Physical literacy evaluation of primary school students in indonesia: validity and reliability analysis of PL-C Quest instrument with rasch model

Evaluación de la alfabetización física de estudiantes de primaria en Indonesia: análisis de validez y confiabilidad del instrumento PL-C Quest con el modelo Rasch

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Abstract

Introduction. Good physical literacy is important for students to support a better life. therefore it is necessary to evaluate it. Objectives. This study aimed to evaluate the level of physical literacy of primary school students in Indonesia with a focus on the validity and reliability of the measurement instrument, PL-C Quest. Methodology. Using Rasch model for data analysis, this study measured physical literacy dimensions including physical, psychological, social, and cognitive aspects. The study sample consisted of 120 students from three provinces in Indonesia. Data were analyzed using WINSTEPS version 4.7.0 application to ensure measurement accuracy.
Results. Showed that 70% of students were in the "high" category in physical literacy, with strengths in social and cognitive aspects. However, the main challenge lies in developing more complex motor skills, such as balance, coordination and endurance. Rasch analysis showed that the PL-C Quest instrument had adequate reliability with a Cronbach Alpha value of 0.78 and good validity in measuring the dimensions of physical literacy. Although the reliability of the instrument was good, some items needed to be improved, especially those measuring students' motor skills.
Discussion. Revealed the importance of intervention programs that focus more on developing basic motor skills and the use of more accurate measurement instruments. This study makes an important contribution to the development of physical education and sport policy in Indonesia and supports the achievement of Indonesia Bugar 2045.
Conclusion. Physical literacy of primary school students has great potential to be developed, but requires improvement of motor skills and improvement of measurement instruments.

Keywords

Motor skills; physical education; Wright map; WINSTEPS; item difficulty.

Resumen

Introducción. Una buena alfabetización física es importante para que los estudiantes tengan una vida mejor. Por lo tanto, es necesario evaluarla. Objetivos. Este estudio tuvo como objetivo evaluar el nivel de alfabetización física de estudiantes de primaria en Indonesia, centrándose en la validez y fiabilidad del instrumento de medición PL-C Quest. Metodología. Utilizando el modelo de Rasch para el análisis de datos, este estudio midió las dimensiones de la alfabetización física, incluyendo los aspectos físicos, psicológicos, sociales y cognitivos. La muestra del estudio consistió en 120 estudiantes de tres provincias de Indonesia. Los datos se analizaron con la aplicación WINSTEPS versión 4.7.0 para garantizar la precisión de la medición. Resultados. Se demostró que el 70% de los estudiantes se encontraban en la categoría "alta" en alfabetización física, con fortalezas en los aspectos sociales y cognitivos. Sin embargo, el principal desafío radica en el desarrollo de habilidades motoras más complejas, como el equilibrio, la coordinación y la resistencia. El análisis de Rasch mostró que el instrumento PL-C Quest presentó una fiabilidad adecuada, con un valor Alfa de Cronbach de 0,78, y una buena validez para medir las dimensiones de la alfabetización física. Si bien la fiabilidad del instrumento fue buena, algunos ítems requerían mejoras, especialmente aquellos que miden las habilidades motoras de los estudiantes.
Discusión. Se reveló la importancia de los programas de intervención que se centran más en el desarrollo de las habilidades motoras básicas y el uso de instrumentos de medición más precisos. Este estudio contribuye significativamente al desarrollo de políticas de educación física y deporte en Indonesia y apoya el logro de la Meta Indonesia 2045.
Conclusión. La alfabetización física de los estudiantes de primaria tiene un gran potencial de desarrollo, pero requiere mejorar las habilidades motoras y los instrumentos de medición.

Palabras clave

Habilidades motoras; educación física; mapa de Wright; WINSTEPS; dificultad del elemento

Introduction

Physical literacy (PL) is a concept in promoting physical activity throughout life that has developed rapidly since it was first introduced in 1993 by Whitehead (Cornish et al., 2020). PL has various definitions, and all of them include physical fitness, psychological, knowledge, and understanding, and physical activity (PA) for life (Shearer et al., 2018).

