STUDIA UNIVERSITATIS
BABEŞ-BOLYAI

UNIVERSITATEA BABEŞ-BOLYAI
BABEŞ-BOLYAI TUDOMÁNYEGYETEM
BABEŞ-BOLYAI UNIVERSITÄT
BABEŞ-BOLYAI UNIVERSITY
TRADITIO ET EXCELLENTIA

EDUCATIO ARTIS GYMNASTICAE

1/2025

STUDIA UNIVERSITATIS BABEŞ-BOLYAI EDUCATIO ARTIS GYMNASTICAE

1/2025
DOI:10.24193/subbeag.70(1)

ISSN (print): 1453-4223;
ISSN (online): 2065-9547; ISSN-L: 1453-4223

PUBLISHED BY BABEŞ-BOLYAI UNIVERSITY

EDITORIAL BOARD:

Address: 7th Pandurilor Street, Cluj-Napoca, Romania, Phone: +40 264 420709,
e-mail: studia.fefs@yahoo.com; https://studia.reviste.ubbcluj.ro/index.php/subbeducatio

YEAR **Volume 70 (LXX) 2025**
MONTH **MARCH**
ISSUE **1**

PUBLISHED ONLINE: 2025-03-30
PUBLISHED PRINT: 2025-05-30
ISSUE DOI: 10.24193/subbeag.70(1)

CONTENT/ SOMMAIRE/ INHALT/ CUPRINS

Paula Alina APOSTU, Maria Daniela MACRA-OȘORHEAN, Radu-Tiberiu ȘERBAN, Ioan-Cătălin CIOCOIU, Velu-Sebastian BARTHA, The Impact of Social Media on Sports Marketing and Consumer Engagement * *Impactul rețelelor sociale asupra marketingului sportiv și implicării consumatorilor*.....5

Maria Daniela MACRA-OȘORHEAN, Iosif SANDOR, Septimiu Vasile ORMENIȘAN, Vasile Roland BINDEA, Velu-Sebastian BARTHA, Study on Employee Satisfaction Within a Sport Organization * *Studiu privind satisfacția în activitatea antrenorilor din cadrul unei organizații sportive*.....17

Octavian POPESCU, Eugen BOTA, Dana GAVRELIUC, Martin DOMOKOS, Motor Skills and Motivation Development by Implementing Handball Elements in First Part of Physical Education Lesson * *Ameliorarea deprinderilor motrice și a motivației utilizând elemente specifice jocului de handbal în partea introductivă a lecției de educație fizică*.....31

János TÓTH Jr., Ádám SZÁNTAI-KIS, Analysis of Diabetic Footballers Blood Sugar Levels.....47

Emmanuel DUMBUYA, Integrating Technology into Physical Education Curricula: A Framework for Enhancing Student Engagement.....57

Hocine ASLI, Adel BELKADI, Nouria BENNAMA, Bendhiba DJOURDEM, Assessing Nutritional Balance and Its Influence on Physical Activity and Performance Among University Sports Students 63

Abderahmane BENGUENAB, Hadj SAYAD, Rachid RAZALI, Ahmed ATALLAH, Use the PLS Micro-Squares Method for Measuring the Teaching Competence of Professors of Physical and Sports Education 81

Cristian SANTA, Andrei CRISAN, Onela SANTA, Increasing the Explosive Power Through Plyometric Training in Athletes Under 18 Years Old * *Dezvoltarea detentei prin intermediul antrenamentelor de pliometrie la grupele de sportivi de sub 18 ani* 93

Sándor VIZI, István BALOGA, Craiova's Sports Facilities and Their Effect on Sports Performance 105

STUDIA UBB EDUCATIO ARTIS GYMN., LXX, 1, 2025, pp. 5-15
(RECOMMENDED CITATION)
DOI:10.24193/subbeag.70(1).01

The Impact of Social Media on Sports Marketing and Consumer Engagement

Paula Alina APOSTU[1], Maria Daniela MACRA-OȘORHEAN[1], Radu-Tiberiu ȘERBAN[1], Ioan-Cătălin CIOCOIU[1], Velu-Sebastian BARTHA[1,*]

Article history: Received 2024 November 18.; Revised 2025 January 13; Accepted 2025 January 15; Available online 2025.03.30; Available print 2025.05.30

ABSTRACT. The Impact of Social Media on Sports Marketing and Consumer Engagement. **Objectives**: This paper investigates the role of social media in sports marketing, analyzing how digital platforms, particularly Instagram and TikTok, influence fan engagement and consumer behavior. The study aims to determine the effectiveness of online marketing strategies over traditional methods and assess consumer preferences for specific social media platforms in the sports context. **Materials and Methods**: A qualitative research design was employed, with semi-structured interviews conducted among 20 social media-active participants aged 18 to 26. Responses were analyzed to identify major themes regarding platform preference, credibility of athlete endorsements, and consumer attitudes toward authentic and interactive content in sports marketing. **Results**: Findings reveal a clear preference for online over traditional marketing due to its accessibility, interactivity, and measurable results. Instagram and TikTok were favored for their engaging, fast-paced content, while athletes' credibility and emotional storytelling were seen as key factors for successful sports marketing. Relevance and creativity in campaign content also emerged as crucial for sustaining consumer interest. **Conclusions:** The research confirms that digital platforms have transformed sports marketing, enhancing audience reach and fostering deeper connections with fans. Social media's influence is expected to grow with advancing technologies, providing sports marketers with expanding opportunities for innovation and consumer engagement.

Keywords: *social media, sports marketing, consumer engagement, digital platforms*

[1] Faculty of Physical Education and Sport, Babeș-Bolyai University, Cluj-Napoca, Romania.
[*] Corresponding author: barthavelu@gmail.com

REZUMAT. ***Impactul rețelelor sociale asupra marketingului sportiv și implicării consumatorilor.*** **Obiective**: Această lucrare investighează rolul rețelelor sociale în marketingul sportiv, analizând modul în care platformele digitale, în special Instagram și TikTok, influențează implicarea fanilor și comportamentul consumatorilor. Studiul își propune să determine eficiența strategiilor de marketing online în comparație cu metodele tradiționale și să evalueze preferințele consumatorilor pentru platformele specifice de social media în contextul sportiv. **Materiale și Metode**: A fost utilizat un design de cercetare calitativ, cu interviuri semi-structurate realizate în rândul a 20 de participanți activi pe social media, cu vârste între 18 și 26 de ani. Răspunsurile au fost analizate pentru a identifica principalele teme legate de preferința pentru platforme, credibilitatea sportivilor în calitate de ambasadori de brand și atitudinile consumatorilor față de conținutul autentic și interactiv în marketingul sportiv. **Rezultate**: Rezultatele indică o preferință clară pentru marketingul online față de cel tradițional datorită accesibilității, interactivității și rezultatelor măsurabile. Instagram și TikTok au fost preferate pentru conținutul captivant și dinamic, iar credibilitatea sportivilor și povestirile emoționale au fost considerate factori cheie pentru succesul marketingului sportiv. Relevanța și creativitatea conținutului campaniilor s-au dovedit, de asemenea, esențiale pentru menținerea interesului consumatorilor. **Concluzii:** Cercetarea confirmă că platformele digitale au transformat marketingul sportiv, sporind raza de acțiune asupra publicului și facilitând conexiuni mai profunde cu fanii. Influența rețelelor sociale este de așteptat să crească odată cu avansul tehnologic, oferind marketerilor sportivi oportunități tot mai mari pentru inovație și implicare a consumatorilor.

Cuvinte-cheie*: rețele sociale, marketing sportiv, implicarea consumatorilor, platforme digitale*

INTRODUCTION

Online marketing has revolutionized how sports organizations, athletes, and fans interact, reshaping the relationship between sports and marketing in the 21st century. This paper explores the critical role of digital marketing in sports, highlighting the ways in which online platforms, particularly social media, influence fan engagement, revenue generation for sports organizations, and the sports sector overall. Adapting to the digital environment is now essential for the long-term growth and success of sports organizations (Beech & Chadwick, 2007). The rapid development of digital technologies and the popularity of social media platforms offer significant opportunities for marketing and promotion, though they also bring new challenges related to competition and capturing consumer attention (Desai, 2019). At the same time, technology allows for more

precise segmentation of target audiences, providing fans with personalized experiences and facilitating direct interactions (Ferrell, Hartline & Hochstein, 2012). Beech and Chadwick, (2007) define marketing as a continuous process of generating competitive events with unpredictable outcomes, offering all participants: customers, sports businesses, organizations, and individuals, fair opportunities to achieve direct and indirect objectives. Thus, sports marketing exercises a pervasive influence on daily life, appearing in various forms, from media broadcasts and magazines to street advertisements.

Sports marketing encompasses two distinct dimensions: "sports marketing" focuses on promoting events and sports entities, such as the Olympic Games, Romania's SuperLiga, or football teams like CFR Cluj. The second dimension, "marketing through sports," involves promoting other products and services by associating them with sports events, teams, and renowned athletes, leveraging their appeal and credibility to enhance the visibility and attractiveness of promoted products. This distinction between sports marketing and marketing through sports is essential for understanding the strategy and impact of marketing within the contemporary sports context (Kaiser & Breuer, 2015).

Much like major corporations, sports teams and organizations function as complex entities, employing financial specialists and operational leaders to ensure operational efficiency and effectiveness. A fundamental task in sports management is identifying and responding to consumer expectations, prioritizing their needs. Within this context, the sports marketer plays a crucial role, with the primary objective of promoting the brand and image of a team or individual athlete using a wide range of channels and strategies tailored to an increasingly diverse market (Kotler & Keller, 2019). Although marketing terminology often refers to products and services, the emphasis is actually on consumer emotions and experiences, as the primary aim of sports marketing is to create an emotional bond between fans and the sports entity, transforming mere participation into an engaging and memorable experience (University of Florida, 2021).

Social media has emerged as a crucial channel for online sports marketing, providing ample opportunities to connect with fans. According to a report by Datareportal, over 62% of the global population -more than 5 billion people- are using social media platforms in January 2024. For sports marketing, this digital medium is ideal for creating an authentic connection with fans and delivering relevant experiences. Social media marketing involves using digital platforms to achieve marketing and business objectives. To maximize the potential of this channel, a well-thought-out strategy based on in-depth insights is essential. Wordstream recommends the following measures for optimizing efficiency:

- Creating audience-specific content: Companies must have a deep understanding of their target audience and produce consistently relevant and updated content to meet their needs.

- Engaging with the audience: Social media facilitates the formation of digital communities, and constant engagement (responding to comments, sharing, and reacting) is essential to foster a sense of belonging. Regular updates on product information also help maintain an active and informed community.

- Repurposing content and using paid advertising: This strategy extends reach by reusing materials across platforms like TikTok, Instagram Reels, and YouTube Shorts. Additionally, social media advertising offers a cost-effective method for reaching audience segments with high potential interest in the offered products.

- Assessing content quality: Statistics are essential for determining the effectiveness of a marketing strategy. The success of a social media campaign cannot be evaluated without clear and relevant data. Current technology enables companies to respond quickly to market changes, adjust strategies based on feedback, and continuously improve content quality (Kotler & Keller, 2019). This adaptability helps organizations optimize impact and remain competitive in the dynamic digital landscape.

PURPOSE OF THE STUDY

The objective of this research is to determine the most effective social media platform and the types of marketing campaigns most favored by consumers within the sports context. Accordingly, specific aims were set, including a comparative analysis of consumer preferences for online versus traditional marketing campaigns, and an evaluation of consumer attitudes toward different social media platforms employed in sports marketing.

MATERIAL & METHODS

The research sample consisted of 20 participants aged 18 to 26, randomly selected from active social media users. This age group is recognized for its high engagement with technology and digital platforms, making it a representative segment for current online consumption trends (Pew Research Center, 2021). This research benefits from access to opinions and behaviors relevant to social media usage for marketing purposes, as younger generations are typically more receptive to new digital marketing trends and actively engage on platforms such as Instagram, TikTok, YouTube, and Facebook (Smith et al.,

2020). The random sampling method minimizes potential biases in participant selection, thus ensuring a diversity of perspectives. In the context of sports marketing, insights from this age group are essential, as young consumers tend to respond differently to marketing campaigns compared to other demographics, often showing distinct preferences for interactivity, authenticity, and dynamic visual content (Kotler & Keller, 2019).

The research methodology is designed to understand consumer preferences and attitudes toward online sports marketing. To analyze these aspects, a qualitative research design was employed, using semi-structured interviews as the primary data collection method. According to Malhotra and Birks (2007), qualitative research is predominantly exploratory and provides an in-depth understanding of attitudes and perceptions within a limited sample. The interviews were conducted either in person or via the Zoom platform, with an average duration of 15-20 minutes.

Data analysis followed the model proposed by Miles and Huberman (1994), which consists of three stages: data reduction, data display, and conclusion drawing. The first stage involved extracting and coding key terms to eliminate redundancy and structuring the information in alignment with the research objectives. In the data display stage, responses were condensed and organized thematically, and in the final stage, primary trends and patterns were identified, forming the foundation of the final conclusions.

Table 1. Interview used in research

Reference Framework of Questions	Questions
I. Consumer Preferences Related to Marketing.	1.1 What comes to mind when you hear the word "marketing"? 1.2 What is your opinion of traditional marketing? 1.3 What is your opinion of online marketing (social media, email, display advertising, etc.)? 1.4 Which of these do you prefer? Why?
II. Consumer Attitude Toward Different Social Media Platforms.	2.1 What are your favorite social media platforms? What do you like about each of them? 2.2 Which platform do you spend the most time on? What sets it apart from the rest? 2.3 Which social media platforms do you dislike? Why? 2.4 On which platforms do you tolerate marketing campaigns?
III. Consumer Attitude Toward Types of Sports Marketing Campaigns.	3.1 What is your favorite type of social media post (image, video, audio, text, story, etc.)? Why? 3.2 What do you understand by sports marketing? 3.3 In your opinion, what is the difference between marketing of sports and marketing through sports?

Reference Framework of Questions	Questions
	3.4 When it comes to sports marketing, do you prefer the same type of post? (What type of post related to sports marketing do you prefer?)
IV. Consumer Attitude Toward Types of Marketing Campaigns Through Sports.	4.1 Do you follow any athlete or sports organization online? What sets them apart from the competition? 4.2 Have past marketing campaigns through sports convinced you to form or change an opinion about a product? What were the elements that influenced your final decision (credibility, appeal, strength)?
V. What Attracts Consumers to a Marketing Campaign.	5.1 What attracts you to a marketing campaign? 5.2 Do you think these elements can be incorporated into sports marketing? How?

RESULTS

The analysis of responses collected during the interviews revealed consumer preferences regarding online marketing and the social platforms used in sports marketing. The analysis was structured according to the five major themes discussed in the interviews: preferences for online versus traditional marketing, attitudes toward social media platforms, preferred types of campaigns, the influence of sports marketing campaigns, and the key attraction factors within a marketing campaign.

