Q8
13	17	-.85	.94	-.1	.90	-.1	.30	.18	81.0	80.9	Q13
14	17	-.85	.98	.1	.99	.1	.21	.18	81.0	80.9	Q14
24	17	-.85	.89	-.2	.84	-.3	.39	.18	81.0	80.9	Q24
27	17	-.85	.94	-.1	.80	-.4	.34	.18	81.0	80.9	Q27
29	19	-1.68	1.10	.4	1.49	.9	-.18	.14	90.5	90.4	Q29
3	20	-2.44	.99	.3	.76	.1	.17	.10	95.2	95.2	Q3
2	21	-3.64	Minimum Measure				.00	.00	100.0	100.0	Q2
Mean	13.5	-.10	1.00	.1	.99	.1			68.4	69.3	
S. D.	3.5	1.01	.10	.7	.16	.8			13.4	9.2	

Table 2 describes several columns that can provide information about the level of selectability of motivational items. The grouping of motivational item selectability levels was adopted from Sumintono by combining the standard deviation (SD) value and the logit mean value. The grouping is based on several categories: extremely difficult to

get elected category with a logit value greater than +1SD; the difficult to get elected category with a value of 0.0 logit +1 SD; easy to get elected category with a value of 0.0 logit -1 SD; and extremely easy to get elected with a value smaller than –SD (Andrich, 2010). Furthermore, item analysis in terms of motivational aspects of physical education was carried out, which is presented in table 3.

Table 3
Item analysis viewed from the aspects of motivation to learn physical education

No	Item Electability Level	Learning Motivation Item	Aspect
1	Extremely Difficult	33, 30, 34, 37	The majority of the choices are on the independent learning aspect such as diligently practicing physical education material and using opportunities outside of physical education lesson hours.
2	Difficult	16, 18, 30, 22, 35, 36, 10, 11, 20, 21, 23, 31, 06, 19	The majority of the choices are in two aspects, interest and attention to learning, such as habits and enthusiasm in following physical education lessons and being independent in learning, such as diligently practicing physical education material and using opportunities outside of physical education lesson hours.
3	Easy	05, 07, 25, 28, 12, 15, 17, 26, 04, 09, 01, 08, 13,14, 24, 27.	The majority of the choices are in the aspect of being diligent in learning such as attending school, participating in outdoor physical education teaching and learning process, and training at home outside of school; tenacious aspect in facing difficulties, for example, the attitude towards movement difficulties in learning physical education and efforts to overcome the difficulties; aspects of achievement in learning such as the desire to excel in physical education lesson and qualified in the result of physical education lessons.
4	Extremely Easy	29, 03, 02	The majority of choices are in the aspect of persistence in learning, such as attending school, following the teaching and learning process of physical education outdoor, and training at home/outside of school.

In table 3, it can be seen that of the 37 question items, there are three extremely easy question items and four extremely difficult question items. In contrast, the easy category question items get the highest results with 16 question items, followed by 14 difficult question items. The grouping shows that there are various levels of student motivation to learn physical education.

An item suitability analysis was conducted to determine whether the items used to measure motivation to learn physical education function normally (fit) or not (misfit). Items that misfit indicates a misconception of students' understanding of the item (Andrich, 2010). The item fit order table output on Winstep is used to determine whether the items used to measure motivation to learn physical education function normally or not.

According to Boone et al., (2014) and Bond (2007), to find out which items are said to be fit or misfit, it can be seen by looking at the mean-square value of outfit (Outfit MNSQ), outfit z-standard (Outfit ZSTD), and point measure correlation. Boone et al.,

(2014) stated that the criteria used to determine the normality of each item are as follows:

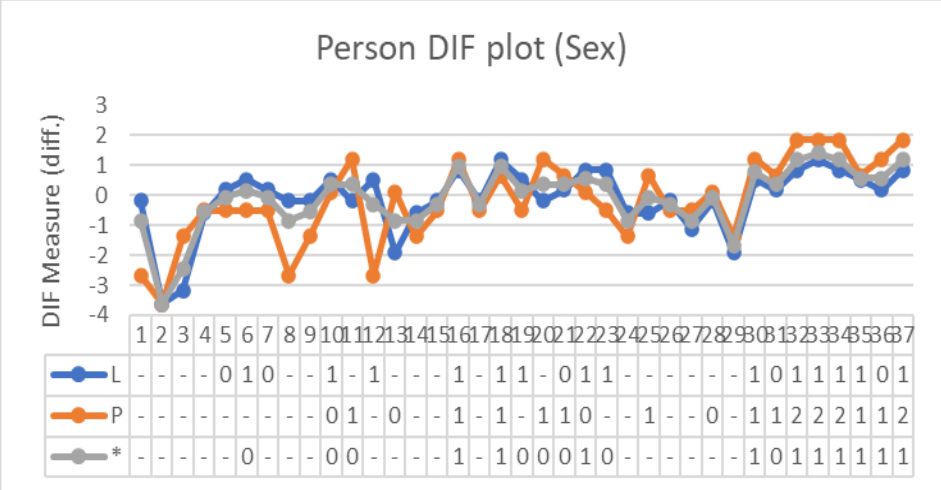
- Outfit MNSQ value on items received is not less than 0.5 and not more than 1.5.
- Outfit ZSTD value on items received is not less than -2.0 and not more than 2.0.
- The point measure correlation value on the item is not less than 0.4 and not more than 0.85.

It can be seen in table 4 that there are three groups of items that have met the criteria. First, there are six items that meet the three criteria: item number 4, 6, 8, 18, 30, and 32. Second, there is 1 item that only meets one criterion, namely item number 16. Third, 29 other items have met both criteria. However, if paying attention, there is 1 item not included in the item fit order table, namely item number 2. If looking at the previous table, namely the item measure table, it is known that the item has exceeded the minimum measurement limit. This statement implies that the item is too easy to do. Hence, it is declared not fit to measure students' motivation to learn physical education. For this reason, items other than number 2 have met at least one predetermined criteria. So, it can be said that the item is fit. Meanwhile, item number 2 requires repair or removal so that the measurements made are still in accordance with what would be measured.

One valid measure is that the items used to measure motivation to learn physical education do not contain bias. An item is said to be biased if it is found that students with specific characteristics benefit more than students with other characteristics (Andrich, 2010; Mellenbergh, 1989; Longford, 2014). Detecting biased items in Rasch modeling is called differential item functioning (DIF). DIF detection can be done by looking at the output of the DIF table in Winstep. There are several criteria that need to be met so that an item is said to be unbiased. One of them is to look at the probability value for each item. If the probability value of the item is below 5% or 0.05, it can be said that the item has a bias (Mellenbergh, 1989).