The importance of PL has attracted widespread attention from the international community, and many countries have developed intervention models and policies based on PL to improve PA and health (Cairney et al., 2019; Whitehead, 2010). The development of PL involves the physical, affective, and cognitive domains (Whitehead, 2010), and requires adaptive motivation, which is an appropriate internal drive that is able to activate an individual's appreciation for physical activity (Linnenbrink-Garcia et al., 2016). The World Health Organization (WHO) has identified PL as an important component in its action plan to address the global public health problem associated with physical inactivity (WHO, 2018).

Early evidence suggests that to increase participation, interventions should also include aspects such as children's psychological, cognitive, and social competencies (Brunton, 2017). PL itself has been widely developed based on user needs such as research by Stoddart et al. (Stoddart et al., 2023) who developed Physical Literacy PLitPE by combining PL and Self-Determination Theory for elementary school students which has an impact on the development of psychological domains (affective and cognitive) and significantly increases students' physical competence. In addition, other studies (Jones et al., 2018) developed PL for parents to maintain lifelong physical activity participation. Furthermore, previous studies have mentioned the importance of developing models, exercises, or other concepts to support strengthening PL from an early age (Lyngstad & Sæther, 2021; Wainwright et al., 2020).

PL and individual fitness are part of the 9 basic dimensions in measuring the Sports Development Index (SDI), which means that understanding PL and fitness is an important element in sports development in Indonesia. The 2022 SDI report states that the national physical literacy score is 0.596 and fitness is 0.194 scale 0.00-1 (Pemuda & Indonesia, 2022). Furthermore, students' physical fitness is in the "poor" and "very poor" categories as much as 82.7% for elementary school/equivalent, 85.8% for junior high school/equivalent, and 83.9% for senior high school/equivalent. This condition is certainly a whip for all sports stakeholders, especially in efforts to realize a Fit Indonesia in 2045.

Then the results of the PL scores on the island of Java are still below the national average with a score of 0.590 for West Java, and 0.567 for Central Java and East Java. This means that serious efforts are needed to promote PL from an early age, in addition to physical education learning in schools which is carried out regularly, there also needs to be a specially designed program in the form of Out of School Hours Care (OSHC) activities. OSHC activities are special programs given to children to be able to develop their physical activities outside of school hours (Hadley et al., 2021). The results of previous studies revealed that children who attended OSHC after school hours in New South Wales, Australia showed positive improvements in their physical activity practices and suggested designing types of scheduled and structured physical activities that can be combined with play activities as an effective strategy to increase children's physical activity (Crowe et al., 2021). In addition, physical literacy itself is considered an important factor in PA and is positively correlated with the development of children's motor skills (Tang et al., 2023) so the Physical Literacy program implemented in Out of School Hours Care (OSHC) activities can be used as an alternative to develop motor abilities which will have implications for children's physical fitness.

The problem raised in this study is the low level of physical literacy in elementary school students is an important issue to discuss in order to support sports development in Indonesia. Based on the national physical literacy score which is still low and the results of previous studies that show disparities in physical literacy levels in various regions in Indonesia, this study tries to analyze more deeply by using a sample of 120 students (twice as many as previous studies) and applying the Rasch model to assess the accuracy and reliability of the physical literacy measurement instruments used. This study also aims to identify students' strengths and weaknesses in aspects of physical literacy which include physical skills, psychological motivation, social interaction, and cognitive understanding of physical activity. In addition, this study tries to evaluate the suitability and reliability of the physical literacy measurement instruments used, to ensure that the measurement instruments can provide valid and consistent data.

Based on these findings, this study aims to provide accurate data-based recommendations for educators and policy makers in designing more effective intervention programs to improve physical literacy of elementary school students in Indonesia, which will support the achievement of Indonesia Fit 2045. This study is expected to provide significant contributions in improving the quality of physical education in Indonesia, as well as forming a strong foundation for the development of better sports and health policies in the future.