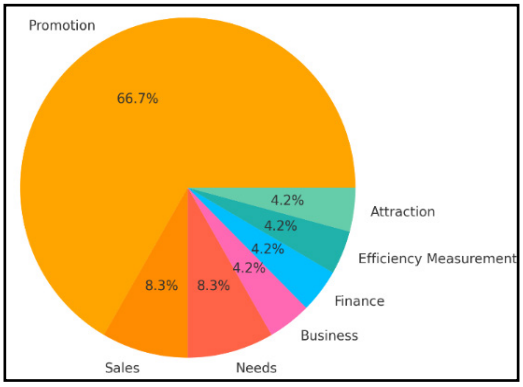


Fig. 1. What comes to the minds of participants when they hear the word "marketing"?

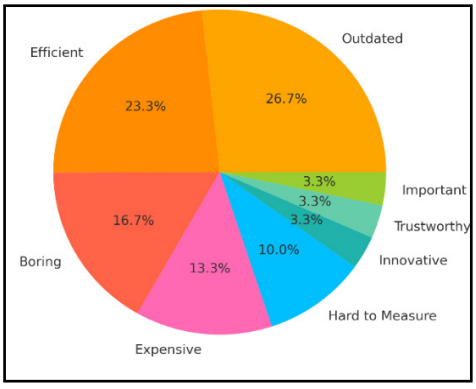


Fig. 2. Opinions about traditional marketing

The preponderance of respondents showed a clear preference for online marketing due to its accessibility and interactivity. They highlighted the benefits of direct engagement with brands and the ability to provide instant feedback as key advantages of the digital environment (Ferrell, Hartline & Hochstein, 2012). Additionally, precise audience targeting and measurable results make online marketing more appealing to younger consumers, contrasting with traditional marketing, which was often described as "outdated" and "less engaging." This is reflected in Fig. 2., where attributes like "outdated" and "boring" have significant representation, indicating traditional marketing's perceived limitations.

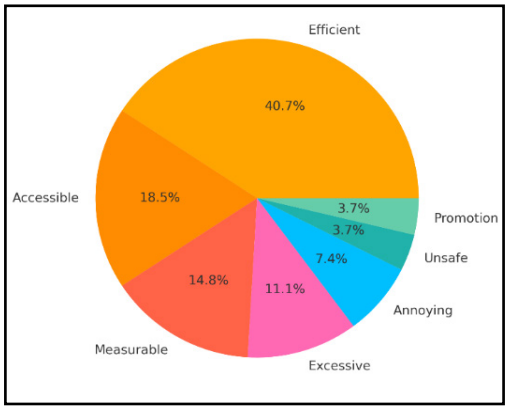


Fig. 3. Opinions about online marketing

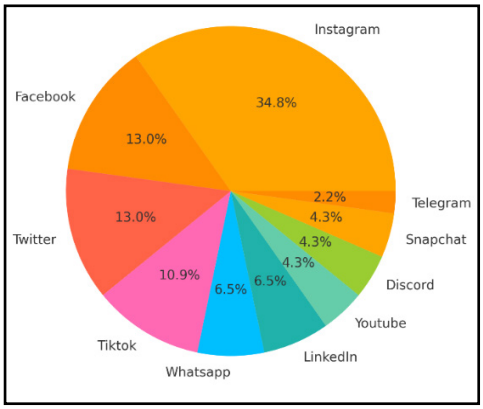


Fig. 4. Favourite social media platforms

Among social platforms, Instagram and TikTok were preferred by respondents due to their rapid, easily consumable content, characteristic of the "continuous feed" format. Respondents also emphasized the importance of community engagement and captivating visuals, considering these platforms ideal for sports marketing campaigns. The chart illustrating the percentage distribution of codes in online marketing opinions supports these findings, with a significant portion of respondents associating online marketing with "efficiency" (40.7%) and "accessibility" (18.5%), both crucial attributes in fast-paced platforms like Instagram and TikTok. In the distribution of social media platforms used, Instagram held the highest preference (34.8%), followed by Facebook and Twitter, which had relatively lower percentages, further reflecting the participants' inclination towards platforms conducive to visually dynamic and engaging content.

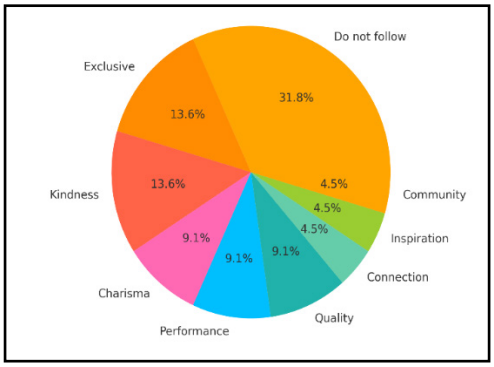


Fig. 5. Results of following famous athletes and the appeal of their content

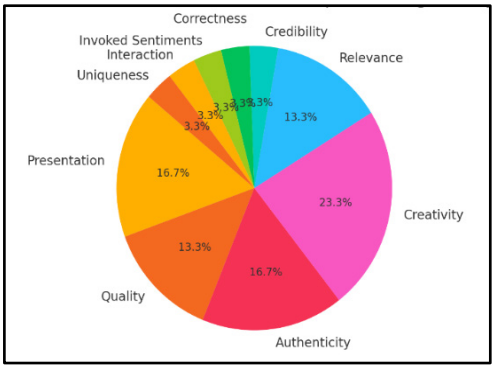


Fig. 6. Key Motivational Factors in Marketing Campaigns

According to Fig. 5., thirteen respondents indicated that they follow athletes and sports organizations online, while seven expressed no interest in doing so. The primary reasons for following athletes include "a unique behind-the-scenes perspective" (exclusivity), the charisma of the athletes, and, in some cases, purely for the quality of information presented by sports pages.

On the other hand, for most respondents, credibility was the foremost attribute for an athlete engaging in a marketing campaign. This aligns with previous responses, where some participants indicated they follow athletes like Messi and Ronaldo. The success of marketing campaigns involving such athletes can be attributed to their expertise and integrity, establishing them as among the world's most successful and credible sports figures. Other important attributes mentioned include charisma (attractiveness), relevance, and the professionalism of the campaign. If a product lacks relevance to the follower, the choice of athlete will have little impact. Additionally, if product information is not presented accurately and concisely, the audience's interest may shift to alternative options.

The responses indicate a strong preference for integrating emotional, authentic, and relevant elements in sports marketing, particularly by leveraging well-known athletes and innovative content. Many participants believe that using famous athletes, whom both adults and children admire, strengthens credibility and connection with the audience. Respondents value campaigns that are authentic, emotionally engaging, and resonate with sports values. Storytelling that connects emotionally with fans is seen as particularly effective. The use of current events, creative collaborations with athletes, and innovative content like humor or contemporary art were highlighted as appealing strategies that enhance engagement.

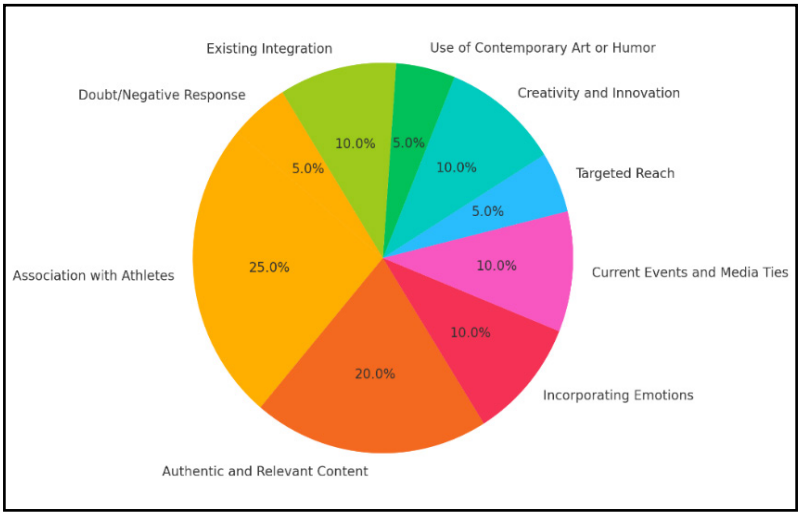


Fig. 7. Important elements to enhance sports marketing campaigns

DISCUSSIONS

This research highlighted the importance of online marketing in the sports context, emphasizing consumer preferences for dynamic and interactive formats, such as videos and stories, specifically to social media platforms. The results show that while traditional marketing remains valuable for certain audience segments, digital marketing offers superior accessibility and measurability, being preferred by younger audiences (Desai, 2019). Sports marketing campaigns, carried out by athletes and sports organizations, had a strong impact on respondents' perceptions. They were more likely to trust a product or brand promoted by a famous athlete, recognizing the essential role of credibility and emotional association in the success of a sports marketing campaign. However, respondents indicated a preference for authentic campaigns that convey real values, not just commercial messages. Factors that attract consumers to a marketing campaign most include originality, relevance to everyday life, and message authenticity.

Respondents emphasized that they feel more drawn to campaigns that use familiar language and present products in a realistic and accessible context. The most prominent theme -endorsed by about a third of respondents- is the association with famous athletes. Respondents emphasize the influence athletes have on consumers, particularly due to their status as admired figures. Research supports

that endorsements by admired public figures, especially athletes, create a halo effect, making associated products more desirable. This strategy is effective because it not only enhances visibility but also aligns sports fans' emotional connection to their idols. Approximately one-quarter of respondents value authentic and relevant content in sports marketing. Authenticity is increasingly recognized as a significant component in modern marketing, particularly among younger audiences, who tend to be skeptical of overt commercialization. This view aligns with findings that audiences prefer content that resonates with real-world experiences and highlights genuine interactions within the sports community (Thompson et al., 2022). These responses suggest that brands could benefit from adopting storytelling strategies that emphasize relatable content, creating narratives that foster a sense of shared experience and genuine connection with sports values.

A segment of responses highlights the emotional connection as a crucial element, suggesting that stories that "touch the hearts" of fans can strengthen brand loyalty. Emotional appeal is a powerful marketing tool, as emotions play a significant role in decision-making (Bagozzi et al., 2019). This approach in sports marketing could involve creating narratives around triumph, struggle, or passion for the game, which can resonate deeply with fans. Such a strategy not only aligns with the values of sports but also builds a stronger brand affiliation by tapping into the audience's emotional investments.

The responses reflect a strong inclination toward strategies that incorporate authenticity, athlete associations, and emotional connections within sports marketing. The preference for authenticity and emotional appeal aligns with current research, which advocates for relatable and genuine content to build trust and loyalty. These findings underscore the importance of aligning marketing strategies with the intrinsic values of sports such as teamwork, resilience, and community.

CONCLUSIONS

Based on the results, we can conclude that sports marketing is a dynamic and complex field that requires constant adaptation, with success depending on a deep understanding of the target audience alongside the expertise and techniques of marketers. Essential to this field is the ability to create original, engaging content and involve compelling figures who convey both credibility and evoke strong emotions in the target audience.

Challenges include managing public perceptions of athletes and teams, navigating the rapid evolution of new technologies, social media platforms, and rapidly shifting trends. Additionally, forming strategic partnerships with sponsors

and crafting impactful campaigns to maximize visibility are crucial. In conclusion, online marketing has transformed the way sports are promoted and consumed, delivering significant benefits for both sports organizations and fans. As digital technologies continue to evolve, the role of online marketing will expand, presenting new opportunities for innovation and success in the field.

Acknowledgments

This article is the result of teamwork between the authors and started from the findings in Ciocoiu Ioan Cătălin's bachelors' degree thesis.

REFERENCES

Bagozzi, R. P., Gopinath, M., & Nyer, P. U. (2019). The Role of Emotions in Marketing. *Journal of the Academy of Marketing Science, 27*(2), 184–206.

Beech, J., & Chadwick, S. (2007). *The marketing of sport*. Financial Times Management.

Desai, V. (2019). Digital marketing: A review. *International journal of trend in scientific research and development, Special Issue*, 196-200.

Ferrel, O. C., Hartline, M. D., & Hochstein B. W. (2012). *Marketing strategy*. Cengage Learning.

Kaiser, S., & Breuer, M.(2015). Defining sports marketing. In S. Chadwick, N. Chanavat & M. Desbordes, *Routledge handbook of sports marketing* (pp. 4-14). Routledge.

Kotler, P., & Keller, K. L. (2019). *Marketing management* (15th ed.). Pearson.

Malhotra, N., & Birks, D. (2007). *Marketing research: an applied approach*. Pearson.

Miles, M.B. & Huberman, A.M. (1994). *Qualitative data analysis: an expanded sourcebook*. Sage Publications

Pew Research Center. (2021, April 7). Social media use in 2021. *Pew Research Center*. https://www.pewresearch.org/internet/2021/04/07/social-media-use-in-2021/

Smith, J., Anderson, M., & McClure, J. (2020). Digital 2020: Global digital overview report. *DataReportal.* https://datareportal.com/reports/digital-2020-global-digital-overview

Thompson, C. J., Rindfleisch, A., & Arsel, Z. (2022). Authenticity in Consumer Culture. *Journal of Consumer Research, 49*(2), 398–414.

University of Florida (2021). What does a sports marketer do? 4 Skills you'll need. *UF online Master of Science in sports management.* https://sm.hhp.ufl.edu/news/what-does-a-sports-marketer

STUDIA UBB EDUCATIO ARTIS GYMN., LXX, 1, 2025, pp. 17-29
(RECOMMENDED CITATION)
DOI:10.24193/subbeag.70(1).02

Study on Employee Satisfaction Within a Sport Organization

Maria Daniela MACRA-OȘORHEAN[1], Iosif SANDOR[1], Septimiu Vasile ORMENIȘAN[1], Vasile Roland BINDEA[1], Velu-Sebastian BARTHA[1,*]

Article history: Received 2025 February 19; Revised 2025 March 26; Accepted 2025 March 28; Available online 2025.03.30; Available print 2025.05.30

ABSTRACT. Employee satisfaction plays a critical role in organizational success, particularly in sports institutions where performance expectations are high. Ensuring a positive work environment enhances motivation, retention, and overall productivity. This study focuses on assessing job satisfaction among coaches at Viitorul Cluj Football Academy by examining key workplace factors. **Objectives**: The primary objective of this study is to evaluate employee satisfaction levels and identify factors that influence both fulfillment and dissatisfaction. Specific areas analyzed include salary, promotion opportunities, supervision, fringe benefits, rewards, operating procedures, coworker relationships, nature of work, and communication. **Materials and Methods**: A quantitative research approach was employed using the Job Satisfaction Survey (JSS) developed by Paul E. Spector (1994). The study was conducted on 14 coaches, utilizing a 36-item questionnaire measuring nine subscales of job satisfaction. Responses were collected through a structured survey and analyzed using descriptive statistical methods. **Results**: Findings indicate that supervision, coworker relationships, nature of work, and communication are the most positively rated aspects, with 100% of respondents expressing satisfaction with their supervisors and 80% reporting enjoyment of their work. However, dissatisfaction was noted in salary (only 55% felt compensated), promotion opportunities (10% perceived limited growth), fringe benefits (25% dissatisfaction), and rewards (only 15% felt adequately rewarded). These results suggest a need for improvement in compensation structures and career development opportunities. **Conclusions**:

[1] Faculty of Physical Education and Sport, Babeș-Bolyai University, Cluj-Napoca, Romania
* Corresponding author: barthavelu@gmail.com

The study highlights the importance of strong leadership, positive team dynamics, and engaging job roles in fostering satisfaction. However, enhancing financial incentives, promotion transparency, and reward systems is essential for sustaining long-term employee motivation. Addressing these areas can contribute to a more engaged, committed, and high-performing workforce, benefiting both employees and the organization.