Table 4
Item fit order

Ent. Numb	Total Scr.	Msr.	Infit		Outfit		Pt-Measure		Exact Obs%	Match Exp%	Item
			Mnsq	Zstd	Mnsq	Zstd	Corr.	Exp.			
29	19	-1.68	1.10	.4	1.49	.9	-.18	.14	90.5	90.4	Q29
16	9	.97	1.25	1.9	1.29	2.1	-.25	.24	52.4	62.3	Q16
37	8	1.18	1.23	1.5	1.21	1.3	-.17	.24	42.9	64.3	Q37
20	12	.36	1.16	1.3	1.22	1.6	-.09	.24	52.4	60.9	Q20
1	17	-.85	1.07	.3	1.17	.5	.01	.18	81.0	80.9	Q1
22	11	.57	1.16	1.5	1.15	1.3	-.05	.24	38.1	60.1	Q22
25	14	-.07	1.04	.3	1.16	.8	.10	.22	71.4	67.0	Q25
21	12	.36	1.10	.9	1.10	.8	.05	.24	52.4	60.9	Q21
26	15	-.30	1.06	.3	1.09	.4	.08	.21	71.4	71.4	Q26
23	12	.36	1.06	.6	1.06	.5	.12	.24	52.4	60.9	Q23
33	7	1.40	1.05	.3	1.03	.2	.16	.24	66.7	67.7	Q33
17	15	-.30	1.04	.3	1.00	.1	.16	.21	71.4	71.4	Q17
31	12	.36	1.03	.3	1.04	.3	.17	.24	61.9	60.9	Q31
12	15	-.30	1.01	.1	1.03	.2	.17	.21	71.4	71.4	Q12
9	16	-.56	1.02	.2	1.02	.2	.16	.20	76.2	76.1	Q9
10	12	.36	1.02	.2	1.01	.1	.21	.24	52.4	60.9	Q10
28	14	-.07	1.02	.2	1.00	.1	.19	.22	71.4	67.0	Q28
15	15	-.30	1.01	.1	.97	.0	.21	.21	71.4	71.4	Q15
36	11	.57	1.01	.1	1.00	.0	.23	.24	57.1	60.1	Q36
35	11	.57	1.00	.0	.98	-.1	.25	.24	47.6	60.1	Q35
14	17	-.85	.98	.1	.99	.1	.21	.18	81.0	80.9	Q14
3	20	-2.44	.99	.3	.76	.1	.17	.10	95.2	95.2	Q3
11	12	.36	.98	-.1	.96	-.2	.29	.24	52.4	60.9	Q11
5	14	-.07	.97	-.1	.94	-.2	.30	.22	61.9	67.0	Q5
34	8	1.18	.95	-.3	.95	-.3	.33	.24	71.4	64.3	Q34
27	17	-.85	.94	-.1	.80	-.4	.34	.18	81.0	80.9	Q27
13	17	-.85	.94	-.1	.90	-.1	.30	.18	81.0	80.9	Q13
19	13	.15	.92	-.6	.93	-.4	.38	.23	71.4	63.1	Q19
7	14	.47	.92	-.4	.89	-.5	.38	.22	71.4	67.0	Q7
24	17	.56	.89	-.2	.84	-.3	.39	.18	81.0	80.9	Q24
8	17	.56	.88	-.3	.73	-.6	.46	.18	81.0	80.9	Q8
4	16	.51	.87	-.4	.76	-.7	.49	.20	76.2	76.1	Q4
30	10	.45	.87	-1.2	.85	-1.3	.50	.24	71.4	60.9	Q30
18	9	.45	.84	-1.3	.82	-1.4	.55	.24	71.4	62.3	Q18
32	8	.46	.82	-1.3	.79	-1.3	.59	.24	81.0	64.3	Q32
6	13	.46	.79	-1.6	.75	-1.6	.65	.23	81.0	63.1	Q6
Mean	13.5	-.10	1.00	.1	.99	.1			68.4	69.3	
S. D.	3.5	1.01	.10	.7	.16	.8			13.4	9.2	



Note : * = Item; L = Male; P = Female

Figure 2
Person DIF plot

In the items used to measure students' motivation to learn physical education, there is no bias when analyzed based on gender characteristics. Male and female students have the same level of selecting each item. This condition indicates that the item does not need to be revised based on its difficulty level. Figure 2 shows that there are some items that are easier for women to work on, and there are some easier for men as well. This interpretation indicates that the higher the value possessed by a gender characteristic, the more difficult it is for the student to work on an item. The fact that there is a difference in the item's difficulty level when viewed from the gender characteristics does not indicate that the item is biased because the item bias is seen in the probability of each item that does not exceed 5%.

Students' motivation to learn physical education can be seen by looking at the output of the person measure table on Winstep. Based on table 5, students' abilities can be grouped into 3 categories: high, medium, and low. The categorization was done by combining the average value with the standard deviation. Since the categorization was done by taking the average value and standard deviation of the sample, then the categorization was done based on the norm reference assessment or PAN. The categories can be seen from the student's measure scores in table 3: High = X > M + 1SD; Medium = M + 1SD > X > M – 1SD; Low = X < M – 1SD. Hence, students' abilities regarding physical education learning motivation can be grouped and explained in table 6.