Method

This study applied a cross-sectional survey method, where data was collected from a population in a certain period of time (Ary et al., 2010). Involving participants consisting of 120 elementary school students from elementary school students from 3 different provinces, namely SD Labschool UNESA 1 and SD Labschool UNESA 2 in East Java, SDs Laboratorium Perpilot UPI Tasikmalaya and SDN Dadaha in West Java, and SD Pembangunan Laboratorium UNP and SDIT Buah Hati Padang in West Sumatra, with each school involving 30 students as research participants who participated in the application trial. The inclusion criteria for participants in this study included students aged 8–12 years.

Table 1. Grid of Elementary School Students' Physical Literacy Questionnaire Instruments

No	Domain	Element	No. Item	Number of Items
1	Physical: The skills and fitness a person acquires and applies through movement.	Movement skills, Moving with equipment, Object manipulation, Coordination, Stability Balance, Flexibility, Agility, Strength, Muscular endurance, Cardiovascular endurance, Reaction time, and Speed.	1,2,3,4,5, 6,7,8,9,10, 11,12	12
2	Psychological: The attitudes and emotions a person has towards movement and the impact they have on their confidence and motivation to move.	Engagement & enjoyment, Confidence, Motivation, Connection to place, Self-perception, Self-regulation (emotions), and Self-regulation (physical).	13,14,15, 16,17,18, 19	7
3	Social: A person's interaction with others in relation to movement	Relationships, Collaboration, Ethics, Society & culture.	20,21,22, 23	4
4	Cognitive: A person's understanding of how, why and when they move.	Content knowledge, Safety & Risk, Rules, Reasoning, Strategy & planning, Tactics, and Perceptual awareness.	24,25,26, 27,28,29, 30	7

The PL-C Quest grid instrument (Barnett et al., 2022) was used to measure students' knowledge and understanding of physical literacy (see table 1). This questionnaire This assessment uses 30 questions (30 Item No.) from the Indonesian version of the PL-C Quest which has been approved by Sport Australia (see APPENDIX 1). In the process, children are asked to read the text and observe the main character, which is shaped like a rabbit, for each question. Visually, they must ensure that only one of the four boxes is selected for each question. In the assessment, there are two choices of pictures that represent a higher level of development with examples of sentences "Some children want to read books", namely "VERY like me" (score 4) and "A LITTLE like me" (score 3). Meanwhile, the other two choices indicate a lower level of development with negative statements with examples of statements "Other children do not want to read books", namely "A LITTLE like me" (score 2) and "A LITTLE like me" (score 1). Thus, children's perceptions of PL competence were assessed using a four-point scale (Diao et al., 2024; Likert, 1932), which was applied to measure the level of agreement with various alternatives (Gonzálvez et al., 2018; Tsujimoto et al., 2018; Vuletich et al., 2019).

This study used a statistical method in which all collected data were entered into a Microsoft Excel file and analyzed with the help of the WINSTEPS application version 4.7.0, a Rasch Model-based measurement software. This analysis was carried out for data validation, data cleaning, calibration of item difficulty levels and individual abilities, and describing the relationship between item difficulty levels and individual abilities using an equivalent logit scale (Linacre, 2012). Several fit indices provided in Rasch analysis are Person Infit ZSTD, Person Outfit ZSTD, Person Infit MNSQ, Person Outfit MNSQ, Item Infit ZSTD, Item Outfit ZSTD, Item Infit MNSQ, and Item Outfit MNSQ (Boone et al., 2014). Validity indicates the extent to which a measurement instrument is accurate and precise in carrying out its measurement function. The quality of item validity in the Rasch Model is achieved if the items meet

