Available online at
MACCA: Science-Edu Journal (ISSN: 3048-0507)
Journal homepage : https://etdci.org/journal/macca/index

Perceptions of Physics Students on the Importance of Physics in Sports

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Received: August 10, 2024 *Accepted: September 23, 2024* *Online Published: October 30, 2024*

ABSTRACT

This study aims to identify and analyze the perceptions of physics students about the relevance of physics in sports. Although physics is often considered a theoretical discipline, many physics principles underpin various techniques and movements in sports, such as Newton's laws of motion, energy principles, and momentum. However, students' understanding of these correlations is often limited or poorly contextualized in sports practice.The study employs a descriptive qualitative approach with purposive sampling techniques, involving 10-15 physics students with experience in recreational or competitive sports. Data were collected through semi-structured interviews to explore their views on the application of physics in sports, challenges in understanding sports-related physics concepts, and how physics can improve athletic performance.The findings indicate that most students recognize the importance of physics in sports. However, they feel that deeper physics understanding is insufficiently integrated into their physics curriculum. Some participants mentioned that the application of physics in sports could help prevent injuries and improve movement techniques. Despite this, many perceive physics as an abstract concept rather than something directly applicable to the sports world.This research provides insights into how students' perceptions of physics in sports can be enhanced and the need for more applicative and contextual teaching approaches. The findings are also expected to contribute to the development of more relevant and engaging physics teaching materials by integrating commonly encountered sports elements into everyday life.

Keywords: sports physics, student perceptions, physics application, sports, qualitative approach.

INTRODUCTION

Sports involve not only physical skills but are also based on scientific principles, including physics. Concepts such as force, momentum, energy, and fluid dynamics often form the foundation for understanding movements in various sports. For example, analyzing the trajectory of a soccer ball or the force applied in long jump techniques cannot be separated from Newton's laws. However, students' understanding of the relationship between physics and sports is often limited.According to Behm & Carter (2020), understanding physics enables individuals to scientifically evaluate various aspects of sports, such as motion efficiency, injury prevention, and performance optimization. This shows that physics is not merely a theoretical discipline but also has practical applications relevant to everyday life, including sports.

Another study by Bartlett (2007) states that mastery of physics concepts can improve the quality of sports training through a biomechanical approach, which utilizes physics principles to analyze and enhance athlete performance. Thus, students' understanding of the importance of physics in sports has the potential to open new opportunities, both in sports careers and science education.However, students' perceptions of the connection between physics and sports are often influenced by their educational backgrounds and experiences. Alias & Siraj (2012) suggest that the delivery of relevant and application-based physics materials can enhance students' interest and understanding of physics. In this context, it is important to explore how students, especially those majoring in physics, perceive the connection between physics and sports.

This study aims to identify students' perceptions of the importance of physics in sports, uncover obstacles in understanding the relationship, and provide recommendations to enhance physics learning through a sports context. The results are expected to contribute to the development of more applicative and relevant teaching methods aligned with students' interests.

METHODS

1. **Research Approach and Design**
   A qualitative approach was used to deeply understand students' perceptions of the importance of physics in sports. The exploratory descriptive design was chosen as this research aims to explore students' experiences, views, and opinions without manipulating variables.
2. **Research Participants**
   Participants were selected using purposive sampling techniques, with the inclusion criteria being:

- Physics students at Universitas Negeri Makassar.
- Currently or previously involved in recreational or competitive sports.
- Willing to participate in interviews or focus group discussions.
  The expected number of participants was 10-15, sufficient to capture a variety of perceptions without losing focus on the depth of analysis.

3. **Research Instruments**
   The instruments used include:

- **Semi-structured Interview Guidelines:** Containing a list of questions to explore students' experiences, perceptions of the relevance of physics in sports, and views on teaching methods that relate physics to sports.
- **Field Notes:** Used to document gestures, expressions, or non-verbal responses during interviews.
- **Recorder or Recording Device:** To document interviews for more precise data analysis.