Table 5
Person measure

Ent. Numb	Total Scr.	Msr.	Infit		Outfit		Pt-Measure		Exact Obs%	Match Exp%	Prsn
			Mnsq	Zstd	Mnsq	Zstd	Corr.	Exp.			
4	31	1.81	.84	-.5	.66	-7	.41	.24	83.3	83.3	04
5	29	1.42	1.05	.3	1.00	.1	.24	.28	77.8	77.7	05
11	28	1.25	1.10	.6	1.42	1.3	.15	.29	77.8	75.1	11
12	28	1.25	1.00	.1	.91	-.2	.30	.29	77.8	75.1	12
14	27	1.09	1.15	.9	1.11	.5	.17	.30	61.1	72.9	14
18	27	1.09	.77	-1.4	.65	-1.3	.53	.30	83.3	72.9	18
21	27	1.09	1.04	.3	1.11	.5	.25	.30	72.2	72.9	21
10	25	.80	.84	-1.1	.81	-.8	.47	.33	77.8	69.4	10
3	24	.66	.97	-.2	1.06	.4	.34	.34	66.7	67.9	03
17	24	.66	.97	-.1	.90	-.4	.37	.34	66.7	67.9	17
1	23	.53	1.24	1.9	1.23	1.2	.13	.35	50.0	66.5	01
7	23	.53	.79	-1.8	.74	-1.4	.54	.35	77.8	66.5	07
20	23	.53	1.10	.8	1.05	.3	.27	.35	50.0	66.5	20
13	22	.40	1.02	.2	.97	-.1	.35	.35	63.9	65.4	13
2	21	.27	1.22	1.8	1.49	2.6	.13	.36	55.6	65.0	02
6	21	.27	.90	-.8	.87	-.7	.45	.36	72.2	65.0	06
16	21	.27	.89	-.9	.87	-.8	.46	.36	66.7	65.0	16
15	20	.14	1.07	.6	1.06	.4	.31	.37	58.3	64.8	15
19	20	.14	1.06	.5	1.02	.2	.33	.37	58.3	64.8	19
8	19	.02	.76	-2.3	.73	-1.9	.60	.38	88.9	64.9	08
9	17	-.24	1.20	1.6	1.15	1.0	.23	.39	50.0	65.7	09
Mean	23.8	.67	1.00	.0	.99	.0			68.4	69.3	
S. D.	3.6	.51	.14	1.1	.22	1.0			11.5	5.1	

Table 6
Student ability category

Category	Student	Interpretation
High (X > 1.18)	4, 5, 11, 12	Students in the high category have a high tendency in the motivational aspects of physical education: perseverance in learning, tenacity in facing difficulties, interest and attention in learning, achievement in learning, and independence in learning. Students who have high motivation to learn physical education have perseverance in learning, including attending school, participating in the learning and teaching process of physical education in the field, and doing exercises at home/out of school. Students are also tenacious in facing difficulties such as their attitude towards movement difficulties in learning and trying to overcome physical education learning material difficulties. In addition, students also have great interest and concern in learning, including habits in following physical education lessons, and enthusiastic in participating in the physical education learning and teaching process. The spirit to excel in learning is also owned by students with high motivation to learn physical education. Students have a desire to excel in learning and have a good qualification in physical education. Finally, students have independence in learning, including perseverance in practicing physical education material and using outside school hours to learn physical education.
Medium (1.18 > X > 0.16)	1, 2, 3, 6, 7, 10, 13, 14, 16, 17, 18, 20, 21	Students in the medium category have a moderate tendency in the motivational aspects of physical education: perseverance in learning, tenacity in facing difficulties, interest and attention in learning, achievement in learning, and independence in learning. Students who have a moderate motivation to learn physical education have enough perseverance in learning, including attending school, participating in the learning and teaching process of physical education in the field, and doing exercises at home/out of school. Students are also quite tenacious in facing difficulties such as their attitude towards movement difficulties in learning and overcoming physical education learning material difficulties. In addition, students also have enough interest and concern in learning, including habits in following physical education lessons and have enough enthusiasm in participating in the physical education learning and teaching process. The spirit to excel in learning is moderately owned by students with moderate motivation to learn physical education. Students have enough desire to excel in learning and have a fairly good qualification in physical education. Finally, students are quite independent in learning, including perseverance in practicing physical education material and using outside school hours to learn physical education
Low (X < 0.16)	8, 9, 15, 19	Students in the low category have a low tendency in the motivational aspects of physical education: perseverance in learning, tenacity in facing difficulties, interest and attention in learning, achievement in learning, and independence in learning. Students who have low motivation to learn physical education do not have perseverance in learning, including attending school, participating in the learning and teaching process of physical education in the field, and doing exercises at home/out of school. Students are also not tenacious in facing difficulties such as their attitude towards movement difficulties in learning and overcoming physical education learning material difficulties. In addition, students also do not have great interest and concern in learning, including habits in following physical education lessons, and enthusiastic in participating in the physical education learning and teaching process. The spirit to excel in learning is also not owned by students with low motivation to learn physical education. Students do not desire to excel in learning and do not have a good qualification in physical education. Finally, students do not yet have independence in learning, including perseverance in practicing physical education material and using outside school hours to learn physical education.