Keywords*: job satisfaction, sports organizations, employee motivation, workplace environment, career development*

REZUMAT. ***Studiu privind satisfacția în activitatea antrenorilor din cadrul unei organizații sportive.*** Satisfacția angajaților joacă un rol primordial în succesul organizațional, în special în instituțiile sportive unde așteptările privind performanța sunt ridicate. Crearea unui mediu de lucru pozitiv contribuie la creșterea motivației și a randamentului. Acest studiu își propune să evalueze satisfacția în activitatea antrenorilor din cadrul Academiei de Fotbal Viitorul Cluj, analizând factorii determinanți ai acesteia. **Obiective:** Obiectivul principal al acestui studiu este de a evalua nivelul satisfacției angajaților și de a identifica factorii care influențează atât sentimentul de împlinire, cât și eventualele nemulțumiri. Domeniile specifice analizate includ salarizarea, oportunitățile de promovare, supervizarea, beneficiile, recompensele, procedurile operaționale, relațiile cu colegii, natura muncii și comunicarea. **Materiale și Metode**: A fost utilizată o abordare cantitativă, prin aplicarea Chestionarului de Satisfacție în Muncă (JSS) dezvoltat de Paul E. Spector (1994). Studiul a inclus 14 antrenori, care au completat un chestionar de 36 de itemi, evaluând nouă subscale ale satisfacției profesionale. Răspunsurile au fost colectate printr-un sondaj structurat și analizate utilizând metode statistice descriptive. **Rezultate**: Rezultatele indică faptul că supervizarea, relațiile cu colegii, natura muncii și comunicarea sunt aspectele cel mai pozitiv evaluate, 100% dintre respondenți declarându-se mulțumiți de supervizorii lor și 80% exprimând satisfacție față de activitatea desfășurată. Totuși, au fost identificate nemulțumiri în ceea ce privește salarizarea (doar 55% consideră că sunt remunerați corect), oportunitățile de promovare (10% percep oportunitățile ca fiind limitate), beneficiile (25% sunt nemulțumiți) și recompensele (doar 15% consideră că sunt recompensați suficient). Aceste rezultate sugerează necesitatea îmbunătățirii structurilor de remunerare și dezvoltare a carierei. **Concluzii**: Studiul subliniază importanța unui management al resurelor umane eficient, a dinamicii pozitive în echipă și a unor sarcini de muncă motivante în menținerea satisfacției angajaților. Optimizarea beneficiilor salariale și implementarea unor sisteme de recompensare sunt necesare pentru asigurarea motivația și un climat pozitiv în cultura organizațională pe termen lung. Abordarea acestor aspecte va contribui la crearea unui mediu de lucru mai motivant, implicat și performant, cu beneficii atât pentru angajați, cât și pentru organizație.

Cuvinte-cheie*: satisfacția, organizații sportive, motivația angajaților, mediul de lucru, dezvoltarea carierei*

INTRODUCTION

In an era of rapid technological advancements, evolving market dynamics, and intensifying competition, sport organizations must exhibit resilience and adaptability to sustain their operations and maintain a competitive edge. The success of an organization is closely tied to its ability to manage these external challenges effectively, and at the core of this adaptability lies its workforce. Employees are directly influenced by organizational shifts, and their ability to perform optimally within these evolving conditions determines the overall efficiency and sustainability of a sport business (Karaman et al., 2020).

For organizations to thrive in today's highly competitive environment, maintaining operational standards and ensuring workforce efficiency are imperative. Achieving high productivity levels is contingent upon employees performing at their best within the set benchmarks and industry standards (Çakır & Gözoğlu, 2019). In this regard, performance is conceptualized as a measurable outcome derived from a structured and goal-oriented process. It can be assessed both quantitatively and qualitatively, reflecting the extent to which an individual or a team achieves predefined objectives (Çalışkan et al., 2019). From another perspective, we can define performance as the level of accomplishment that an individual or a group attains in relation to a specified goal, in terms of both efficiency and quality.

Job performance is the extent to which an employee fulfills the duties outlined in their job description and aligns their contributions with organizational objectives (Karaman et al., 2020). This suggests that performance is not merely an outcome, but a dynamic process shaped by job responsibilities, employee engagement, and organizational support. Organizations that prioritize performance management through well-structured evaluation systems, regular feedback, and employee development initiatives stand a better chance of achieving long-term success. When employees are recognized and rewarded for achieving their professional goals, their level of job satisfaction increases significantly.

Moreover, the efficiency and productivity of employees are closely linked to their level of job satisfaction. Employees who experience higher satisfaction in their roles are more engaged, motivated, and committed to their organization's goals, which means that organizations must identify the factors influencing job satisfaction and implement measures to enhance them.

In specific contexts, such as the sports industry, job satisfaction becomes even more complex due to the unique challenges associated with the field. Those in leadership roles, particularly, face heightened stress levels resulting from the demands of top management, the expectations of fans, and the pressure from athletes during and after matches or championships (Guenzi & Ruta, 2013).

The dynamic nature of the sports environment amplifies the need for effective management of job satisfaction, as the high stakes often create a stressful and demanding workplace. Individuals vary significantly in their reactions, behaviors, and emotional responses to their work environment. This diversity in perception explains why some individuals find satisfaction in certain aspects of their job, while others experience dissatisfaction under similar circumstances. These differences underline the importance of understanding the subjective nature of job satisfaction and the need for tailored approaches to enhancing employee well-being and engagement.

PURPOSE OF THE STUDY

The objective of this study, conducted within the ,,Viitorul Cluj" Football Academy, is to analyze and enhance employee job satisfaction levels to foster a positive organizational culture and improve overall performance. We conducted a comprehensive survey to evaluate the current level of job satisfaction among coaches, focusing on various aspects of the workplace.

MATERIAL AND METHODS

To achieve a comprehensive understanding of job satisfaction among the coaching staff at Viitorul Cluj Football Academy, this study involved the Job Satisfaction Survey (JSS), a widely recognized instrument developed by Paul E. Spector (1994). The JSS has been used in workplace research due to its ability to assess various dimensions of employee satisfaction, offering valuable insights into the factors that contribute to both fulfillment and dissatisfaction.

Taking the research in Cluj-Napoca, we used the Romanian-adapted version of the JSS, translated and validated by Professor Horia Pitariu from the Faculty of Psychology at Babeș-Bolyai University. This adaptation ensures cultural and linguistic appropriateness, allowing for a more accurate assessment of employees' perceptions in the Romanian organizational environment.

The Job Satisfaction Survey consists of 36 items, divided into nine subscales, each designed to evaluate a specific dimension of job satisfaction. These subscales include pay, promotion, supervision, fringe benefits, contingent rewards, operating procedures, coworkers, nature of work, and communication. Respondents were asked to rate their level of agreement with each statement on a six-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (6).

The study was conducted among 14 coaches employed at Viitorul Cluj Football Academy, all of whom participated voluntarily. To ensure honest and uninfluenced responses, the questionnaires were distributed in a confidential

format. Each participant received clear instructions on how to complete the survey, emphasizing that their responses would remain anonymous and be used for research purposes.

RESULTS

Once collected, the responses were systematically coded and analyzed using descriptive statistical methods to determine general satisfaction levels and identify patterns in the data. Each subscale was examined individually to highlight areas where employees reported high levels of satisfaction, as well as aspects where dissatisfaction was more prevalent.

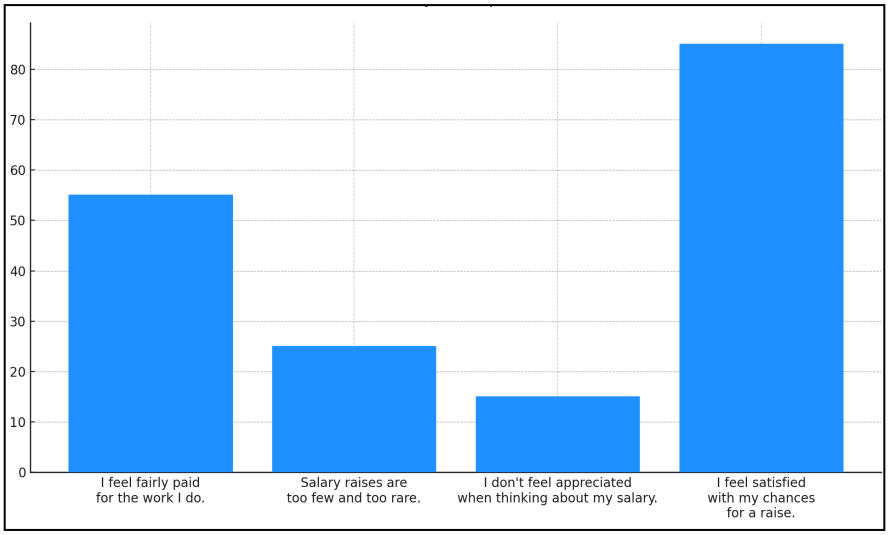


Fig. 1. Salary perception among coaches

According to Fig. 1., the results indicate a nuanced perception of salary satisfaction among respondents. While 85% of employees expressed optimism about their chances of a salary increase, only 55% felt fairly compensated for the work they do, suggesting a gap between perceived potential and current remuneration. Furthermore, 25% of employees felt salary raises were too infrequent, and 15% reported a lack of appreciation when thinking about their salary. This highlights that while prospects of salary growth are encouraging, the current pay structure and lack of appreciation around compensation may undermine motivation.

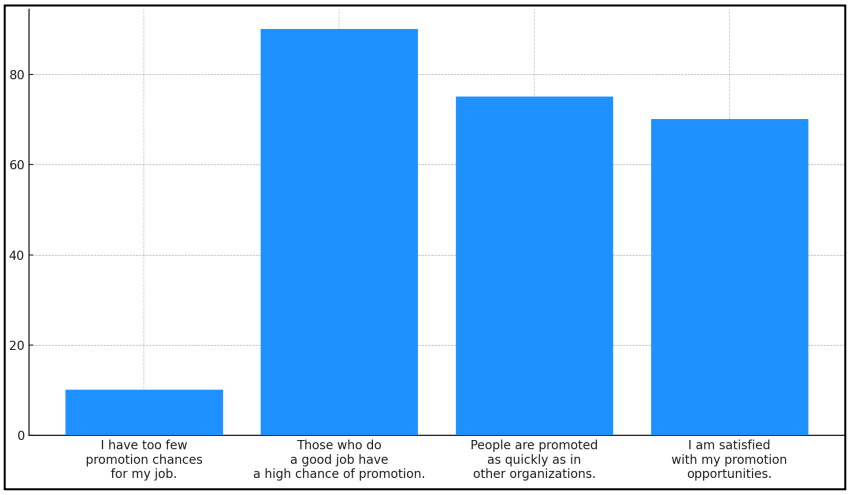


Fig. 2. Promotion opportunities for the coaches

The data reveals a predominantly positive sentiment toward promotion opportunities. 90% of respondents agreed that high performers have significant chances for promotion, and 75% believed the organization's promotion speed aligns with industry standards. However, 10% of employees felt there were too few promotion opportunities, indicating that some workers perceive limited upward mobility. This suggests that while merit-based promotions are well-regarded, providing greater transparency regarding career pathways could enhance overall satisfaction.

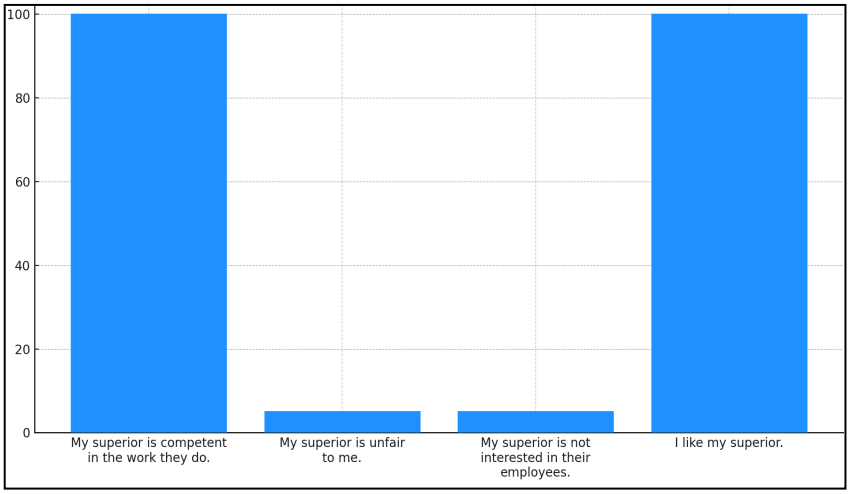


Fig. 3. Supervision feedback

Feedback about supervisors was overwhelmingly positive, with 100% of respondents stating their supervisor was competent, and 100% indicating they liked their supervisor on a personal level. Additionally, only 5% felt their supervisors were unfair or uninterested in employees' needs. These scores suggest a strong leadership presence, marked by competence and interpersonal skills.