4. **Data Collection**
   Data were collected through:

- **Individual Interviews:** Exploring students' personal experiences regarding the relationship between physics and sports.

5. **Data Analysis**
   Data were analyzed using thematic analysis techniques (Braun & Clarke, 2006):

- **Initial Coding:** Reading interview transcripts to identify recurring themes.
- **Main Theme Identification:** Grouping codes into broader categories representing students' perceptions.
- **Data Interpretation:** Linking findings to relevant theories and their implications for physics education.

RESULT AND DISCUSSION

From the interviews conducted, three main themes emerged regarding students' perceptions of physics and sports:

1. **Basic Awareness of Physics Concepts in Sports**

The majority of students recognize the significant role of physics in sports. They understand basic physics concepts such as force, motion, and energy. Common examples cited include the role of friction in running or the influence of shooting angles in basketball.

2. **The Relevance of Physics in Enhancing Sports Performance**

Students believe that applying physics can help improve sports performance. For instance, knowledge of friction and acceleration can be used to refine running techniques. However, they also admit difficulties in connecting the physics theories taught in class with practical applications in sports, as these theories are rarely applied beyond classroom contexts.

3. **Limitations in Understanding and Applying Physics in Sports**

Some students feel they lack a deep understanding of the practical applications of physics in sports, particularly in direct experimental contexts. They perceive that the physics lessons they receive are too theoretical and less relevant to the sports situations they encounter. Additionally, they feel that learning physics in the context of sports has not been sufficiently integrated into the existing curriculum.

The findings indicate that students have a basic understanding of the relevance of physics in sports, but their knowledge remains limited to theoretical insights without practical comprehension. Although they are aware that physics can enhance sports performance, many struggle to connect physics concepts with the sports techniques they practice. This highlights the importance of a more applicative teaching approach where physics concepts are not only taught in theory but also practiced in motion analysis or sports techniques. In this research, the results from the interviews provide an in-depth picture of students' perceptions regarding the importance of physics in sports. Based on the data collected, several key findings can be further elaborated.

A. The Importance of Physics in Sports: General Understanding

Most students in this study acknowledge the significant role of physics in various aspects of sports, but they often lack detailed knowledge of how physics is applied in their sports activities. This aligns with Behm & Carter's (2020) findings, which state that physics principles can be used to analyze various elements in sports, such as movement efficiency, injury prevention techniques, and performance improvement strategies. However, despite awareness of physics' role, students often view it as separate from their sports experiences. For instance, students may understand that more efficient movements or precise techniques involve physics principles, but they might not know the underlying basic concepts. This demonstrates the need for integrating physics education with practical sports applications to help students understand physics in a more contextual manner, directly applicable to everyday life.

B. Challenges in Understanding Physics Related to Sports

One major challenge identified is the lack of a bridge between the physics theory learned in class and its application in sports. Physics curricula generally teach more abstract fundamental concepts without sufficient emphasis on real-world relevance in sports. This aligns with Alias & Siraj's (2012) findings, which highlight that application-based physics teaching using technology can make the material more relevant and increase students' interest.

Many students feel that the physics taught in their program focuses more on fundamental theories without practical connections. This potentially limits their understanding of how physics principles can be adapted and applied in sports. Thus, a curriculum reform that includes more content connecting physics to sports is necessary so that students can more easily understand the benefits of physics in the context of sports they practice.

C. The Application of Physics in Enhancing Athletic Performance

The findings show that most students recognize the importance of physics in sports, especially in improving techniques and athletic performance. Many students mentioned the application of physics in sports like running, basketball, or soccer, where they understand that factors such as force, momentum, and energy can influence the effectiveness of an athlete's movements. This aligns with Bartlett's (2007) perspective, which explains that physics and biomechanics can be used to improve athletic techniques in both individual and team sports. For example, in running sports, applying physics principles can be used to analyze foot propulsion force on the ground and ways to enhance movement efficiency to reduce completion time. Or in basketball, understanding the principles of ball motion and propulsion force can help improve shooting techniques. By using physics principles, athletes can design their movements more efficiently and reduce injury risks.