The level of students' abilities regarding the motivation to learn physical education has already been identified. However, it is necessary to ensure that the answers given by students are indeed following their abilities. Individual suitability analysis was conducted to determine whether the response pattern given by the individual is genuinely following their ability or not (Andrich, 2010). The analysis was done by looking at the output of the person fit order table on Winstep. The table 7 displays the output of the person fit order table.

Table 7
Person fit order

Ent. Numb	Total Scr.	Msr.	Infit		Outfit		Pt-Measure		Exact Obs%	Match Exp%	Prsn
			Mnsq	Zstd	Mnsq	Zstd	Corr.	Exp.			
2	21	.27	1.22	1.8	1.49	2.6	.13	.36	55.6	65.0	2
11	28	1.25	1.10	.6	1.42	1.3	.15	.29	77.8	75.1	11
1	23	.53	1.24	1.9	1.23	1.2	.13	.35	50.0	66.5	1
9	17	-.24	1.20	1.6	1.15	1.0	.23	.39	50.0	65.7	9
14	27	1.09	1.15	.9	1.11	.5	.17	.30	61.1	72.9	14
21	27	1.09	1.04	.3	1.11	.5	.25	.30	72.2	72.9	21
20	23	.53	1.10	.8	1.05	.3	.27	.35	50.0	66.5	20
15	20	.14	1.07	.6	1.06	.4	.31	.37	58.3	64.8	15
3	24	.66	.97	-.2	1.06	.4	.34	.34	66.7	67.9	3
19	20	.15	1.06	.5	1.02	.2	.33	.37	58.3	64.8	19
5	29	1.42	1.05	.3	1.00	.1	.24	.28	77.8	77.7	5
13	22	.40	1.02	.2	.97	-.1	.35	.35	63.9	65.5	13
12	28	1.25	1.00	.1	.91	-.2	.30	.29	77.8	75.1	12
17	24	.66	.97	-.1	.90	-.4	.37	.34	66.7	67.9	17
6	21	.27	.90	-.8	.87	-.7	.45	.36	72.2	65.0	6
16	21	.27	.89	-.9	.87	-.8	.46	.36	66.7	65.0	16
10	25	.80	.84	-1.1	.81	-.8	.47	.33	77.8	69.5	10
4	31	1.81	.84	-.5	.66	-.7	.41	.24	83.3	83.3	4
7	23	.53	.79	-1.8	.74	-1.4	.54	.35	77.8	66.5	7
18	27	1.09	.77	-1.4	.65	-1.3	.53	.30	83.3	72.9	18
8	19	.02	.76	-2.3	.73	-1.9	60	.38	88.9	64.9	8
Mean	23.8	.67	1.00	.0	.99	.0			68.4	69.3	
S. D.	3.6	.51	.14	1.1	.22	1.0			11.5	5.1	