several criteria (Peeters & Harpe, 2022). If it meets the validity criteria based on the three indicators used: Outfit MNSQ, Z-Standard (ZSTD), and Point Measure Correlation (PMC). Items with MNSQ values generally between 0.5 and 1.5 (Logit 0.5 <MNSQ) indicate a reasonable fit of the data to the model (Wright & Linacre, 1994), ZSTD between -2.0 and +2.0, and PMC between 0.4 and 0.85 can be considered valid (Boone et al., 2014). However, (Keeves & Alagumalai, 2005) classified PMC values into very good (>0.40), good (0.30–0.39), sufficient (0.20–0.29), unable to differentiate (0.00–0.19), and needs to be reviewed (<0.00). If the sample used is large (>500), there is a tendency for the ZSTD value to have a value above 3. Therefore, some experts recommend not using this ZSTD criterion if the sample used is large enough (Sumintono & Widhiarso, 2015), in this case a sample of 120 students can still be used. However, if two of the three indicators show validity, the item is still considered valid as a whole.

Test-retest reliability is calculated by the intra-class correlation coefficient (ICC), where values less than 0.5 are considered to indicate low reliability, values between 0.5 and 0.75 indicate moderate reliability, values between 0.75 and 0.9 indicate good reliability, and values greater than 0.90 indicate excellent reliability (Portney & Watkins, 2009). Rasch theory uses a logistic regression model to estimate the probability of a person answering a question correctly and creates a logit scale with equal intervals for individuals and items (Bond & Fox, 2015; Dunne et al., 2012). In Rasch modeling, the difficulty level of the item is categorized based on the Measure logit and Standard Deviation (SD) values of the item logit, which are then divided into four categories as shown in Table 2 (Planinic et al., 2019). A higher logit value indicates a higher level of question difficulty

Table 2. Criteria for Difficulty Levels of Question Items with Rasch Modeling

Measure Value (logit)	Interpretation of Question Item Difficulty
Measure logit < - SD logit	Easy
- SD logit ≤ Measure logit ≤ 0	Medium
0 ≤ Measure logit ≤ SD logit	Difficult
Measure logit > SD logit	Highly Difficult

The difficulty level of an item indicates how many respondents are likely to answer the item correctly (Andrade, 2018; Hamdu et al., 2020). The items on the physical literacy test instrument have an average of 0, which means they are at the equilibrium point. These items are used to determine a person's position on the variable (for example, whether they are at a high or low level on the variable) (Planinic et al., 2019). One ability parameter for each individual and one difficulty parameter for each item (WRIGHT, 1977) in the form of a Wright map image.

Table 3. The criteria for grouping student abilities

Measure Value (logit)	Interpretation of Question Item Difficulty
> SD logit	Hight
< SD logit	Medium
< - mean logit	Low

In addition to the test items, Wright Map also produces a picture of students' actual abilities which are divided into three categories (see table 3), namely high, medium, and low (Kristyasari et al., 2022). This division is done because the criteria for grouping test items and student abilities are based on the Standard Deviation (SD) value (Wahyu et al., 2020). Because the average logit person is not 0, the low criterion uses the value of the average logit person.

Results

Based on the results of the validity test of the Physical Literacy questionnaire shown in table 4, the majority of items meet the validity criteria based on the three indicators used (Outfit MNSQ, ZSTD, and PMC). Several items show low PMC values and extreme ZSTD, so they need further attention. However, if two of the three indicators show validity, the item is still considered valid overall. Therefore, although there are several items that need improvement, most of the items in this questionnaire can be accepted to measure the dimensions of Physical Literacy with sufficient accuracy for further research.

Table 4. Results of the Validity Test of the Physical Literacy Questionnaire.