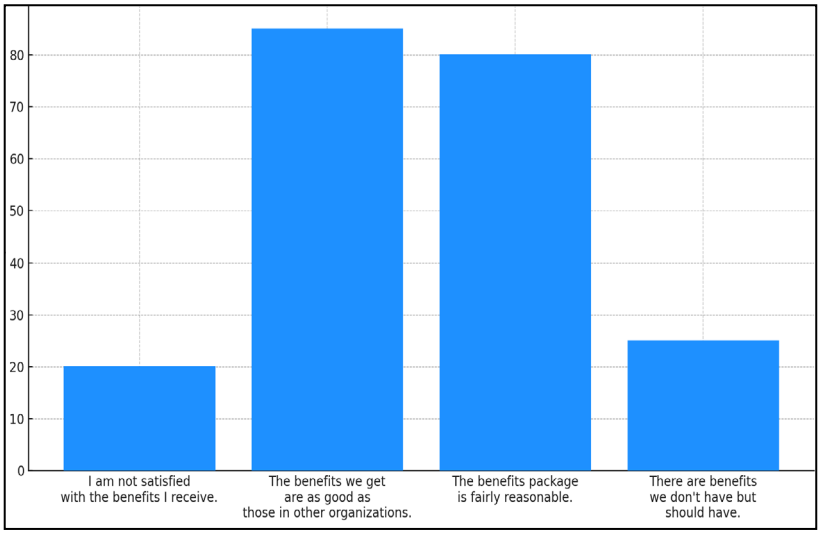


Fig. 4. Coaches benefits at workplace

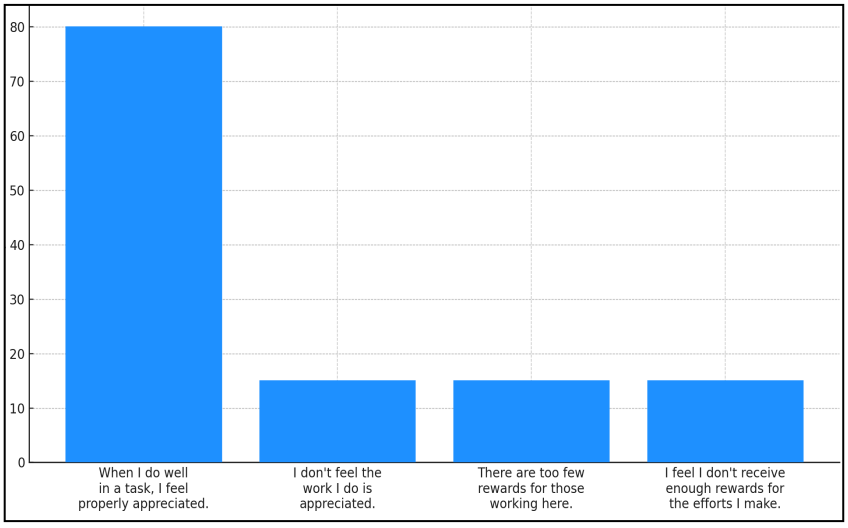


Fig. 5. Perception of recognition and rewards

Responses regarding benefits were mixed but leaned positive. 85% of employees believed their benefits were on par with them or better than those offered by competitors, and 80% felt the benefits package was reasonable. However, 25% expressed dissatisfaction, citing gaps in the benefits they expected but were not provided. This difference in opinion suggests that while the overall benefits package is strong, there may be individual unmet needs.

The results of this section reveal a disparity in perceptions of recognition and rewards. 80% of respondents reported feeling appreciated for good performance, but only 15% felt that rewards were sufficient or frequent enough. This indicates that while immediate recognition is present, tangible rewards like bonuses or salary increments are perceived as lacking.

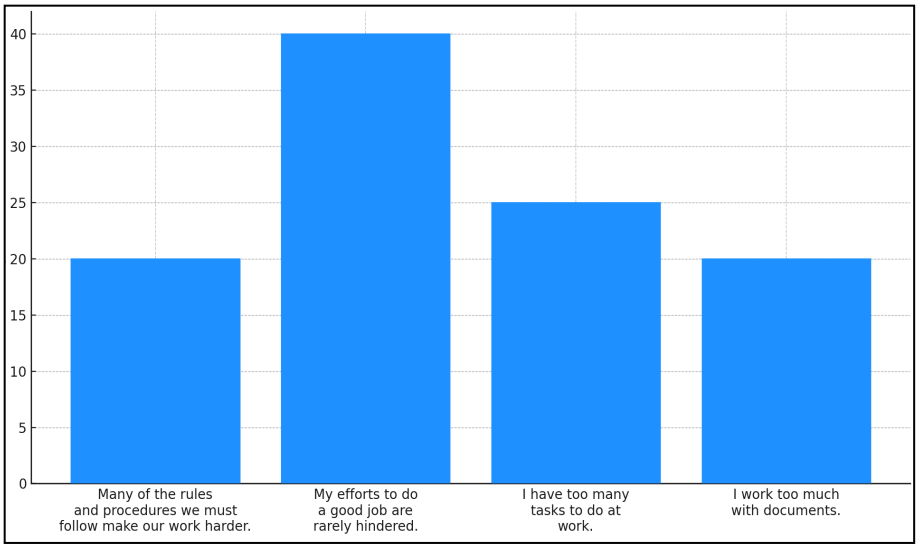


Fig. 6. Challenges in work environment for coaches

This category highlights a generally positive work environment. 40% of respondents reported their efforts to excel were rarely disadvantaged, while 20% expressed challenges related to excessive tasks and document handling, and 20% found organizational rules inconvenient.

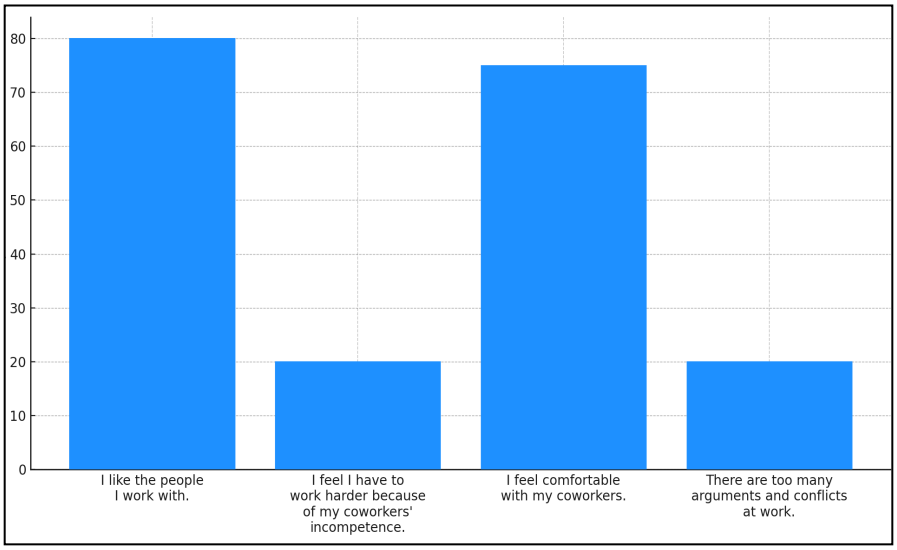


Fig. 7. Coaches' interpersonal relationships within organization

Perception about coworkers underscores strong interpersonal relationships within the organization. 80% of employees reported liking their colleagues, and 75% felt comfortable working with them. However, 20% noted having to compensate for perceived incompetence among coworkers, and 20% highlighted workplace conflicts as a concern.

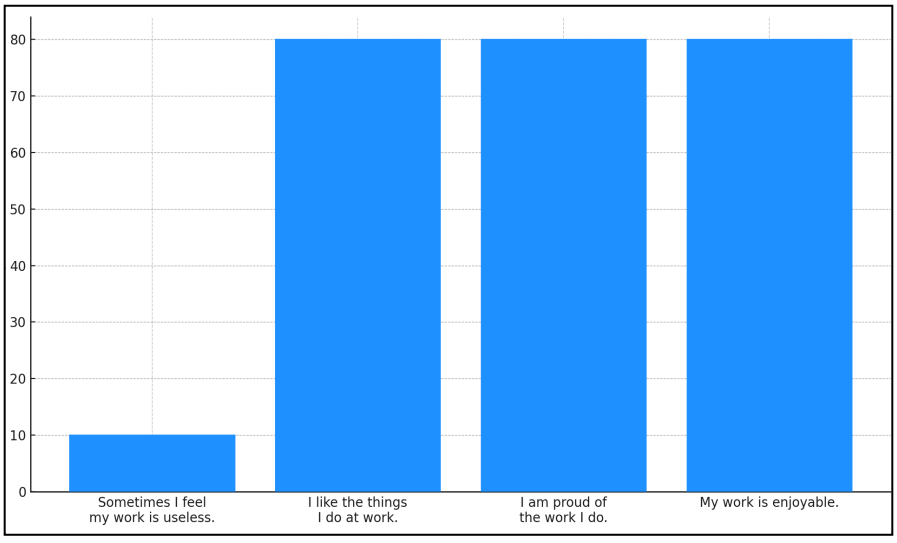


Fig. 8. Coaches' perspective about importance of their work

Findings in this category demonstrate high levels of intrinsic job satisfaction. 80% of respondents reported enjoying their work, feeling proud of their contributions, and valuing the tasks they perform. Only 10% felt their work was occasionally meaningless. These results highlight the importance of maintaining task alignment with employee interests and ensuring continued engagement by showcasing the impact of their work on organizational goals.

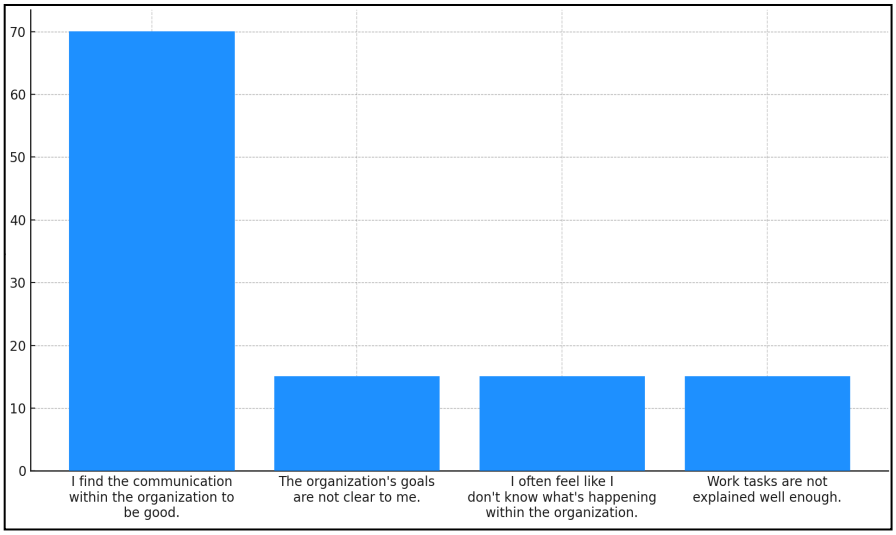


Fig. 9. Internal communication within organization

The data reflects a predominantly positive perception of organizational communication. 70% of respondents felt that internal communication was effective, while 15% reported unclear organizational goals, insufficient explanations of work tasks, and a lack of transparency regarding ongoing activities.

DISCUSSIONS

The present study aimed to assess job satisfaction among coaches at Viitorul Cluj Football Academy using the Job Satisfaction Survey (JSS). The analysis focused on nine subscales: pay, promotion, supervision, fringe benefits, contingent rewards, operating procedures, coworkers, nature of work, and communication. The results presented above provide valuable insights into the factors influencing job satisfaction within this specific sports organization. The results of the first scale indicated moderate satisfaction levels concerning pay

and promotion opportunities. This aligns with the research suggesting that compensation and career advancement are critical determinants of job satisfaction. For instance, Lee et al. (2023) found that both intrinsic factors, such as recognition, and extrinsic factors, including pay and promotion, significantly influence job satisfaction across various industries. In the context of sports organizations, competitive salaries and advancing pathways are essential to attract and retain talented coaches. High satisfaction levels were observed in the areas of supervision and relationships with coworkers. Supportive leadership and positive interpersonal relationships are known to enhance job satisfaction. Effective supervision fosters a sense of appreciation and recognition, which are internal factors contributing to job satisfaction (Cooper et al., 2018). Moreover, a collaborative work environment among colleagues promotes a sense of belonging and mutual support, further enhancing satisfaction levels.

Participants reported lower satisfaction with fringe benefits and contingent rewards. This finding is consistent with studies indicating that inadequate benefits and lack of performance-based rewards can lead to dissatisfaction. Ensuring that coaches feel adequately rewarded for their efforts is imperative, as it directly impacts their motivation and commitment to the organization (Lee et al., 2023). Implementing a structured system of contingent rewards may address this issue, providing clear motivation for performance. Satisfaction with operating procedures was moderate, suggesting that the organization can search for improvement in organizational policies and processes. Improving procedures to reduce bureaucracy and enhance efficiency can positively impact job satisfaction. Employees who perceive organizational processes as fair and efficient are more likely to exhibit higher levels of job satisfaction and organizational commitment (Cooper et al., 2018).

The nature of work and communication received high satisfaction ratings. Engagement in meaningful tasks and effective communication channels are decisive in fostering job satisfaction. When employees find their work intrinsically rewarding and are well-informed about organizational matters, they are more likely to experience job satisfaction (Lee et al., 2023). Maintaining open lines of communication ensures that employees feel valued and heard, contributing to a positive work environment. The results suggest that while certain areas, such as supervision, coworker relations, nature of work, and communication, are sources of satisfaction, attention should be directed toward enhancing pay structures, promotion opportunities, fringe benefits, contingent rewards, and operating procedures. Addressing these areas may involve conducting market salary analyses to ensure competitive compensation, establishing transparent promotion criteria, offering comprehensive benefits packages, implementing performance-based reward systems, and improving organizational procedures.

CONCLUSIONS

This study examined job satisfaction among coaches at Viitorul Cluj Football Academy, revealing strengths and areas for improvement. Supervision, coworker relationships, nature of work, and communication emerged as key factors contributing to a positive work environment. However, dissatisfaction with pay, promotion opportunities, benefits, and rewards indicated the need for better compensation structures and career development pathways. Enhancing these aspects can lead to a more motivated, engaged, and high-performing workforce, ultimately benefiting both employees and the organization.

Study Limitations

This study's sample size was limited to 14 coaches within a single football academy, which may affect the general aspects of the results. Future research should consider larger, more diverse samples across multiple organizations to validate these findings.

Acknowledgments

This article is the result of teamwork between the authors and started from the findings in Bindea Vasile Roland's bachelors' degree thesis.

REFERENCES

Cooper, I., Heinsen, C., & Menges, C. (2018). Job Satisfaction: A Comparative Analysis of Intercollegiate Athletics Department Employees. *Butler Journal of Undergraduate Research*, 4(1), Article 4. https://digitalcommons.butler.edu/bjur/vol4/iss1/4/

Çakır, A., & Gözoğlu, Ö. F. (2019). The Effect of Perceived Institutional Reputation on Job Performance and Intention to Leave: A Study on Hospitality Businesses in Şanlıurfa. *Harran Üniversitesi İİBF Dergisi, 3*(4), 46-71.

Çalışkan, A., & Pekkan, N. Ü. (2017). The Effect of Organizational Silence on Business Performance: The Mediating Role of Ethical Climate. *Hasan Kalyoncu University, Journal of Turkish Social Sciences Studies, 2*(1), 4.

Çalışkan, A., Turunç, Ö., & Mert, İ. S. (2019). The Mediating Role of Organizational Support in the Effect of Employee Empowerment on Job Performance. *Toros University Journal of Social Sciences, 6*(10), 1-21.

Guenzi, P., & Ruta, D. (2013). *Leading teams: Tools and techniques for successful team leadership from the sports world*. John Wiley & Sons.