The individual suitability analysis carried out is the same as what was carried out in the item suitability analysis. The analysis was also carried out with the same criteria. Hence, if seen in table 7, it can be seen that there is one student who only meets one criterion, student number 2. There are 13 students who meet two criteria: students number 1, 3, 5, 9, 11, 12, 13, 14, 15, 17, 19, 20, and 21. 7 students meet the three criteria: students number 4, 6, 7, 8, 10, 16, and 18. Students who meet the three criteria can be ascertained that the response pattern given is appropriate with their abilities. However, students who only meet two criteria are less likely to have a response pattern that does not match their abilities. Moreover, students who only meet one criterion have a greater likelihood of having a response pattern that is not following their abilities.

Overall instrument analysis was done by checking the output summary statistics table on Winstep. Summary statistics and measurement information functions are displayed in the statistical summary table. There is some information obtained through table 8, which displays summary statistics. First, the average value of respondents is at logit 0.67. The average value that exceeds logit 0 indicates more respondents who answered agree on each statement on various items. Therefore, it can be concluded that the student's motivation to learn physical education is above average.

Second, the Cronbach Alpha value measures the reliability of the interaction between the person and the item as a whole. Based on table 8, the Cronbach Alpha has a value of 0.44. Based on the criteria presented by Fisher (2007), it can be seen that the score is in

a bad category because the value is below 0.5. In short, the interaction between the person and the item has a poor quality.

Third, Table 8 displays the person and the items' reliability that explain the consistency of students and the quality of the items. The reliability of the person and the item has a value of 0.42 and 0.59, respectively. Based on the criteria presented by Fisher (2007), it was found that the person and item reliability values were in the weak category because their values were below 0.67. Hence, it can be inferred that students have weak consistency in answering questions. This statement implies that students are likely to give different answers when given the same question. This condition also applies to items that are of poor quality. If these items are given several times to students, they will give different answers so that the consistency obtained in measuring is weak.

Fourth, the Infit value will provide information regarding the sensitivity of the response pattern to the item and vice versa. In addition, the outfit value will also provide information related to the sensitivity of the response pattern to items with a certain level of difficulty. In the summary person table, the MNSQ Infit and MNSQ Outfit values are 1.00 and 0.99. Also, in the summary item table, the MNSQ Infit and MNSQ Outfit values are 1.00 and 0.99. The closer the value is to the number 1, it can be said that the condition is suitable for measurement (Andrich, 2010). In addition, in the summary person table, the Infit ZSTD and Outfit ZSTD values are 0, and in the summary items table, the Infit ZSTD and Outfit ZSTD values are 0.1. The closer the value is to the number 0, it can be said that the data has a logical estimate (Andrich, 2010).

Table 8
Summary statistics

Summary Person

	Total Score	Count	Measure	Model S.E.	InFit Mnsq	InFit Zstd	OutFit Mnsq	OutFit Zstd
Mean	23.8	37.0	.67	.38	1.00	.0	.99	.0
SD	3.6	.0	.51	.03	.14	1.1	.22	1.0
Max.	31.0	37.0	1.81	.46	1.24	1.9	1.49	2.6
Min.	17.0	37.0	-.24	.36	.76	-2.3	.65	-1.9
Real RMSE	.39	True SD	.33	Separation	.86	Person Reliability		.42
Model RMSE	.38	True SD	.34	Separation	.91	Person Reliability		.45
S.E. Of Person Mean = .11								

person raw score-to-measure correlation = 1.00
cronbach alpha (kr-20) person raw score "test" reliability = .44

Summary Item

	Total Score	Count	Measure	Model S.E.	Infit Mnsq	Infit Zstd	Outfit Mnsq	Outfit Zstd
Mean	13.3	21.0	.00	.51	1.00	.1	.99	.1
SD	3.3	.0	.83	.11	.10	.7	.16	.8
Max.	20.0	21.0	1.40	1.03	1.25	1.9	1.49	2.1
Min.	7.0	21.0	-2.44	.45	.79	-1.6	.73	-1.6
Real RMSE	.53	True SD	.63	Separation	1.20	Item Reliability		.59
Model RMSE	.52	True SD	.64	Separation	1.23	Item Reliability		.60
S.E. Of Person Mean = .14								

