

Identify Student Misconceptions Using Three Tier Diagnostic Instruments on Physical Fitness Materials SD Negeri Danasri Kidul 02

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ABSTRACT

This research aims to identify the misconceptions of grade 6 students at SD Negeri Danasri Kidul 02 regarding physical fitness. The approach used is descriptive quantitative with a three-tier diagnostic instrument. This instrument reveals misconceptions through multiple-choice questions, reasons for answers, and students' level of confidence. The research subjects are all 15 grade 6 students (8 female and 7 male). Data is analyzed to examine the types of misconceptions, the frequency of their occurrence, and students' confidence in those misconceptions. The research results are expected to provide an accurate overview of students' misconception profiles. This information is important for designing more effective and targeted learning strategies. The three-tier instrument is considered important for an in-depth evaluation of students' understanding, beyond just right or wrong answers. This research also encourages the development of teaching materials to minimize misconceptions. Consequently, the conceptual understanding of physical fitness at the elementary school level can be improved.

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1. INTRODUCTION

Physical education has an important role in developing the physical, mental, and social aspects of students¹. One of the important materials is physical fitness, which includes endurance, muscle strength, flexibility, agility, and speed². Physical fitness is a fundamental aspect of the holistic development of learners in primary school, contributing significantly to their physical, mental, and social health³. Accurate mastery of the concept of physical fitness is an important prerequisite in shaping healthy and active living behaviors in the future. However, the learning process is often colored by the emergence of misconceptions.

¹ Pinton Setya Mustafa, "Peran Pendidikan Jasmani Untuk Mewujudkan Tujuan Pendidikan Nasional," *Jurnal Ilmiah Wahana Pendidikan* 8, no. 9 (2022): 68–80, <https://doi.org/10.5281/zenodo.6629984>.

² A. Setiawan, H., Rahayu, E. W., & Pramudita, *Developing Physical Fitness through School-Based Physical Education, A Systematic Review* (International Journal of Human Movement and Sports Sciences, 10(2), 322-329., 2022).

³ Fida Syarofiyatul Lizza, Iin Purnamasari, and Asep Ardiyanto, "Analisis Miskonsepsi Dalam Pembelajaran Pendidikan Jasmani Olahraga Dan Kesehatan (PJOK) Pada Guru Sekolah Dasar Di Kecamatan Kayen," *Pena Edukasia* 2, no. 3 (2024): 130–39.

Misconceptions can be defined as false or unscientific beliefs that learners believe in a particular concept or phenomenon, which may be caused by another subject or derived from their previous experiences⁴. These misconceptions need to be systematically identified so that teachers can design more effective learning⁵. One effective tool is a diagnostic instrument based on the Three-Tier Test, which measures students' answers, reasoning, and confidence levels⁶.

In physical fitness materials can hinder the correct absorption of knowledge and its implementation in daily practice. This study aims to deeply identify the misconceptions experienced by 15 6th grade students of SD Negeri Danasri Kidul 02 (consisting of 8 female students and 7 male students) on the essential material of physical fitness. To comprehensively uncover students' understanding, this study adopts a *three-tier* diagnostic instrument, which is able to distinguish between correct answers due to luck and true conceptual understanding through the stages of answer choice, reason, and level⁷.

The results of this study are expected to provide a clear picture of student misconception patterns, so that they can be the basis for the development of more effective and relevant learning interventions to improve the understanding of physical fitness concepts at the elementary school level.

2. Method of the Research

This study uses a quantitative descriptive method to identify misconceptions of 6th grade students of SD Negeri Danasri Kidul 02 on physical fitness materials. The descriptive design was chosen to provide a systematic and factual picture of the type and degree of misconception experienced by students.

2.1 Research Subject

The subjects in this study are all 6th grade students of SD Negeri Danasri Kidul 02 for the 2024-2025 school year totaling 15 children, consisting of 8 female students and 7 male students. The selection of all grade 6 students as research subjects aims to obtain comprehensive data on misconceptions in the target population.