Domain	No. Item	MNSQ		ZSTD		Pt. MC		Information
		Value	Status	Value	Status	Value	Status	
Physical	1	1.26	Valid	1.83	Valid	0.25	Invalid	Valid
	2	1.16	Valid	1.35	Valid	0.36	Valid	Valid
	3	1.25	Valid	1.75	Valid	0.25	Invalid	Valid
	4	1.09	Valid	0.69	Valid	0.53	Valid	Valid
	5	0.98	Valid	-0.16	Valid	0.39	Valid	Valid
	6	0.82	Valid	-1.57	Valid	0.52	Valid	Valid
	7	0.78	Valid	-1.73	Valid	0.24	Invalid	Valid
	8	1.27	Valid	1.97	Valid	0.27	Invalid	Valid
	9	0.95	Valid	-0.31	Valid	0.42	Valid	Valid
	10	1.21	Valid	1.43	Valid	0.40	Valid	Valid
	11	0.99	Valid	-0.03	Valid	0.41	Valid	Valid
	12	0.73	Valid	-2.19	Invalid	0.58	Valid	Valid
Psychological	13	0.70	Valid	-2.74	Invalid	0.62	Valid	Valid
	14	1.05	Valid	0.40	valid	-0.12	Invalid	Valid
	15	0.62	Valid	-3.29	Invalid	0.56	Valid	Valid
	16	1.30	Valid	2.07	Invalid	0.40	Valid	Valid
	17	0.72	Valid	-2.21	Invalid	0.56	Valid	Valid
	18	0.93	Valid	-0.46	Valid	0.19	Invalid	Valid
	19	1.30	Valid	2.09	Invalid	0.53	Valid	Valid
Social	20	1.13	Valid	0.88	Valid	0.14	Invalid	Valid
	21	1.18	Valid	1.00	Valid	0.21	Invalid	Valid
	22	0.78	Valid	-1.77	Valid	0.31	Invalid	Valid
	23	1.02	Valid	0.16	Valid	0.50	Valid	Valid
Cognitive	24	0.92	Valid	-0.57	Valid	0.32	Invalid	Valid
	25	1.26	Valid	1.82	Valid	0.34	Invalid	Valid
	26	1.12	Valid	0.89	Valid	0.05	Invalid	Valid
	27	0.86	Valid	-1.28	Valid	0.57	Valid	Valid
	28	1.26	Valid	1.81	Valid	0.29	Invalid	Valid
	29	0.79	Valid	-1.61	Valid	0.62	Valid	Valid
	30	1.28	Valid	1.96	Valid	-0.18	Invalid	Valid

In table 5 where the measurement instrument used for 120 participants and 30 items shows reliable and accurate results. The average total score of participants is 94.4 with a standard deviation of 7.7, and the average measurement is 1.21 with a standard error of 0.06, indicating good accuracy. The reliability of the model is recorded at 0.80, indicating adequate consistency in assessing participants, while Cronbach Alpha is 0.78 indicating fairly good internal consistency. For items, the average score is 377.5 with a very high reliability of 0.97, indicating very good consistency in measuring items. The RMSE for participants and items is 0.31 and 0.15 respectively, indicating very small model errors. The correlation between raw scores and measurements for items is -0.99, indicating a strong negative relationship. Overall, this instrument is reliable for further research, with very good accuracy and reliability.

Table 5. Statistical Test of Reliability and Validity of Measurement on Participants and Items

Parameter	Person (N=120)	Item (N=30)
Total Average Score	94.4	377.5
Standard Deviation (SD)	7.7	48.9
Mean Measurement	1.21	0.00
Standard Error of Measurement (SEM)	0.06	0.17
Model Reliability	0.80	0.97
RMSE (Model)	0.29	0.15
Correlation of Raw Score to Measurement	0.99	-0.99
Cronbach's Alpha	0.78	-