Finally, table 8 can provide information about the quality of the instrument and students. This information could be gathered by processing the separation value with the following formula:

$$H = [(4 \times separation) + 1] / 3$$

The greater the value of separation, the better the instrument will be because the instrument can identify a wider group of students (capable–incapable) and a group of items (difficult–easy) (Parkitny et al., 2012; Sumintono & Widhiarso, 2015). In the summary person table, the separation value is 0.86, and when processed with the formula, the result is 1.5 (rounded to 2). These results indicate that the instrument can only identify two groups of students. While in the summary item table, the separation value is 1.20. Furthermore, when processed with the previous formula, the result is 1.93 (rounded up to 2). These results indicate that the instrument can only identify two groups of items.

CONCLUSION

Rasch modeling allows for a more precise depiction of the distribution map of student learning motivation. The Rasch model analysis provides a good overview of the instrument's construct validity, ensuring that the data acquired is accurate. The results of this study also provide an overview and information for teachers about how student motivation varies. The choice and implementation of learning models, as well as the management of learning settings, must be considered carefully in order to maximize students' learning motivation in physical education classes. Students with a high level of motivation are more likely to attain their learning objectives.

REFERENCES

Andrich, D. (2010). Rasch models. In International encyclopedia of education. (pp. 111-122). *Pergamon*. https://doi.org/10.1016/B978-0-08-044894-7.00258-X

Bailey, R. (2006). Physical education and sport in schools: A review of benefits and outcomes. *Journal of school health, 76*(8), 397-401.

Bice, M. R., Ball, J. W., & McClaran, S. (2016). Technology and physical activity motivation. *International Journal of Sport and Exercise Psychology, 14*(4), 295-304.

Bond, T. G., & Fox, C. M. (2007). *Applying the Rasch model: Fundamental measurement in the human sciences*. Psychology Press.

Boone, W. J., Staver, J. R., & Yale, M. S. (2014). *Rasch analysis in the human sciences. Springer Science & Business Media*.

Brogden, H. E. (1977). The Rasch model, the law of comparative judgment and additive conjoint measurement. *Psychometrika, 42*(4), 631-634.

Chen, S., Sun, H., Zhu, X., & Chen, A. (2014). Relationship between motivation and learning in physical education and after-school physical activity. *Research Quarterly for Exercise and Sport, 85*(4), 468-477.

Cortés, A. S., Correa-Díaz, A. M., Benjumea-Arias, M. L., Valencia-Arias, A., & Bran-Piedrahita, L. (2017). Motivational factors and effects associated with physical-sport practice in undergraduate students. *Procedia-Social and Behavioral Sciences*, *237*, 811-815.

Deci, E. L., Vallerand, R. J., Pelletier, L. G., & Ryan, R. M. (1991). Motivation and education: The self-determination perspective. *Educational psychologist*, *26*(3-4), 325-346.

Fisher, W. P. (2007). Rating scale instrument quality criteria. *Rasch measurement transactions*, *21*(1), 1095.

Hamdu, G., Fuadi, F. N., Yulianto, A., & Akhirani, Y. S. (2020). Items Quality Analysis Using Rasch Model To Measure Elementary School Students' Critical Thinking Skill On Stem Learning. *JPI (Jurnal Pendidikan Indonesia)*, *9*(1), 61-74.

Higgins, G. E. (2007). Examining the original Grasmick scale: A Rasch model approach. *Criminal Justice and Behavior*, *34*(2), 157-178.

In'am, A., & Sutrisno, E. S. (2020). Strengthening Students' Self-efficacy and Motivation in Learning Mathematics through the Cooperative Learning Model. *International Journal of Instruction*, *14*(1). https://doi.org/10.29333/IJI.2021.14123A

Jaakkola, T., Yli-Piipari, S., Barkoukis, V., & Liukkonen, J. (2017). Relationships among perceived motivational climate, motivational regulations, enjoyment, and PA participation among Finnish physical education students. *International Journal of Sport and Exercise Psychology*, *15*(3), 273-290.