D. Perceptions of Learning Physics in a Sports Context

Most students in this study revealed that they would be more interested in learning physics if it were directly related to applications in sports. They want physics education to be more contextual, not only theoretical but also directly applicable to activities they engage in. This aligns with research by Ellizar et al. (2018), which showed that using technology-based modules in physics education can enhance students' interest and understanding, as the material becomes more relevant and connected to their daily experiences. Students feel that a contextual approach linking physics to sports could make physics lessons more engaging and easier to understand. Application-based learning can help students better comprehend how the physics concepts they learn can be used to solve real-world problems in sports, ultimately increasing their motivation and understanding of physics.

E. Development of Technology-Based E-Modules to Enhance Students' Interest and Understanding

The use of technology-based e-modules in teaching sports physics offers advantages in improving students' understanding and interest. One key reason is that physics learning materials, which are often abstract and difficult to grasp, can be explained more interactively and engagingly through technology. E-modules allow the materials to be accessed in a more flexible manner, catering to students' varied learning styles. Several studies have shown that e-module-based learning can alleviate difficulties students face in understanding physics concepts by providing various media, such as images, animations, and videos, that visually clarify the material (Arifin et al., 2017; Sari et al., 2019). Technology-based modules also enable independent learning, allowing students to learn at their own pace and revisit the material as needed. Additionally, content that is more relevant and connected to students' daily experiences—such as examples of physics applications in sports—can increase their interest and engagement (Hendrayani, 2021). This aligns with findings by Ellizar et al. (2018), which revealed that e-modules enhance students' motivation and understanding by providing contexts closely tied to their experiences, specifically through the application of physics in sports.

F. ***Enhancing Students' Independent Learning Skills through Technology-Based Modules***

Independent learning is a crucial component of higher education, especially in the context of sports physics. In technology-based education, the use of e-modules provides opportunities for students to manage their learning more flexibly and efficiently. A study by Nurhasnah et al. (2019) indicated that technology-based e-modules can support the development of students' independent learning skills. These e-modules present clearly structured materials, often supplemented with interactive exercises, quizzes, and assessments that offer immediate feedback to students. This independent learning process enables students to learn according to their own pace and style, giving them the opportunity to explore topics in greater depth. In the context of sports physics, students can access physics theories relevant to their favorite sports, such as body motion, Newton's laws of motion in sports, or the application of physics principles in sports equipment. Research conducted by Ramadhan et al. (2020) also demonstrated that students who used e-modules for independent learning were better able to apply physics concepts in real-world situations, ultimately enhancing their practical skills in the field.

Implications of the Findings

These findings underscore the importance of developing a physics curriculum that is more applicative and connected to real-world contexts, particularly sports. One potential step is to design teaching materials that integrate physics concepts with scenarios frequently encountered in sports. Moreover, the use of technology and problem-based learning approaches involving sports case studies can be an effective way to increase students' interest and understanding of physics. Thus, there is an urgent need to reform how physics is taught in physics departments to make it more relevant and applicative, especially by incorporating elements directly related to sports. This approach is expected to open opportunities for students to view physics not only as a theoretical discipline but also as a useful tool for improving athletic performance and refining sports techniques.

CONCLUSION

This study reveals that physics students recognize the importance of physics in sports, but they require more applicative learning to connect physics theory with sports practice. Therefore, it is recommended that the sports physics curriculum be adapted to a more application-based approach, such as through case studies or the use of visual media to explain physics phenomena in sports and conduct direct sports experiments. Overall, students' perceptions of the importance of physics in sports are greatly influenced by how the material is delivered and how the connection between theory and practice is explained. Using a technology-based approach to link physics with sports can enhance students' interest, clarify the application of physics concepts, and open opportunities to use physics more efficiently in improving athletic performance and preventing injuries. Therefore, to improve students' positive perceptions of physics in sports, there needs to be an integration between theoretical learning and practical applications in the field, which can motivate students to better understand and apply physics in the world of sports.

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