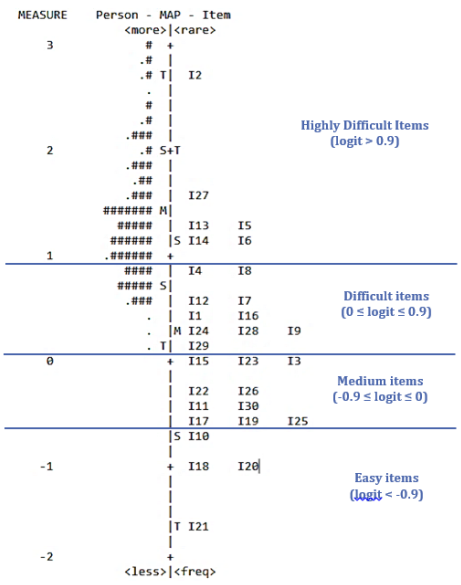
Based on the data analysis in Table 6 and Figure 1, the level of item difficulty in measuring physical literacy shows significant variation across domains. Items in the Highly Difficult category (logit > 0.9) are mainly found in physical aspects such as skateboarding skills, hanging for a long time, and jumping rope without error, which require complex coordination and high endurance. In the psychological aspect, the highest difficulty is found in controlling emotions when failing and the drive to stay active in sports, while in the cognitive aspect, the ability to think alternatively related to physical activity is a challenge in itself.

Table 6. Item difficulty level based on Item Logit Value (LVI)

Domain	No. Item	Total Count	Total Score	Total Likert scale (scale 4)	Measure (LVI)	Category
Physical	1	120	374	480	0.19	Difficult
	2	120	217	480	2.49	Highly Difficult
	3	120	393	480	-0.19	Medium
	4	120	343	480	0.72	Difficult
	5	120	316	480	1.12	Highly Difficult
	6	120	324	480	1	Highly Difficult
	7	120	364	480	0.37	Difficult
	8	120	346	480	0.67	Difficult
	9	120	378	480	0.11	Difficult
	10	120	426	480	-0.98	Easy
	11	120	413	480	-0.64	Medium
	12	120	367	480	0.32	Difficult
Psychological	13	120	321	480	1.05	Highly Difficult
	14	120	329	480	0.93	Highly Difficult
	15	120	397	480	-0.27	Medium
	16	120	370	480	0.26	Difficult
	17	120	421	480	-0.84	Medium
	18	120	434	480	-1.22	Easy
	19	120	418	480	-0.77	Medium
Social	20	120	437	480	-1.31	Easy
	21	120	449	480	-1.75	Easy
	22	120	408	480	-0.52	Medium
	23	120	392	480	-0.17	Medium
Cognitive	24	120	379	480	0.09	Difficult
	25	120	421	480	-0.84	Medium
	26	120	408	480	-0.52	Medium
	27	120	298	480	1.37	Highly Difficult
	28	120	384	480	0	Medium
	29	120	385	480	-0.02	Medium
	30	120	413	480	-0.64	Medium
Mean (SD)			377.5 (48.9)		0.00 (0.90)	

The Difficult category (0 ≤ logit ≤ 0.9) covers aspects of balance, body flexibility, and awareness of personal abilities, indicating that some motor skills and self-confidence are still difficult for some children. In contrast, the Medium category (-0.9 ≤ logit ≤ 0) covers social aspects such as the desire to cooperate in activities, as well as cognitive aspects such as decision-making in movement. Meanwhile, the Easy category (logit < -0.9) mainly consists of social behaviors, such as interaction with peers, indicating that children tend to have an easier time in cooperation aspects compared to certain physical skills and emotional regulation.