Karaman, M., Yoldaş, A., & Kılıç, B. (2020). Investigation of the Effect of Organizational Exclusion on Job Performance and Intention to Leave. *Journal of Selcuk University Vocational School of Social Sciences, 23*(2), 479-496. https://doi.org/10.29249/selcuksbmyd. 683115

Lee, C., Lee, B., Choi, I., & Kim, J. (2023). Exploring Determinants of Job Satisfaction: A Comparison Between Survey and Review Data. *Sage Open, 13*(4). https://doi.org/10.1177/21582440231216528

Spector, P. E. (1985). Measurement of human service staff satisfaction: Development of the Job Satisfaction Survey. *American Journal of Community Psychology, 13*(6), 693–713. doi:10.1007/bf00929796.

STUDIA UBB EDUCATIO ARTIS GYMN., LXX, 1, 2025, pp. 31-46
(RECOMMENDED CITATION)
DOI:10.24193/subbeag.70(1).03

Motor Skills and Motivation Development by Implementing Handball Elements in First Part of Physical Education Lesson

Octavian POPESCU[1], Eugen BOTA[1*], Dana GAVRELIUC[1], Martin DOMOKOS[1]

Article history: Received 2025 March 06; Revised 2025 April 25.; Accepted 2025 April 2; Available online 2025.03.30; Available print 2025.05.30

ABSTRACT. Introduction: Physical education lesson are the ideal environment for educating and consolidating active lifestyle habits that will last throughout the students' lives. Teachers play a central role in the success and longevity of school-based interventions. Students' motor skill levels are directly associated with their participation in physical education lessons or movement activities. Motivation is recognized as an important factor related to students engagement and active participation in physical education lessons. Therefore, it might be reasonable to assume that physical education programs will have a more positive impact when students are motivated to participate. **Purpose:** Through hypothesis testing we wanted to evaluate the effect of the intervention on motor skills and motivation in physical education lessons. **Material:** Longitudinal experimental study design without control group, number of subjects N=38 subjects from two different classes. The research instrument was a questionnaire composed of 3 subscales and an application trail counted in seconds and number of cumulative points from shots on goal. **Results:** The results support the tested hypotheses that the intervention will improve motor skills and increase the motivation score, demonstrating that there are significant differences between pre-test and post-test. **Conclusion:** The ludic character of the physical education lesson can significantly influence the active participation of students in the physical education lesson, also improving the level of motor skills.

Keywords: *physical education, motor skills, motivation, handball.*

[1] West University of Timișoara, Romania
[*] Corresponding author: eugen.bota@e-uvt.ro

REZUMAT. ***Ameliorarea deprinderilor motrice şi a motivaţiei utilizând elemente specifice jocului de handbal în partea introductivă a lecţiei de educaţie fizică.*** **Introducere:** Orele de educaţie fizică reprezintă mediul ideal pentru educarea şi consolidarea obiceiurilor unui stil de viaţă activ, care vor dăinui pe tot parcursul vieţii elevilor. Profesorii joacă un rol central în succesul şi longevitatea intervenţiilor bazate pe şcoală. Nivelul de deprinderi motrice ale elevilor sunt direct asociate cu participarea acestora la lecţia de educaţie fizică sau la activităţi de mişcare. Motivaţia este recunoscută ca fiind un factor important legat de implicarea şi participarea activă a elevilor la orele de educaţie fizică. Prin urmare, ar putea fi rezonabil să presupunem că programele de educaţie fizică vor avea un impact mai pozitiv atunci când elevii sunt motivaţi să participe. **Scop:** Prin testarea ipotezelor ne-am dorit să evaluăm efectul intervenţiei asupra deprinderilor motrice şi a motivaţiei în lecţia de educaţie fizică. **Material:** Design de studiu experimental longitudinal fără grup de control, număr subiecţi N=38 alcătuind 2 clase diferite. Instrumentul de cercetare a fost chestionarul compus din 3 subscale şi un traseu aplicativ contorizat în secunde şi număr de puncte cumulate din aruncările la poartă. **Rezultate:** Rezultatele susţin ipotezele testate, conform cărora în urma intervenţiei se vor ameliora deprinderile motrice şi va creşte scorul motivaţiei, demonstrând faptul că există diferenţe semnificative între pre-test şi post-test. **Concluzii:** Caracterul ludic al lecţiei de educaţie fizică poate influenţa semnificativ participarea activă a elevilor în lecţia de educaţie fizică, ameliorând de asemenea nivelul deprinderilor motrice.

Cuvinte-cheie*: educaţie fizică, deprinderi motrice, motivaţie, handbal.*

INTRODUCTION

According to a WHO report, 80% of the adolescent population does not regularly practice any type of physical sports activity (Guthold, 2020). Data collected from 1.6 million students with aged beetwen 11-17 years from 146 countries show that 81% of them were under-active in 2016 (Guthold, 2020). Physical education lesson are the ideal environment for educating and consolidating active lifestyle habits that will last throughout their lives (Trigueros, 2019). European pre-adolescent children (aged 6 and 12 years) spend 209 minutes/day (64%) of their time at school in sedentary activities, while they spend only 16 minutes/day (5%) in moderate to vigorous physical activity (Zhang, Relations among School Students' Self-Determined Motivation Perceived Enjoyment, Effort, and Physical Activity Behaviors., 2009).

Evolving with technology, students' free time allocated for practicing motor activities has turned into an overloaded schedule where digitalization and inactivity predominate. Therefore, in modern education, both the lessons and the teacher must adapt to the requirements of students, because their motor skills are much poorer, so the motor skills once practiced in free time need to be maximized in the physical education lesson.

Teachers play a central role in success and longevity of school-based interventions (Lander, 2017). Learning of motor skills increases the possibilities to move, to experience new motor sensations, to enrich the universe of knowledge, which favors the expression of personality (Dragnea, 2006). Student's motor skills level are directly associated with their participation in physical education lessons or movement activities (Okely, 2001). Children's motor activities practice contribute to their physical and motor development (Chen W. H.-B., 2017). Empirical studies have shown that motor skills were positively associated with physical activity participation and negatively associated with sedentary behaviors in children (Fisher, 2005). Furthermore, childhood manipulative skills significantly predicted whether the adolescent would participate in any moderate to vigorous activity and spend time in organized activities compared to locomotor skills (Barnett, 2009). Knowing fundamental skills has been associated with an important contribution to children's physical, cognitive and social development and is believed to be the basis for an active lifestyle (Lubans, 2010).

Physical preparation programs in physical education can provide positive developments in motor and technical skills (Kahraman, 2023). Students' free-time physical activity is related to motivational experiences in physical education. Perceptions of competence, autonomy and relatedness, self-determined motivation, enjoyment and physical activity in physical education directly or indirectly predict free-time physical activity (Cox A. E., 2008). Enjoyment of physical activity is a motivational construct that is a significant determinant of children and adolescents' physical activity behaviors. Enjoyment is a psychological experience characterized by fun, sympathy and pleasure. It can be influenced by factors such as the intensity of physical activity, children's perceptions of success and the emotional state before physical activity (Burns, 2017). It is argued that physical education programs in schools present a tremendous opportunity to positively influence attitudes and patterns of participation in physical activity among adolescents (Alderman, 2012; Bassett, 2013; Chen, 2014). Motivation is recognized as an important factor related to student's engagement and meaningful participation in physical education classes (Cox, 2009). Motivation in physical education was associated with increased activity during class time; intention to engage in physical activity outside of class time; positive changes in students' experiences of physical education; and intention to participate in physical

education in the future (How, 2013; Standage,2003; Zhang, 2009; Shen, 2010). It might therefore be reasonable to assume that physical education programs will have a more positive impact when students are motivated to participate (Haerens, 2010). Therefore, due to some phenomena that the body undergoes during the lesson, some physiological changes occur, which we will call characteristics.

Focusing on the introductory part of the physical education lesson we can achieve these characteristics traditionally, or integrated into games. According to the traditional method, we only address the physical component. Without increasing the complexity or introducing an element of innovation, the monotonous nature of this part comes into play and the students lose interest. As a effect of this part, the fundamental part will be affected later on.

By practicing the motor skills in the first part of the lesson, we approach not only the physical side but also the technical, theoretical or even tactical side. In order to prepare the body optimally for the effort, we need to take into account the following factors (cardio-respiratory, muscular, articular, nervous system excitation, by increasing attention the subjects will react faster and more efficiently). Warm up is the physiological and psychological preparation for the lesson tasks ahead. Warming up increases body temperature which has been shown to be a major facilitator of performance. It stimulates the central nervous system which coordinates the athlete's systems, reduces motor reaction time and develops coordination (Bompa, 2001).

THE STUDY'S HYPOTHESES

In accordance with the literature, in activity carried out in physical education classes as a result of trying to improve motor skills in the preparatory part of the lesson, we test the following hypotheses. Under H1 the physical performance will be tested. Furthermore, H2 has the aim to measure the effect of the intervention on those three subscales. H3 will test the physical differences between the classes and H4 will measure the differences between genders.

H1.1 There are significant differences between the pre-test and post-test in the time to complete the sport trail.

H1.2 There are significant differences between pre-test and post-test in total number of points at goal-scoring.

H2.1 There are differences between pre-test and post-test in motivation score as an effect of the experiment.

H2.2 There are differences between pre-test and post-test in the total score on autonomy, relatedness and competence as an effect of the experiment.

H2.3 There are differences between pre-test and post-test in the total self-efficacy score as an effect of the experiment.

H3.1 There are significant differences between 6th students and 8th students in terms of the pre-test and post-test average route completion.

H3.2 There were differences between 6th students and 8th students in terms of average shots on goal between pre and post test.

H4.1 There are gender differences in the time taken on the trail between pre-test and post-test.

H4.2 There are differences between genders in the number of points in shots on goal between pre-test and post-test.

PARTICIPANTS

In this study it took part N=38 subjects, of which 21 were male and 17 were female, composing 2 different heterogeneous classes, respectively 6th grade and 8th grade. The 6th grade students are N=18, 8 male and 10 female. Among them, 11 of them practice another sport other than physical education, 7 declare that they do not practice any other sport. The 8th grade students are N=20 students, 13 male, 7 female. Among them 9 declare that they practice sport, 11 declare that they do not practice sport. The sports history of the practicing sports is between 1-5 years. Firstly, verbal agreement was given by the director of the school and the teacher. Additionally, every parent was informed about this study. Ethical standards were in accordance with Declaration of Helsinki. All particular aspects and standards of ethic were respected. All participants were part of this intervention as volunteers.

METHODS

In the present paper, we used a longitudinal experimental design without control group with pre-test and post-test. Both classes followed the same intervention. Students underwent initial testing on December 12, 2023 and final testing on March 12, 2024. Both measures consisted of two assessment methods: an applied trail with specific handball elements and the questionnaire method. The applied route consisted of different movement patterns required in the handball game, as well as passing, shooting, dribbling and demarcation procedures. This trail can also be applied through the influences of other sports such as basketball or football, but by analyzing the material base that the school had, we decided to approach handball. This method of evaluation had two forms

of counting the performance obtained: the time in which the student completed the trail measured in seconds and the number of points accumulated from the 3 shots at the goal measuring the accuracy of the shots by separating the goal into 9 zones. Garmin Fenix 5X Plus Sapphire watch was used to record the timing. The trail can be seen in figure 1.

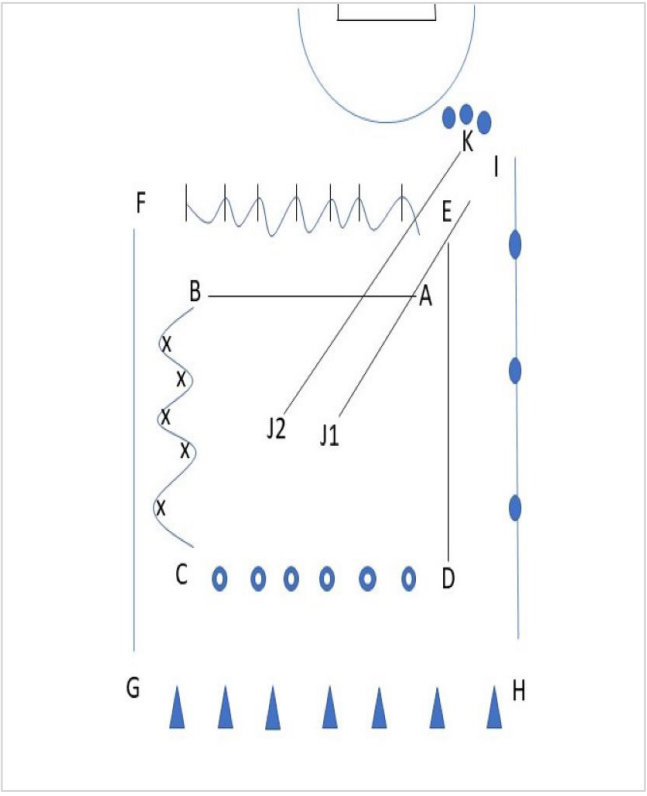


Figure 1. Trail

A-B – running over a distance of 8 m
B-C – driblling between the cones for a distance of 10 m
C-D – running with skipping over cones on 8 m distance
D-E – running backwards for a distance of 10 m
E-F – running with knees up over the buttock for a distance of 10 m
F-G – dribbling forward for 12 m
G-H – "in - out" between cones with passing ball, distance 10 m
H-I – running with ground ball passing (3 passes), distance 12 m
I-J1 – side running for distance 7 m
J2-K – other side running for distance 7 m

At the end of the trail there will be 3 balls placed at the semi-circle. After completing the trail the student must throw all 3 balls, and the throws will be counted in points as shown in figure 2.

3	1	3
1	1	1
2	1	2

Figure 2. Scoring points on the goal frame for handball shots

The goal was divided into 9 parts. The sides were scored differently, with throws in the center area being 1 point, throws to the top left and right 3 points, and throws to the bottom left and right 2 points. After the 3 throws, the points obtained are added together with the time taken by the student to complete the trail. These two results represent the student's athletic performance. The effective amount of work has been divided into 4 stages which will be briefly presented below. We would like to point out that the 4 stages refer to the preparatory part of the organism for the effort, therefore the school program does not suffer any delay, so it can proceed normally. Starting with the first period, the children practicing the forms of movement with the ball (running with the front, with the back on the direction of movement, lateral running, running using only the right hand for dribbling, etc.). stage characterized by a low complexity, with the aim of getting the students used to the ball. Further, the groups was divided into two teams, each with the ball practicing on a small side different ways of dribbling and passing the handball, continuous running under different forms of movement, the subjects executing the teacher's command (pass the ball with teammate, pass the ball with opponent, etc). The second stage is characterized by an increase in complexity and practice of the forms of movement in the handball game. In the third period, bilateral game play at a low intensity was practice to the students, but they are not allowed to run, the game is played only by walking, students position the ball between the ankles and execute the movement only by jumping, etc. Stage characterized by a higher complexity, following the principle of specificity. The intensity remains low, being characteristic of the preparatory part. Finally, in the last period, students practice the full trail gradually increasing and controlled intensity.