Linacre, J. M. (1999). Investigating rating scale category utility. *Journal of outcome measurement*, *3*(2), 103-122.

Longford, N. T. (2014). Screening test items for differential item functioning. *Journal of Educational and Behavioral Statistics*, *39*(1), 3-21.

Masters, G. N. (1982). A Rasch model for partial credit scoring. *Psychometrika*, *47*(2), 149-174.

Mellenbergh, G. J. (1989). Item bias and item response theory. *International journal of educational research*, *13*(2), 127-143.

Misbach, I. H., & Sumintono, B. (2014). Pengembangan dan validasi instrumen "persepsi siswa tehadap karakter moral guru" di Indonesia dengan model Rasch.

Nur, L., Nurani, L. A., Suryana, D., & Ahmad, A. (2020). Rasch model application on character development instrument for elementary school students. *International Journal of Learning, Teaching and Educational Research*, *19*(3), 437-459.

Nur, L., Setiadi, P. M., Kusdinar, Y., & Malik, A. A. (2019). Electronic rubric for motivation in physical education. *In Journal of Physics*: Conference Series (Vol. 1318, No. 1, p. 012129). IOP Publishing.

Olsen, L. W. (2003). Essays on Georg Rasch and his contributions to statistics. Københavns Universitet, Økonomisk Institut.

Parkitny, L., McAuley, J. H., Walton, D., Costa, L. O. P., Refshauge, K. M., Wand, B. M., ... & Moseley, G. L. (2012). Rasch analysis supports the use of the depression, anxiety, and stress scales to measure mood in groups but not in individuals with chronic low back pain. *Journal of Clinical Epidemiology*, *65*(2), 189-198.

Perlman, D., & Webster, C. A. (2011). Supporting student autonomy in physical education. *Journal of Physical Education, Recreation & Dance*, *82*(5), 46-49.

Ramdani, R., Hanurawan, F., Ramli, M., Lasan, B. B., & Afdal, A. (2020). Development and Validation of Indonesian Academic Resilience Scale Using Rasch Models. *International Journal of Instruction*, *14*(1). https://doi.org/10.29333/IJI.2021.1417A

Rasch, G. (1993). *Probabilistic models for some intelligence and attainment tests*. Chicago: MESA Press.

Rokhayati, A., Nur, L., & Gandana, G. (2017, March). Tactical Approach to Increase Motivation for Learning Students on Physical Education Teaching in Primary Schools. In IOP Conference Series: Materials Science and Engineering (Vol. 180, No. 1, p. 012259). IOP Publishing.

Suherman, A. (2011). Realitas Kurikulum Pendidikan jasmani. Upaya Menuju Kurikulum Berbasis Penelitian. Bandung: Rizqi Press

Sumintono, B and Widhiarso, W. (2014). Aplikasi model Rasch untuk penelitian ilmu-ilmu sosial (edisi revisi). Cimahi: Trim Komunikata Publishing House.

Sumintono, B., & Widhiarso, W. (2015). Aplikasi pemodelan rasch pada assessment pendidikan. Trim komunikata.

Timofte, R. S., & Siminiciuc, L. (2018). Utilisation of Rasch model for the analysis of an instrument developed by mapping items to cognitive levels of Marzano taxonomy. *Acta Didactica Napocensia*, *11*(2).

Ul Hassan, M., & Miller, F. (2020). Discrimination with unidimensional and multidimensional item response theory models for educational data. *Communications in Statistics-Simulation and Computation*, 1-21.

Vallerand, R. J. (2007). Intrinsic and extrinsic motivation in sport and physical activity: A review and a look at the future.

Wright, B. D. (1977). Solving measurement problems with the Rasch model. *Journal of Educational Measurement*, *14*(2). https://doi.org/10.1111/j.1745-3984.1977.tb00031.x