2.2 Research Instruments

The main instrument used in this study is a three-tier diagnostic test⁸. This test was developed based on learning indicators on physical fitness materials that are relevant to the elementary school curriculum. Each *three-tier* question item consists of three parts:

1. Tier 1 (Multiple Choice): Presents multiple-choice questions related to physical fitness concepts with one correct answer and multiple distractions designed based on possible misconceptions.
2. Tier 2 (Reason): Provides several choices of reasons that may underlie students' answers in the *first tier*. Students are asked to choose the reason that best matches their answers.
3. Tier 3 (Confidence Level): Ask students to rate their level of confidence in the answers and reasons that have been chosen in the *first and second tiers*, using a *Likert scale* (e.g.: *very confident, confident, less confident*).⁹

The development of this three-tier instrument is through expert validation by physical education teachers and learning material experts to ensure the validity of the content and constructs. Instrument trials were also conducted on groups of students outside the research sample to test language clarity and readability of questions, as well as to identify potential problems with the instruments. Examples of Physical Fitness Three-Tier *Diagnostic Test Questions*

1. Muscle Strength:

- 1) Tier 1: The ability of muscles to produce maximum force in a single contraction is called...
 - a. Muscle endurance
 - b. Muscle strength
 - c. Speed
 - d. Flexibility

⁴ Sony Yunior Erlangga and Susanti Susanti, "Identifikasi Miskonsepsi Peserta Didik Menggunakan Instrumen Diagnostik Three Tier Pada Materi Gerak Lurus," *Jurnal Sosial Humaniora Sigli* 5, no. 2 (2022): 312–16, <https://doi.org/10.47647/jsh.v5i2.914>.

⁵ Sansan Hastuti Ningrum et al., "Cross Card Sebagai Inovasi Media Pembelajaran Materi Persilangan Kelas Ix Smp Berbasis Construct 2 Guna Mengurangi Miskonsepsi Pada Peserta Didik Di Smp Negeri 3 Malang," *Jurnal Pembelajaran, Bimbingan, Dan Pengelolaan Pendidikan* 4, no. 8 (2024): 1–11, <https://doi.org/10.17977/um065.v4.i8.2024>.

⁶ M Mokhtari, H., Ebrahimzadeh, S. M., & Rashidi, "The Use of Three-Tier Tests for Diagnosing Misconceptions in Physical Education," *Journal of Physical Education and Sport Sciences*, 2022, 14(3), 112–120.

⁷ Cos Ma'arif Hidayatul Laeli, Gunarhadi, and Muzzazinah, "The 3 Tiers Multiple-Choice Diagnostic Test for Primary Students' Science Misconception," *Pegeg Egitim ve Ogretim Dergisi* 13, no. 2 (2023): 103–11, <https://doi.org/10.47750/pegegog.13.02.13>.

⁸ Desfi Ida Muryani, Padrul Jana, and Sitti Mutia Umasugi, "The Students' Misconceptions in Using Three-Tier Multiple Choice Diagnostic Test on the Angle Relationships," *Formatif: Jurnal Ilmiah Pendidikan MIPA* 12, no. 1 (2022): 25–34, <https://doi.org/10.30998/formatif.v12i1.9641>.

⁹ Siti Maisyarah and Berry Kurnia Vilmala, "Penerapan Instrumen Tes Diagnostik Th Ree- Tier Untuk Mengidentifikasi Miskonsepsi Siswa Pada Materi Sel" 2, no. April (2024): 35–44.

- 2) Tier 2: I chose the above answer because...
- a. Muscles can perform repetitive movements.
 - b. Muscles are capable of lifting or pushing heavy loads.
 - c. The movement is done quickly.
 - d. The body becomes more flexible.
- 3) Tier 3: Confident/Unsure

2. Muscle Endurance:

- 1) Tier 1: The ability of muscles to perform a series of repeated contractions against a load over a long period of time is called...
- a. Muscle strength
 - b. Muscle endurance
 - c. Agility
 - d. Balance
- 2) Tier 2: I chose the above answer because...
- a. Muscles can produce great energy.
 - b. Muscles do not get tired easily when doing repetitive activities.
 - c. Body movements become more agile.
 - d. The body can stand stably.
- 3) Tier 3: Confident/Unsure

2.3 Data Collection Procedure

Data collection was carried out directly at SD Negeri Danasri Kidul 02 by providing *three tier* test instruments to all 6th grade students. The test is conducted in one session with enough time to allow students to answer all questions carefully. The researcher provides a brief explanation of how to charge the instrument before the test begins and ensures students understand the instructions given.