Characterized by the practice of the competition test. Then, a questionnaire composed of 3 subscales was used: 1. Physical Education Autonomy Relatedness Competence Scale (PE-ARCS) (Lauren Sulz, 2016); 2. - Physical Education Motivation Scale (PEMS) (Lauren Sulz, 2016); 3. - General Self-Efficacy Scale (GSE) (Schwarzer, 1995), validated and adapted for Physical Education and Sport. By using this questionnaire we wanted to observe whether personality factors change as a result of our intervention. The didactic intervention was realized through the implementation of handball specific motor skills in the preparatory part of the lesson with the aim of increasing the duration of the students' handball handling.

The exercises in the preparatory part have been rationalized and standardized so that they constitute a preamble to the exercises used in the fundamental part of the lesson. The use of the exercises in the preparatory part was a prerequisite for a facilitated approach to the exercises in the fundamental part, thus creating a transfer to the formation and preservation of the targeted skills.

RESULTS

To test hypotheses 1.1, 1.2, 2.1, 2.2, 2.3 we used the Paired Samples T-test. Instead, for hypothesis testing 3.1, 3.2, 4.1, 4.2 which involve comparing means between classes and between genders respectively, we used the Independent Samples T-test.

Table 1. Trail time

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	TIME_ TRAIL 1 TIME_ TRAIL 2	6.632	6.800	1.103	4.396	8.867	6.012	37	.000

By testing hypothesis 1.1 we can see that the travel time of the trail has improved significantly, p<.01, the average of participants dropping by about 7 seconds since the pretest (M=50.26) compared (M=43.63) at post test; *T(df=37) = 6.01, p= .00, p<.01*.

Table 2. Number of points accumulated for shots on goal

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	THROW1 - THROW2	-2.237	1.218	.198	-2.637	-1.837	-11.323	37	.000

Also the number of points for shots on goal increased from pre-test to post-test, (M=2.63) compared with (M=4.87); *T(df=37) = -11.32, p=.00, p<.01;*

Table 3. Total motivation score

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Mot_tot_T1-Mot_tot_T2	-4.237	3.522	.571	-5.394	-3.079	-7.416	37	.000

Total score of motivation has increased from pre-test to post-test (M=37.24) compare with (M=41.47); *T(df=37)= -7.41, p=.00, p<.01;*

Table 4. Total score autonomy - relatedness – competence

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	ARC_tot_T1 - ARC_tot_T2	-7.737	5.336	.866	-9.491	-5.983	-8.939	37	.000

Also total score at autonomy-relatedness-competence has increased from pre-test (M=56.47), to post-test (M=64.21); *T(df=37)= -8.93, p=.00, p<.01;*

Table 5. Total self-efficacy score

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Aut_tot_T1 - Aut_tot_T2	-9.105	4.567	.741	-10.606	-7.604	-12.291	37	.000

Hence, total score of self-efficacy from post test (M=38.16), to pre-test (M=47.26); *T(df=37)= -12.29, p=.00, p<.01.*

Table 6. Inter-class differences time on pretest route

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
TIME_ TRAIL1	Equal variances assumed	.802	.376	2.544	36	.015	6.150	2.417	1.247	11.053
	Equal variances not assumed			2.491	29.086	.019	6.150	2.469	1.102	11.198

Table 7. Inter-class differences time on route, post test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
TIME_ TRAIL2	Equal variances assumed	3.751	.061	-1.468	36	.151	-2.994	2.040	-7.133	1.144
	Equal variances not assumed			-1.442	30.316	.160	-2.994	2.077	-7.235	1.246

Testing athletic performance between the 2 classes, according to the results the 8th students taken on average lower on the trail (M=47.35), compared with students from 6th (M=53.50), tested at pre-test; *T(df=36)= 2.54, p=.015, p<.05;* but, we observed at post-test, that 6th students had a better average time on the trail.

Table 8. Inter-class differences in shots on goal pre-test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
THROW 1	Equal variances assumed	.299	.588	-1.595	36	.119	-.778	.488	-1.767	.211
	Equal variances not assumed			-1.593	35.417	.120	-.778	.488	-1.768	.213

Also a higher score for shots on goal (M=5.35), compared to their peers in grade 6th (M=4.33); *T(df=36)= -4.35, p=.00, p<.01.*

Table 9. Differences in shots on goal

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
THROW 1	Equal variances assumed	1.631	.210	2.704	36	.010	1.249	.462	.312	2.186
	Equal variances not assumed			2.665	32.080	.012	1.249	.469	.295	2.204

Due to some variables that we did not test, not being the purpose of our study, we found that male students on average score higher in shots on goal (M=3.19), compare to female students (M=1.94); *T(df=36)=2.70, p=0.010, p<.05.*

DISCUSSION

Following the results obtained, we can generate the following discussions in relation to the literature. Testing the hypotheses 1.1 şi 1.2 shows that students improved their motor skills as a result of participating in the intervention. Students motor skills are directly associated with their participation in physical education lessons or movement activities (Okely, 2001). If childrens will practice motor activities will contribute to their physical and motor development (Chen W. H.-B., 2017). Motor skills were improved in the introductory part of the lesson, so the curriculum did not suffer. The characteristic of the introductory part have been kept, adding elements from sports games. Exercise programs in physical education can provide positive developments in motor and technical skills (Kahraman, 2023).

Testing the hypotheses 2.1, 2.2 we found that the total variable score improved post intervention. Perceptions of competence, autonomy and relatedness, self-determined motivation, enjoyment and physical activity in physical education directly or indirectly predict free-time physical activity (Cox A. E., 2008). Variables may improve as a result of introducing elements of sports games into the lesson, their playfulness may influence students' willingness to actively participate in the lesson.

Then we measured the differences in motor level between the two classes, obtaining better pre-test values for the 8th students. They completed the trail in an average of 47.35 seconds compared to 53.50 for the 6th graders. But at post-test , students in grade 8 showed very little improvement in their results (45.05), compared to the significant improvement of 6th graders (42.06). This again supports the hypothesis that students' motor skill levels are directly associated with their participation in physical education lessons or movement activities (Okely, 2001).

The last hypothesis tested supports the fact that male students have a higher level of motor skills than female students, scoring an average of 3.19 points when shooting at the goal, compared to girls who scored an average of 1.94. These results are in line with Moreno-Briseño (2010) which investigating the level of motor skills by gender, specifically throwing accuracy.

CONCLUSION

The playfulness of the physical education lesson can significantly influence the active participation of students in the physical education lesson. According to the results, we can observe that the scores of the tested variables measuring students involvement and motivation in the physical education lesson improved after the intervention. Motor skills as measured by time on the trail and the number of cumulative points in shots on goal also improved. This shows a correlation between student engagement and student performance in the sample on which the intervention was applied. Also the motor ability of the 6th students exceeded that of the 8th graders in post-intervention. From this we can conclude either that the 6th grade students have a higher motor capacity than the 8th grade students, or that the programme we implemented is better suited to the 6th grade students than to the 8th grade students, or that we did not rationalize and standardize the exercises correctly for the 8th grade students.

Study limitations

Our study has a number of limitations including:a study design with low research conclusiveness as we have no control group. Also fragmentation of the intervention program on the part of some of the students involved in the study due to health or personal reasons. We could not subject students to an adaptive program for our intervention, so the statistically significant effects may be due to some extent to the learning effect, not entirely to the quality of the intervention.

According to the results, the higher grade students score better on the pre-test, but the values equalize at the post-test. This shows the lack of correct rationalization and standardization of the exercises at the 8th grade level, which is a limitation of the study.

Future research directions

According to the results obtained by testing the first two hypotheses, we can observe that there is a correlation between the time on the course and the number of points for shots on goal. These two variables are related to the improvement of motor skills, the other variable being the time to implement the intervention. A future research direction could be to what extent, but also up to what level, the number of hours of physical education correlates with motor skill improvement. It is well known that from the stage of consolidation of motor skills, one lesson per week is no longer sufficient to progress to mastery stage.

Also a future direction of research could be the problem reported at the pre-test level between classes, i.e. older students score better, but at the post-test the results are reversed. Is this due to a rationalization, standardization of the exercises not adapted to the potential of the class or due to other variables?

REFERENCES

Alderman, B. L., Benham-Deal, T., Beighle, A., Erwin, H. E., & Olson, R. L. (2012). Physical education's contribution to daily physical activity among middle school youth. *Pediatric exercise science*, *24*(4), 634-648. doi: 10.1123/pes.24.4.634. PMID: 23196768.

Barnett, L. M., Van Beurden, E., Morgan, P. J., Brooks, L. O., & Beard, J. R. (2009). Childhood motor skill proficiency as a predictor of adolescent physical activity. *Journal of adolescent health*, *44*(3), 252-259. doi: 10.1016/j.jadohealth.2008.07.004. PMID: 19237111.

Bassett, D. R., Fitzhugh, E. C., Heath, G. W., Erwin, P. C., Frederick, G. M., Wolff, D. L., ... & Stout, A. B. (2013). Estimated energy expenditures for school-based policies and active living. *American journal of preventive medicine*, *44*(2), 108-113. doi: 10.1016/j.amepre.2012.10.017. PMID: 23332325.

Bompa TO. *Teoria şi metodologia antrenamentului - Periodizarea.* 2001; Bucureşti: Tana.

Burns, R. D., Fu, Y., & Podlog, L. W. (2017). School-based physical activity interventions and physical activity enjoyment: A meta-analysis. *Preventive medicine*, *103*, 84-90. doi: 10.1016/j.ypmed.2017.08.011. PMID: 28823682.

Chen, S., Kim, Y., & Gao, Z. (2014). The contributing role of physical education in youth's daily physical activity and sedentary behavior. *BMC public health*, *14*, 1-7 doi: 10.1186/1471-2458-14-110. PMID: 24495714.

Chen, W., Hammond-Bennett, A., & Hypnar, A. (2017). Examination of motor skill competency in students: evidence-based physical education curriculum. *BMC Public Health*, *17*, 1-8 doi: 10.1186/s12889-017-4105-2. PMID: 28228116.

Chen, W., Zhu, W., Mason, S., Hammond-Bennett, A., & Colombo-Dougovito, A. (2016). Effectiveness of quality physical education in improving students' manipulative skill competency. *Journal of sport and health science*, *5*(2), 231-238 doi: 10.1016/j.jshs.2015.04.005. PMID: 30356505.

Cox, A., Duncheon, N., & McDavid, L. (2009). Peers and teachers as sources of relatedness perceptions, motivation, and affective responses in physical education. *Research quarterly for exercise and sport*, *80*(4), 765-773. doi: 10.1080/02701367.2009.10599618. PMID: 20025118.

Cox, A. E., Smith, A. L., & Williams, L. (2008). Change in physical education motivation and physical activity behavior during middle school. *Journal of adolescent health*, *43*(5), 506-513.. doi: 10.1016/j.jadohealth.2008.04.020 PMID: 18848680.

Dragnea A, Bota A, Stănescu M, Teodorescu S, Şerbănoiu S, Tudor V. *Educaţie fizică şi sport - Teorie şi metodică.* 2006; Bucureşti: FEST.

Fausto G. *Warm-ups: Essential aspects and scientific findings. 2021;* Londra: Soccer Tutor.

Fisher, A. B. I. G. A. I. L., Reilly, J. J., Kelly, L. A., Montgomery, C. O. L. E. T. T. E., Williamson, A. V. R. I. L., Paton, J. Y., & Grant, S. T. A. N. (2005). Fundamental movement skills and habitual physical activity in young children. *Medicine & Science in Sports & Exercise*, *37*(4), 684-688. DOI: 10.1249/01.mss.0000159138.48107.7d. PMID: 15809570.

Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2020). Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1· 6 million participants. *The lancet child & adolescent health*, *4*(1), 23-35. doi: 10.1016/S2352-4642(19)30323-2. PMID: 31761562.

How, Y. M., Whipp, P., Dimmock, J., & Jackson, B. (2013). The effects of choice on autonomous motivation, perceived autonomy support, and physical activity levels in high school physical education. *Journal of teaching in physical education*, *32*(2), 131-148. doi.org/10.1123/jtpe.32.2.131

Kahraman, M. Z., İşlen, T., Bilici, Ö. F., Sari, C., & Bilici, M. F. (2023). The effect of different warm-up protocols on the motor and technical skills of handball players in sports education. *Journal of Educational Issues*, *9*(1), 336-348. doi:10.5296/jei.v9i1.20719.

Lander, N., Eather, N., Morgan, P. J., Salmon, J., & Barnett, L. M. (2017). Characteristics of teacher training in school-based physical education interventions to improve fundamental movement skills and/or physical activity: A systematic review. *Sports medicine*, *47*, 135-161. DOI: 10.1007/s40279-016-0561-6. PMID: 27294354.

Sulz, L., Temple, V., & Gibbons, S. (2016). Measuring student motivation in high school physical education: Development and validation of two self-report questionnaires. *Physical Educator*, *73*(3), 530. DOI:10.18666/TPE-2016-V73-I3-6370.

Lubans, D. R., Morgan, P. J., Cliff, D. P., Barnett, L. M., & Okely, A. D. (2010). Fundamental movement skills in children and adolescents: review of associated health benefits. *Sports medicine*, *40*, 1019-1035. DOI: 10.2165/11536850-000000000-00000. PMID: 21058749.

Moreno-Briseño, P., Díaz, R., Campos-Romo, A., & Fernandez-Ruiz, J. (2010). Sex-related differences in motor learning and performance. *Behavioral and brain functions*, *6*, 1-4. doi: 10.1186/1744-9081-6-74. PMID: 21182785.

Okely, A. D., Booth, M. L., & Patterson, J. W. (2001). Relationship of physical activity to fundamental movement skills among adolescents. *Medicine and science in sports and exercise*, *33*(11), 1899-1904. DOI: 10.1097/00005768-200111000-00015. PMID: 11689741.

Schwarzer, R., & Jerusalem, M. (1995). Generalized self-efficacy scale. *J. Weinman, S. Wright, & M. Johnston, Measures in health psychology: A user's portfolio. Causal and control beliefs*, *35*(37), 82-003.

Shen, B., Li, W., Sun, H., & Rukavina, P. B. (2010). The influence of inadequate teacher-to-student social support on amotivation of physical education students. *Journal of teaching in physical education*, *29*(4), 417-432. doi: 10.1123/jtpe.29.4.417.

Standage, M., Duda, J. L., & Ntoumanis, N. (2003). A model of contextual motivation in physical education: Using constructs from self-determination and achievement goal theories to predict physical activity intentions. *Journal of educational psychology*, *95*(1), 97. DOI: 10.1037/0022-0663.95.1.97.

Trigueros, R., Mínguez, L. A., González-Bernal, J. J., Jahouh, M., Soto-Camara, R., & Aguilar-Parra, J. M. (2019). Influence of teaching style on physical education adolescents' motivation and health-related lifestyle. *Nutrients*, *11*(11), 2594. DOI: 10.3390/nu11112594. PMID: 31671742.