Figure 1. Item Ability and Difficulty Map



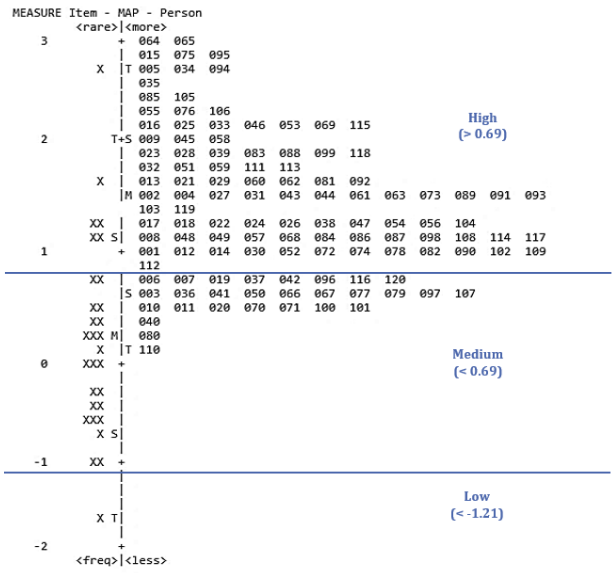
Based on the data presented in table 6 and Wright's map in figure 2 Physical Literacy, several relevant interpretations can be made in the context of this study. Of the total 120 respondents, the majority (84 people or 70%) are classified in the High category with a logit value ≥ 0.69, while 36 people (30%) are in the Medium category with a logit value ≤ 0.69, and no respondents are classified in the Low category (≤ -1.21). This indicates that most respondents have a fairly good level of Physical Literacy, and no individuals with low levels of physical literacy were found in this sample.

Table 7. Logit Value of People (LVP) in Physical Literacy

Classification	Hight	Medium	Low	Total
Person	84 (70%)	36 (30%)	0 (0%)	120

Furthermore, the Wright Map (Figure 2) provides a more in-depth picture of the distribution of individual abilities as measured by the logit value. Most respondents are distributed in the High zone with a logit greater than 0.69, reflecting high ability in the Physical Literacy aspect. Meanwhile, the Medium category includes respondents with varying logit values, ranging from around 0.23 to 0.62, indicating variation in ability. The absence of respondents classified in the Low category confirms that there are no individuals with very low performance in the physical literacy aspect measured in this study.

Figure 2. Wright map to show the distribution map of respondents



The average total score obtained by respondents was 94.4 with a standard deviation of 7.7, indicating that the majority of respondents had relatively consistent performance and were spread over a not too wide range. Meanwhile, the average logit value recorded was 1.21 with a standard deviation of 0.65, indicating that most respondents were at a higher level in terms of Physical Literacy. This relatively narrow spread indicates a high level of uniformity in physical literacy abilities among respondents. Overall, these findings indicate that respondents in this study tended to have good levels of physical literacy, with no individuals showing low performance.

Discussion

This study aims to evaluate and analyze the physical literacy profile of elementary school students in Indonesia, specifically using the Rasch model to assess the reliability and validity of the measurement instruments used. Based on the results of the study, the majority of students have a high level of physical literacy, with more than 70% of students classified in the "high" category. This finding supports the importance of physical literacy in supporting children's health and development, as has been mentioned

in various international studies. One important aspect of this study is the use of the Rasch model in analyzing the data. By using the Rasch model, this study succeeded in revealing the validity and reliability of the physical literacy measurement instruments used. The PL-C Quest instrument, which has been tested internationally, has proven effective in measuring students' physical literacy with fairly high accuracy. The reliability of the model was recorded at 0.80, indicating that this instrument can be relied on to provide consistent data on the level of physical literacy of students in Indonesia. In addition, the Cronbach's Alpha value of 0.78 indicates fairly good internal consistency of this instrument. These results support the results of previous research which stated that valid and reliable instruments are the main key to measuring physical literacy appropriately and accurately (Bond & Fox, 2015).

However, although the instruments used in this study have a good level of reliability, the results of the analysis show variations in the level of difficulty between the items used. Several items that measure more complex motor skills, such as coordination, balance, and endurance, are categorized as "difficult" and "highly difficult". This shows that although the majority of students show adequate physical literacy, they still face difficulties in mastering more complex motor skills. Motor skills involving body coordination, balance, and endurance are indeed skills that require consistent practice and repetition. This phenomenon is in line with the findings of various previous studies that have identified that children have lower self-perceived motor skills for skills they have never tried compared to skills they have mastered (Barnett et al., 2016; Diao et al., 2018; Lopes et al., 2016).