2.4 Data Analysis

The data collected from the students' responses were analyzed quantitatively. The data analysis steps include:

1. Identification of Misconceptions: Students are considered to have misconceptions if they answer incorrectly in the *first tier* and choose the wrong reason in the second tier, regardless of their belief level. Combinations of correct answers in the *first tier* but with the wrong reason are also identified as indications of incomplete understanding.

Table 1. Results of Student Misconception Identification

No	Concept	Number of Misconceptions	Unknown Amount	Number of Guesses	Number of Concepts
1	Muscle Strength	6	2	1	6
2	Muscle Endurance	5	3	2	5
3	Cardiovascular Endurance	8	2	1	4
4	Flexibility	7	1	0	7
5	Speed	4	3	1	7
6	Balance	5	4	0	6
7	Agility	9	2	1	3
8	Coordination	7	3	1	4
9	Body Composition	6	4	2	3
10	Reaksi	5	2	1	7

2. Misconception Type Classification: Students' incorrect answers and reasons are grouped based on the type of related physical fitness concept to identify the dominant pattern of misconception.

Table 2. Results of the classification of types of misconceptions

No	Concept	Types of Misconceptions
1	Muscle Strength	Think of strength as just a matter of muscle size.
2	Muscle Endurance	The misconception that resilience is determined by speed.
3	Cardiovascular Endurance	Assuming it is only related to breathing, not blood circulation.
4	Flexibility	It is a misconception that flexibility is only important for gymnastics.
5	Speed	Thinking speed is only a matter of leg strength.
6	Balance	It is a misconception that balance is only for gymnastics.
7	Agility	Consider agility equal to speed.
8	Coordination	Confused coordination with movement agility.

No	Concept	Types of Misconceptions
9	Body Composition	Not understanding that body composition includes fat, muscle, and body water.
10	Reaction	Consider reactions only in sports games.

3. Determination of Misconception Percentage: The percentage of students who experience misconceptions on each concept is calculated to determine the level of difficulty students understand on a particular material.

Formula:

$$\text{Misconception Percentage} = \frac{\text{Number of Misconceptions}}{15} \times 100\%$$

Table 3. Misconception Percentage

No	Concept	Number of Misconceptions	Misconception Percentage
1	Muscle Strength	6	40%
2	Muscle Endurance	5	33,3%
3	Cardiovascular Endurance	8	53,3%
4	Flexibility	7	46,7%
5	Speed	4	26,7%
6	Balance	5	33,3%
7	Agility	9	60%
8	Coordination	7	46,7%
9	Body Composition	6	40%
10	Reaksi	5	33,3%

4. Confidence Level Analysis: Students' confidence levels in correct and incorrect answers are analyzed to see the extent to which students are aware or unaware of the misconceptions they are experiencing¹⁰.

Category Scale:

- Tall : 2,5–3,0
- Keep : 1,5–2,4
- Low : 1,0–1,4

Table 4. Confidence Level Analysis

No	Concept	Average Confidence Score	Category
1	Muscle Strength	2,7	Tall
2	Muscle Endurance	2,5	Tall
3	Cardiovascular Endurance	2,8	Tall
4	Flexibility	2,6	Tall
5	Speed	2,3	Keep
6	Balance	2,2	Keep
7	Agility	2,9	Tall
8	Coordination	2,4	Keep
9	Body Composition	2,5	Tall
10	Reaction	2,6	Tall

3. RESULTS AND DISCUSSIONS

3.1 Result

1. Identifying Student Misconceptions

Based on the results of a three-tier diagnostic test on 15 students of SD Negeri Danasri Kidul 02 for physical fitness materials, the following data was obtained:

- The number of students who experience misconceptions varies in each material concept.
- The highest level of misconception occurred in the concept of Agility with 9 students (60%) experiencing misconceptions.
- The lowest rate of misconception was found in the concept of Speed with 4 students (26.7%).

¹⁰ Surya Pratama et al., "Analysis Students Misconception of Reproduction System Material in Grade XI," *Jurnal Inovasi Pendidikan Dan Sains* 1, no. 3 (2020): 59–65.

In general, it can be seen that some physical fitness concepts such as Cardiovascular Endurance and Coordination also show quite high rates of misconceptions (53.3% and 46.7%). The following is a recapitulation of the identification results:

Table 4.