Zhang, T. (2009). Relations among School Students' Self-Determined Motivation Perceived Enjoyment, Effort, and Physical Activity Behaviors. *Perceptual and Motor Skills*, *109*(3), 783-790. DOI: 10.2466/pms.109.3.783-790. PMID: 20178278.

STUDIA UBB EDUCATIO ARTIS GYMN., LXX, 1, 2025, pp. 47-55
(RECOMMENDED CITATION)
DOI:10.24193/subbeag.70(1).04

Analysis of Diabetic Footballers Blood Sugar Levels

János TÓTH Jr.[1*], Ádám SZÁNTAI-KIS[1]

Article history: Received 2025 January 04; Revised 2025 March 18; Accepted 2025 March 21; Available online 2025.03.30; Available print 2025.05.30

ABSTRACT. Diabetes is one of the fastest growing diseases of our time. (Bakó, 2022) Nowadays 64 million people are diagnosed with diabetes and this number is rising with high tendency. (WHO, 2024) Furthermore lots of people do not know about their diabetes, so this number is not the exact one, it is a lot higher. In Hungary 1,2 million people were diagnosed with diabetes and a bit more of 39.000 people got type one diabetes. (Hungarian Government, 2024) We know about some methods to keep these people healthy and one of them is to do some exercise but also must pay attention to eat healthy and the most important one is the insulin supplement. Luckily, we got some tools like Continuous Glucose Monitoring sensors (CGM), insulin pumps which help us to control diabetes easier. Football has many effects on blood sugar levels. In our research we investigate these. The effects of a training session or a match on the blood sugar levels. Our hypotheses are to watch the differences of training sessions and matches, and the athletes thinking of their performance, in particular their impact of diabetes. From our three hypotheses only one was true, but I have to mention that our population was only ten people, therefore, if we got a chance to examine a bigger population maybe we would have got different results. Because of the rise of this disease in the future we can work with a lot more diabetic athletes in this sport like Nacho Fernandez, former Real Madrid defender (Somfai, 2018). This research can be useful for many coaches and also can help to prepare to work with diabetic players.

Keywords: *football, diabetes, health*

[1] Hungarian University of Sports Science, Football Section, Budapest, Hungary
[*] Corresponding author: toth.janos@tf.hu

INTRODUCTION

Type 1 Diabetes is an irreversible disease, when the immune system mistakenly treats the beta cells in the pancreas which create the insulin as a foreign invader and destroys them. If enough beta cells are destroyed the pancreas cannot make insulin which can cause hyperglycaemia which means high blood sugar level. Insulin is a hormone that helps blood glucose enter your body as cells and then it is used as energy. When your organism has not got enough insulin you have to enter your body outwardly. The most common solution for that is insulin pen injections, but lots of people use insulin pumps. If your diabetes does not manage well you can notice many symptoms just name of few: Urinating often and because of that you can feel very thirsty. Feeling very hungry, even if you ate well. And fatigue these are the most common ones, but these are not total (Vörös and Mészárosné, 2023). Fatigue is a common symptom in diabetes, when the organism has not got enough insulin it is not available to create energy for itself (Øystein et al., 2017).

We must know the three main factors that are key to managing the blood sugar level and the diabetes well. Start with the insulin supplement which is the main factor of the three. As I mentioned before, if the organism can create it we need to gain in another way, outwardly. Nowadays we know lots of different types of insulins like quickly absorbed, slowly absorbed and mixed absorbed. Patients are choosing the most optimal ones for themselves with their diabetologist (Szakszon, Kis, Shenker-Horváth and Martos, 2022). This depends on their lifestyles and routines usually. Insulin is needed when we have a main meal or higher blood sugar level as the optimal one to avoid hyperglycaemia which leads to feeling sick. Insulin pumps are a small wearable medical device which can supply a continuous flow of insulin underneath the skin. In the past they can cause uncomfortable feelings because of their size, but nowadays these are not bigger than a deck of cards. Insulin pumps have many advantages like we can avoid a lot more thrust, if the patients are on the insulin pen injections therapy they have to thrust themselves at least 3-4 times a day.

Continuous Glucose Monitoring sensors can report the blood sugar level in every five minutes. We can synchronise with our smart devices, and we can check how our blood sugar level changes. We can get notifications about when the blood sugar level is rising fast and also when it is falling. Therefore, we can react fast to these changes, and we can keep the blood sugar level in optimal range. Finally, we can also synchronise these sensors with insulin pumps too, so we can change the doses of the insulin when it is needed (Mezővári, Martos, 2023).

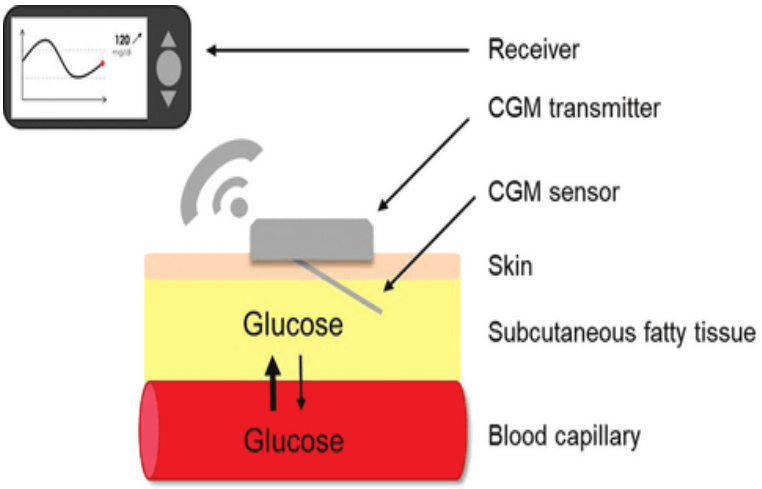


Figure 1. CGM sensor (Randy, 2022)

Secondly, nutrition is really important in the life of athletes, but as a diabetic athlete you have to pay more attention to that. Diabetic athlete's nutrition is almost the same as a normal athlete, but they have to note three main factors of their meals. First, the carbohydrates value of their meal. The daily calorie requirement can be 3000 kcal for an athlete, this can be a huge challenge for a diabetic athlete organism. Suggested to take daily 4-5 meals a day with lower carbohydrate intake to avoid high blood sugar level. Secondly, the time of the meal. This is very important because of the absorption of the carbohydrates. If we eat very close to the training session or the match, we can easily reach a higher blood sugar level than the optimal one, which can influence the performance of the athletes. Finally, the glycaemic index (GI) of the meals and foods. The glycaemic index shows how fast we can absorb the food that we eat (Kusztor, Martos, 2024). When the patient has low blood sugar, he suggests eating high GI foods to raise the flood sugar level. In normal cases they eat normal GI foods to hold their blood sugar level in optimal range. Daily water intake requirement is nearly 2-2,5 litres for a normal person, but for a footballer easily can reach above 3 litres. It also depends on the person's height, weight and of course the daily load intensity (Egy Csepp Figyelem Foundation team, 2022). If a diabetic person dehydrates, their blood is dense which raises their blood sugar level. They have to be hydrated to avoid that (Bibok, 2022).

Finally, physical activity which can improve insulin sensitivity. First of all, the blood sugar level check before starting the activity is mandatory, because if we start the activity with a blood sugar level which is outside of the optimal range, we can easily get hypoglycemia or hypoglycaemia (Beyond Type 1, 2016).

If a diabetic athlete starts activity with blood sugar level which is above 13 mmol/l it can raise their value much higher. The solution is to take bolus insulin before the activity (Szakszon, Kis, Shenker-Horváth, Martos, 2022). This is needed to avoid the following symptoms like feeling thirsty or frequent urination (American Diabetes Association, 2024). On the other hand, if a blood sugar level is below 5 mmol/l the value can be falling down and it can cause hypoglycemia (Matthew et al., 2015). The solution is to take 20-30 grams of high GI carbohydrates before the start of the activity (Suszter, Shenker-Horváth, 2022). We differentiate two types of form of movement. Aerobe and anaerobe activity. The aerobe one can reduce the blood sugar level and the anaerobe do the opposite it is raise the blood sugar level (Szakszon, Kis, Shenker-Horváth, Martos, 2022). Fitness level is an important factor because a small intensity run can be also an anaerobic activity for someone on the other hand someone can sprint for a long time (Sheri, 2023). For a diabetic athlete the mixed form of those movements are the optimal one which is the football too.

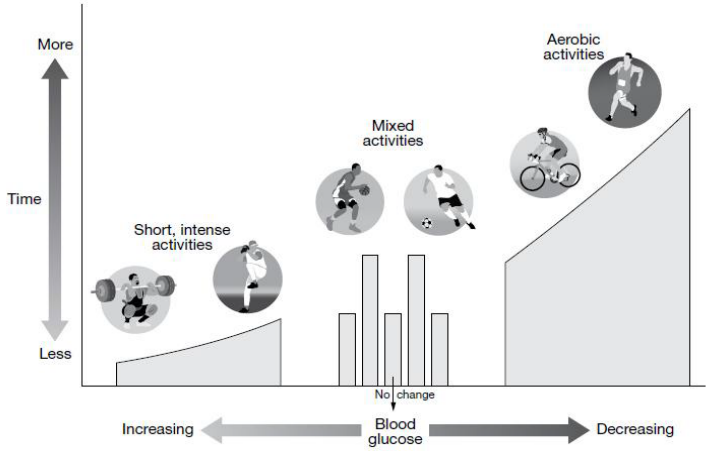


Figure 2. Effects of forms of exercise on blood sugar levels (Sheri, 2020)

HYPOTHESES

In the course of our work, we formulated three hypotheses:

1. We hypothesized that the blood sugar level fluctuated more on the matches than the training sessions.

2. We assumed that blood sugar levels are lower after the training sessions and matches than before in a larger proportion.

3. We assume that the blood sugar level did not influence their playing time on a smaller proportion based on the diabetic player's opinions.

METHOD

First, we made a Google Forms survey which contains an ethical approval from the players and questions about players' routines of their diabetes like are you checking your blood sugar level before/during/after the training session/match? Also, some simple information about them like, how old are you? Or which is your position on the pitch? The players attached their daily CGM reports of their training sessions and matches too. Based on this we can analyse the differences of the blood sugar levels. Our research is really circumscribed, that is the reason for the number of answers. We got 10 answers, which means 20 daily CGM reports, 10 from the training sessions and also 10 from the matches. The average age of our population is 20-22 years old. Most of them are playing in the Hungarian amateur leagues, but one of them is in the Hungarian third division. Firstly, we checked the hypotheses with the Shapiro-Wilk normality test, after that we used Wilcoxon test, paired samples T-test and Chi-square test to decide the validity of hypotheses. For the tests we used the Jamovi programme.

RESULTS

The first hypothesis where we investigate the blood sugar level differences between the training sessions and matches, we assumed that we can find bigger fluctuations on the matches than the training sessions. Only one hormone can reduce the blood sugar level which is the insulin every other one raising the blood sugar level. Football matches can increase the adrenalin level and the stress level too. After the analysis of daily reports of the matches we find 4 times of the 10 when the difference was higher than the training. In our population we have 2 goalkeepers who can influence the result. Goalkeepers easily can get bigger loads at the training sessions than the matches. After the normality test *W(10) = [0.884] p = [0.146]*, we checked the hypothesis with the Wilcoxon test. Because of the result W =31, p =0.652 we have to reject our hypothesis. Nevertheless, this is not evidence totally. In a bigger population we can get other results. The time of the training sessions and matches can influence the research and also we have not got information about the size of the meal from the players.

Paired Samples T-test					
			Statistic	**df**	**p**
Training fluctuation	Match fluctuation	Student's t	-0.139 t	9.00	0.446
		Wilcoxon W	31.0		0.652
Normality test (Shapiro-Wilk)					
				w	**p**
Training fluctuation-		Match fluctuation		0.884	0.146

Figure 3. Results of the first hypothesis

In the second hypothesis, we assumed that the players got big loads of work at the matches and the training sessions, which leads to lower blood sugar levels after the sessions than the start. In this case we also have many factors which can influence the result. Time of the sessions, time of the meals and also their sizes and glycemic indexes and finally the loads of insulins and the intensity of the sessions.

In the case of the training sessions, we found 4 times when the blood sugar level was lower at the end than the start out of 10. As we mentioned before, the training intensity is a key factor and maybe these training sessions were less intense. On the other hand, in the case of matches we find 7 times of the 10 when the blood sugar level was lower than the start. After the normality test *W(9) = [0.942] p = [0.0.17]* we checked the hypothesis with paired samples T-test *(t([9.00]) = -0.563 ([2-tailed]) [-0.178]* we have to reject our hypothesis.

Paired Samples T-Test					
			statistic	**df**	**p**
Before training	**after training**	studen's t	-0.563	9	0.707
Before match	**after match**	studen's t	1.522	9	0.081
Notmality Test (Shapiro-Wilk)					
				w	**p**
Before training-		**after training**		0.942	0.570
Before match-		**after match**		0.807	0.017

Figure 4. Results of the second hypothesis

In our final hypothesis, we assumed that the blood sugar level did not influence the athletes' play times on their matches based on their own opinions. We think diabetes is not a factor which can reduce the player's time on the pitch. The average play time is 88,1 % in our population, but in the survey, we got 5 yes and 5 no answers.

Do you think your blood sugar level has affected your time on the pitch?		
10 Answers		
Yes	5	
No	5	

Figure 5. Results of the Google survey

After the normality test, *W(10) = [0.655] p = [0.01],* we checked our hypothesis with Chi-square test, *Pearson x2 (5, (N=10)=5.20, p = 0.392 2-tailed 0.721)* because of that we accepted our hypothesis. We really think diabetes is not an obstacle to playing football or any other sport on any level. Nacho Fernandez is a role model who played over 300 games at Real Madrid and won many trophies like Champions League and European Championship as a captain.

Independent Samples T-Test				
		statistic	df	p
Play time in %	student's t	02.jan	8	0.335
Assumptions				
Normality Test (Shapiro-Wilk)	W		p	
Play time in %	0.900		0.219	

Figure 6. Normality test of the third hypothesis

Contingency Tables			
Play time in %	2 (yes)	1 (no)	Total
50.0	0	1	1
66.0	0	1	1
75.0	1	0	1
88.1	1	0	1
90.0	0	1	1
100.0	3	2	5
Total	5	5	10

Contingency Tables			
x^2 tests			
	Value	df	p
x2	5.20	5	0.392
N	10		
Nominal			
	Value		
Phi-coefficient	NaN		
Cramer's V	0.721		

Figure 7. Result of the third hypothesis

CONCLUSIONS

In our research we checked 3 hypotheses, but we can accept only one which shows diabetes is not holding back anyone to play football. The other two results are not a totally sure statement because our population was not as big to manage this as evidence. We need more people and a modified survey to reduce our limitations. In the future we are looking to do this research with a bigger population and investigate some other factors too.