In contrast, items that measure the social and cognitive aspects of physical literacy, such as cooperation in physical activities and understanding of tactics in sports, show better results. Most students are able to master social skills such as cooperation and collaboration in physical activities. This indicates that children at primary school age tend to learn more easily through collaborative experiences and social interactions in physical play. In China, children's social skills and academic achievement are aspects that are highly considered by parents and teachers (DING et al., 2015). In particular, collectivist cultures emphasize the importance of children's cooperation with others and their integration into groups in the socialization process (Zhong & Fan, 2020).

The cognitive aspects related to understanding and decision-making in physical activity also showed adequate results. Many students were able to demonstrate a good understanding of how and why to do physical activity, as well as how to strategize in games. This reflects that physical literacy is not only limited to motor skills, but also includes the ability to understand and plan physical activity well. This is due to the higher level of self-perception in physical, psychological, and cognitive aspects, which is in line with the literature on PL scores measured using the CAPL-2 in Hong Kong children aged 8 to 12 years (Li et al., 2020).

The use of the internationally validated PL-C Quest instrument provides advantages in terms of the validity and reliability of physical literacy measurements. This instrument provides an opportunity to measure various dimensions of physical literacy in a more comprehensive manner, namely covering physical, psychological, social, and cognitive aspects. As a measuring instrument that has been proven to provide valid and reliable results, this instrument is an excellent basis for conducting further research on physical literacy. The use of valid and reliable instruments is very important to ensure that the results obtained reflect the real conditions of students' physical literacy, so that they can be a strong basis for physical education and sports policies (Bond & Fox, 2007).

However, although the results obtained are quite promising, this study also faces several limitations that need to be considered. The instrument used, although valid and reliable, still needs improvement on several items. Several items showed low Point Measure Correlation (PMC) values, indicating that some items may be less effective in distinguishing students' ability levels in physical literacy. This can reduce the instrument's ability to provide accurate information about motor skills or other more complex aspects of physical literacy. Therefore, it is important to revise and improve this instrument so that it can be more effective in measuring various dimensions of physical literacy, especially for more difficult motor skills. Further research should retest this instrument using larger and more diverse samples to ensure that the instrument can be applied effectively in various contexts (Bond & Fox, 2007; Linacre, 2012). The ability of the measurement instrument to distinguish various levels of ability is very important to ensure the accuracy and usefulness of the data obtained in further analysis, in accordance with the theory of validity and reliability of measurement (Kline, 2015).

The success of this study is also inseparable from the use of digital technology in supporting the measurement and development of physical literacy. Technology-based applications designed to improve students' physical literacy can offer a more interactive and engaging approach. The use of this application allows students to participate in physical activities in a more enjoyable way and in accordance with existing technological developments. Greve, Diekhoff, & Süßenbach, (Greve et al., 2022) in their study concluded that students were very reflective about the use of applications in physical education. However, it should be reminded that the challenge faced in this era of technological development is that physical inactivity can occur if the use of technology cannot be controlled wisely (Woessner et al., 2021). Other external factors that have not been taken into account in this study, such as diet, lifestyle, and level of access to sports facilities at home or in the surrounding environment, can also affect students' physical literacy outcomes. Future research needs to consider these variables to provide a more comprehensive picture of the factors that influence elementary school students' physical literacy.

Conclusions

Physical literacy of elementary school students in Indonesia still has great potential to be developed. This study uses the Rasch model to assess the validity and reliability of the physical literacy measurement instrument, namely the PL-C Quest, which has been proven effective in measuring dimensions of physical literacy comprehensively, covering physical, psychological, social, and cognitive aspects. The results showed that the majority of students had a high level of physical literacy, with more than 70% of students classified in the "high" category. However, there are several challenges, such as difficulty in mastering more complex motor skills, including coordination, balance, and endurance, indicating that these motor skills require more intensive practice and repetition. Therefore, improvements to the measurement instrument are needed, as well as the implementation of more structured intervention programs, especially in the development of more complex motor skills. These results provide an important contribution to the development of physical education and sports policies in Indonesia, especially in achieving the vision of Indonesia Fit 2045.

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