No	Concept	Misconception Percentage
1	Muscle Strength	40%
2	Muscle Endurance	33,3%
3	Cardiovascular Endurance	53,3%
4	Flexibility	46,7%
5	Speed	26,7%
6	Balance	33,3%
7	Agility	60%
8	Coordination	46,7%
9	Body Composition	40%
10	Reaction	33,3%

2. Classification of Misconceptions

Types of misconceptions found include:

- The wrong understanding of the concept, for example, students think that muscle strength is only judged by muscle size.
 - Inaccurate generalizations, such as assuming agility equals speed.
 - Conceptual reduction, for example cardiovascular endurance, is only considered to be related to breathing without paying attention to blood circulation.
 - Misattribution of concept functions, such as assuming balance is only important for gymnastics only.
- This suggests that the misconceptions that occur are mostly due to partial understanding, misconceptions of associations, and improper practical experiences.

3. Determination of the Percentage of Misconceptions

From the percentage calculation:

- The Agility material showed the highest percentage of misconceptions (60%).
- The Speed Material showed the lowest percentage of misconceptions (26.7%).
- The average percentage of misconceptions across concepts is 41.6%.

This indicates that almost half of the learners have misconceptions about most of the concepts of physical fitness.

4. Confidence Level Analysis

The level of confidence of students in answering questions is categorized as follows:

Table 6.

No	Concept	Confidence Score	Category
1	Muscle Strength	2,7	Tall
2	Muscle Endurance	2,5	Tall
3	Cardiovascular Endurance	2,8	Tall
4	Flexibility	2,6	Tall
5	Speed	2,3	Keep
6	Balance	2,2	Keep
7	Agility	2,9	Tall
8	Coordination	2,4	Keep
9	Body Composition	2,5	Tall
10	Reaction	2,6	Tall

The majority of learners show a high level of belief, despite the fact that they are misconceptions. This indicates that the misconception that occurs is strong (hard misconception) so it requires a more corrective and reflective learning approach.

3.2 Discussions

Based on the results of the analysis:

- The high level of misconception shows that students do not understand the concept of physical fitness thoroughly, and even quite a few believe in misunderstandings.

2. The high level of confidence in the wrong answer makes it clear that the misconception is not realized by the students, so it will be difficult to correct it if it is not through a deep learning process based on real concepts.
3. The concept of agility is a major concern because in addition to the highest percentage of misconceptions, students' confidence in their answers is also very high (average 2.9).
4. The factors that cause misconceptions may come from less varied practical experience, inappropriate use of terms in teaching, and lack of understanding of the relationship between physical fitness components.
5. The implication of this study is the need for innovation in the approach to learning physical fitness materials in elementary schools. Teachers are advised to use more active, interactive, and concept-oriented learning methods. The use of visual media, demonstrations, group discussions, and relevant practical activities can help students build a deeper and more accurate understanding. In addition, the regular use of diagnostic instruments such as *three tiers* can help teachers identify student misconceptions early on and provide appropriate interventions to correct them. Further research is needed to explore the effectiveness of various learning strategies in overcoming misconceptions about physical fitness materials at the elementary school level.

4. CONCLUSIONS

Based on the results of the research on the identification of misconceptions of students using three-tier diagnostic instruments on physical fitness materials at SD Negeri Danasri Kidul 02, the following can be concluded:

1. The Rate of Misconception of Students

Grade 6 students at SD Negeri Danasri Kidul 02 experienced misconceptions about various concepts of physical fitness. The level of misconception varies across concepts, with an average of 41.6% of students experiencing misconceptions. The concept of agility is the concept with the highest misconception rate of 60%, while the concept of speed has the lowest misconception rate of 26.7%.

2. Types of Misconceptions

The types of misconceptions that occur include misunderstanding concepts, incorrect generalizations, concept reduction, and misattribution of concept functions. For example, students consider agility to be equal to speed and cardiovascular endurance only with regard to breathing.

3. Confidence Level

Learners The majority of learners show a high level of confidence in their answers, even though many of those answers are wrong. This shows that the misconception that occurs is hard misconception, which indicates that students are not aware of their misunderstanding.

4. Learning Implications

The high level of misconception and belief in wrong answers indicates the need for improvement in learning strategies in schools. Teachers need to use more active, interactive, and real-world experience-based learning methods to help students build the correct understanding of concepts. In addition, the regular use of diagnostic instruments such as three-tier is recommended to detect misconceptions early.

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