REFERENCES

Beyond Type 1 Editorial Team (2016). T1D Exercise basics. https://beyondtype1.org/t1d-workout-basics/

Bakó, B. (2022). A cukorbetegség elnevezése, osztályozása, https://diabetes.hu/cikkek/diabetes/2201/a-cukorbetegseg-elnevezese-osztalyozasa

Bibok, Gy. (2022). Az extrém fáradtság a cukorbetegség egyik tünete is lehet, 2022.07.11. 15:41

Campbell, M. D., Walker, M., Bracken, R. M., Turner, D., Stevenson, E. J., Gonzalez, J. T., Shaw, J. A., West, D. J. (2015). Insulin therapy and dietary adjustments to normalize glycemia and prevent nocturnal hypoglycemia after evening exercise in type 1 diabetes: A randomized controlled trial. *BMJ Open Diabetes Research Care, 3*(1), e000085. doi: 10.1136/bmjdrc-2015-00008

Egy Csepp Figyelem Alapítvány csapata (2022). Sport és diabétesz: Hogyan hat a dehidratáltság a vércukorszintre? *Magyar Edzők* - 2022/1. Special issue 34. page. https://lib.tf.hu:443/liberty/OpacLogin?mode=BASIC&openDetail=true&corporation=HU_TF&action=search&queryTerm=uuid%3D%2291f4ab50c106d61e3284075c000a5c98%22&operator=OR&url=%2Fopac%2Fsearch.do

Kusztor, P. S., Martos, É. (2014). *Táplálkozás és élsport 1-es típusú cukorbetegként*.[pdf] Hungarian University of Sports Science

Magyarország Kormánya (2024). Elkezdődött a Nemzeti Diabétesz Stratégia kidolgozása, https://kormany.hu/hirek/elkezdodott-a-nemzeti-diabetesz-strategia-kidolgozasa

Mezővári, K., Martos, É. (2023). *Folyamatos glükózmonitorozás szerepe a sportban*.[pdf] Hungarian University of Sports Science

Randy, F. (2022). What's new in glucose sensing? Design World 2022 October 24 .[pdf]

Sheri, C. (2023). How to prevent lows during exercise with exercise itself. https://beyondtype1.org/sheri-colberg-prevent-lows/

Sheri, C. (2020). The Athlete's Guide to Diabetes

Somfai, K. (2024). Real Madrid-játékos 1-es típusú diabétesszel. https://diabetes.hu/junior/2018/cikkek/real-madrid-jatekos-1-es-tipusu-diabetesszel

Szakszon, F., Kis, V., Shenker-Horváth, K., Martos, É. (2022). Sport és diabétesz: A fizikai aktivitás és az étrend sajátosságai az 1-es típusú diabétesz kezelésében. *Magyar Edzők* 1./2022, 35-37 pages.

Vörös, A., Mészárosné, S. L. (2023). *1-es típusú diabéteszes gyermekek sportja*. [pdf] Hungarian University of Sports Science

World Health Organization (2024). Diabetes. https://www.who.int/europe/news-room/fact-sheets/item/diabetes

Øystein, J., Tomm, B., Lars-Petter, Jelsness-J. (2017). Fatigue in type 1 diabetes: A systematic review of Observational studies. https://www.diabetesresearchclinicalpractice.com/article/S0168-8227(16)30363-1/abstract.

STUDIA UBB EDUCATIO ARTIS GYMN., LXX, 1, 2025, pp. 57-62
(RECOMMENDED CITATION)
DOI:10.24193/subbeag.70(1).05

Integrating Technology into Physical Education Curricula: A Framework for Enhancing Student Engagement

Emmanuel DUMBUYA[1]

Article history: Received 2025 February 01; Revised 2025 March 19; Accepted 2025 March 20; Available online 2025.03.30; Available print 2025.05.30

ABSTRACT. This paper explores the integration of technology into Physical Education (PE) curricula, focusing on how digital tools and mobile applications can enhance student engagement and improve learning outcomes. A framework is proposed for incorporating these technologies effectively into both in-class activities and out-of-class learning experiences. Through a mixed-methods research approach, this study investigates the potential of digital tools in transforming PE education, the barriers to successful integration, and the pedagogical benefits of using such technologies. The findings offer practical recommendations for educators and policymakers aiming to modernize physical education programs.

***Keywords**: Technology Integration, Physical Education, Digital Learning, Student Engagement, Curriculum Innovation, Inclusive Education*

INTRODUCTION

In the evolving landscape of education, integrating technology into curricula is becoming essential for improving student engagement and achievement. The field of physical education (PE), traditionally characterized by face-to-face and hands-on learning, is no exception. Advances in technology, particularly digital tools and mobile apps, have the potential to revolutionize the way physical

[1] Njala University, Sierra Leone, West Africa
* Corresponding author: emmanueldumbuya1@gmail.com

education is taught and experienced. As digital technologies become ubiquitous in students' daily lives, leveraging these tools in PE can bridge the gap between traditional physical activity and modern learning styles (Tønnessen et al., 2020). This paper presents a framework for integrating technology into PE curricula to enhance student engagement, skill development, and inclusive learning practices.

LITERATURE REVIEW

Technology integration in PE education has been a topic of growing interest over the last decade. Research indicates that digital tools such as fitness tracking apps, virtual reality (VR), and interactive learning platforms can significantly impact student motivation, participation, and skill acquisition in PE (Wang & Chen, 2018). A study by McNamara et al. (2019) found that incorporating wearable technology, such as heart rate monitors and pedometers, in PE lessons promoted self-regulation and awareness of personal fitness among students.

Moreover, the use of mobile applications has been linked to increased student engagement. According to research by Chan et al. (2017), apps that allow students to track their physical activity and set personal goals have shown positive results in fostering autonomy and enhancing students' intrinsic motivation. Furthermore, VR has the potential to immerse students in simulated physical environments, offering a new way to experience sports and exercise remotely (Jiang et al., 2020).

Despite these promising developments, challenges remain. Many schools still face barriers such as limited access to technology, inadequate teacher training, and resistance to change (Bauer & Varga, 2018). Therefore, it is crucial to develop strategies that support the effective and sustainable integration of technology in PE curricula.

TECHNOLOGY IN PHYSICAL EDUCATION: KEY TOOLS AND APPLICATIONS

This section highlights the key digital tools and applications that can be incorporated into PE curricula to enhance student engagement:

1. Wearable Technology

Wearable devices such as fitness trackers, heart rate monitors, and smartwatches provide real-time data on students' physical performance. These devices not only offer students the opportunity to track their progress but also

help teachers monitor student engagement and performance in various activities. For instance, heart rate monitors allow PE teachers to assess the intensity of exercises and adjust the curriculum accordingly to ensure all students are working within their optimal physical zones (Pate et al., 2020).

2. Mobile Apps for Physical Activity Tracking

Apps such as Strava, Nike Training Club, and MyFitnessPal are commonly used in PE settings to encourage students to track their workouts, set fitness goals, and engage in friendly competition. These apps offer personalized feedback, which can motivate students to improve their performance. Research by Benassi (2019) suggests that students who use fitness apps are more likely to engage in physical activity outside of school, thereby extending the learning experience beyond the classroom.

3. Virtual Reality (VR)

Virtual Reality offers immersive experiences that can simulate various physical activities, sports, or even fitness challenges that students may not have access to in real life. VR can be used to teach complex movements or techniques, such as gymnastics or swimming, in a controlled virtual environment, where students can practice repeatedly without fear of injury. A study by Flanagan et al. (2021) demonstrated the effectiveness of VR in improving students' technical skills in sports by providing instant feedback and enabling them to perform at their own pace.

BENEFITS OF TECHNOLOGY INTEGRATION IN PHYSICAL EDUCATION

1. Enhanced Student Engagement

Integrating technology into PE lessons increases student engagement by offering interactive, personalized, and dynamic learning experiences. According to studies by Dunston et al. (2019), technology creates more engaging and interactive lessons, which help keep students motivated and excited about participating in physical activities. Technology also allows students to see the immediate results of their efforts, which can boost their self-esteem and intrinsic motivation.

2. Promotion of Inclusivity

Technology can support inclusivity by providing students with different learning styles and abilities equal opportunities to engage with the material. Adaptive technologies, such as speech recognition and interactive games, allow

students with physical disabilities or learning difficulties to participate fully in PE activities (Anderson et al., 2020). This inclusivity fosters a more equitable learning environment and ensures that all students can benefit from the curriculum.

3. Data-Driven Feedback and Personalized Learning

The use of wearable devices and mobile apps provides instant feedback on student performance, which helps students track their progress toward their physical fitness goals. This data-driven approach encourages a growth mindset and helps students set achievable targets (Mertler, 2017). Teachers can also use this data to tailor their lessons to meet individual needs, ensuring that every student is working at the appropriate level of difficulty.

CHALLENGES TO INTEGRATION

Despite the benefits, the integration of technology in PE education faces several challenges. These include:

1. **Limited Access to Technology**: Many schools, particularly those in underfunded districts, lack the necessary infrastructure and resources to implement technology-based PE programs (Bauer & Varga, 2018).
2. **Teacher Training**: Teachers may lack the knowledge and skills required to effectively integrate technology into their teaching. Professional development programs are needed to train PE educators on how to use these tools in their classrooms (Li et al., 2020).
3. **Resistance to Change**: Some educators may be hesitant to adopt new technologies due to fear of failure or unfamiliarity with digital tools (Robinson et al., 2019).

FRAMEWORK FOR INTEGRATING TECHNOLOGY INTO PHYSICAL EDUCATION CURRICULA

To overcome these challenges, this paper proposes the following framework for integrating technology into PE curricula:

1. **Assessment of Technology Readiness**: Schools must first assess their technological infrastructure and ensure that adequate devices, internet connectivity, and support systems are in place.
2. **Teacher Professional Development**: PE teachers should receive ongoing professional development that focuses on using technology in the classroom effectively.

3. **Student-Centered Approach**: Technology should be used to enhance, not replace, traditional PE teaching methods. The focus should be on creating engaging, interactive, and personalized learning experiences that meet the needs of all students.

4. **Collaboration and Support**: Schools should collaborate with technology providers, local governments, and educational institutions to secure funding and technical support.

CONCLUSION

The integration of technology into Physical Education curricula has the potential to significantly enhance student engagement, promote inclusivity, and improve learning outcomes. By adopting a strategic approach to integrating digital tools such as wearable technology, mobile apps, and virtual reality, educators can create more dynamic, engaging, and personalized PE programs. However, overcoming challenges such as limited access to technology, teacher training, and resistance to change is essential to ensure the successful implementation of these innovations.

REFERENCES

Anderson, L., Tuttle, C., & Ryan, R. (2020). Adaptive technologies in physical education: Ensuring inclusivity for all students. *Journal of Inclusive Education*, *25*(3), 54-70.

Benassi, L. (2019). The role of fitness apps in promoting physical activity among students. *Journal of Digital Learning in Education*, *12*(4), 83-97.

Bauer, S., & Varga, A. (2018). Barriers to technology integration in physical education: A case study approach. *International Journal of Educational Technology*, *21*(5), 37-49.

Chan, K., Lee, S., & Yip, D. (2017). The effectiveness of mobile apps in promoting student engagement in physical education. *Journal of Sports Education*, *32*(2), 105-112.

Dunston, L., Taylor, S., & Moore, P. (2019). Enhancing student engagement in physical education through technology. *Journal of Physical Education and Sport Science*, *29*(1), 55-62.

Flanagan, S., Pierce, J., & Thomas, D. (2021). Virtual reality in physical education: A tool for skill development. *Journal of Virtual Learning in Education*, *10*(2), 45-59.

Jiang, Z., Wang, F., & Zhao, M. (2020). The future of virtual reality in physical education: Opportunities and challenges. *Journal of Physical Education Research*, *18*(3), 220-235.

Li, X., Zhang, Y., & Liu, L. (2020). Teacher professional development for integrating technology into physical education. *Journal of Teacher Education*, *42*(1), 78-85.

Mertler, C. (2017). Data-driven instruction in physical education: Using technology for feedback. *International Journal of Physical Education and Sports Science*, *8*(4), 92-101.

McNamara, J., Ellis, A., & Clarke, R. (2019). The impact of wearable technology on student learning outcomes in physical education. *Journal of Educational Technology in Sports*, *15*(2), 103-116.

Pate, R., Davis, M., & Smith, K. (2020). Wearable technology in physical education: A review of research and practice. *Journal of Physical Education Technology*, *11*(1), 33-45.

Robinson, K., Adams, L., & Taylor, G. (2019). Overcoming resistance to technology in the classroom: A teacher's perspective. *Journal of Educational Change*, *28*(6), 122-138.

Tønnessen, E., Nilsen, T., & Eilertsen, S. (2020). Technology in physical education: A systematic review of its impact on student engagement and performance. *Journal of Technology in Education*, *30*(4), 87-102.

Wang, Y., & Chen, G. (2018). Digital tools for physical education: Enhancing teaching and learning. *Journal of Physical Education and Technology Integration*, *25*(3), 56-71.

STUDIA UBB EDUCATIO ARTIS GYMN., LXX, 1, 2025, pp. 63-79
(RECOMMENDED CITATION)
DOI:10.24193/subbeag.70(1).06

Assessing Nutritional Balance and Its Influence on Physical Activity and Performance Among University Sports Students

Hocine ASLI[1,*], Adel BELKADI[2,3], Nouria BENNAMA[2], Bendhiba DJOURDEM[2]

Article history: Received 2025 March 05; Revised 2025 April 12; Accepted 2025 April 22; Available online 2025.03.30; Available print 2025.05.30

ABSTRACT. Purpose: This study analyzes the nutritional balance both quantitative and qualitative of meals provided at university dining halls in Oran and explores how this balance relates to the physical activity levels of students at the Institute of Physical Education and Sports. **Method:** The research involved 134 male students (ages 18-25 years, body weight: 71.84±4.55 kg, height: 174.66±8.52 cm) living in university dormitories "S2," "S5," and "S1." Food portions were measured, and students' energy expenditure from physical activity was calculated, following energy value standards set by Gandy, Madden, and Holdsworth (2012). **Results:** The students' average daily energy intake was 2729.93 kcal, while their energy expenditure from physical activity averaged 3277.66 kcal. According to Joan Webster's 2020 guidelines, the recommended energy intake is 3521.6 kcal. The study revealed that energy intake was below recommended levels and energy expenditure was higher, suggesting a need for dietary adjustments to meet energy requirements due to high physical activity levels. **Conclusion:** There is a notable gap between energy intake and expenditure, influenced by poor meal planning rather than economic constraints.

[1] Laboratory of Physical Activity and Children Sports, Mohamed Boudiaf University of Sciences and Technology, Oran, Algeria
[2] Laboratory of Applied Sciences to Human Movement, Institute of Physical Education and Sport, University of Mostaganem, Mostaganem, Algeria
[3] Training-University Research Projects (PRFU N° J00L02UN270120230001 Agreement: January 2023), 16000 Algeria
[*] Corresponding author: asli.houcine_sport@yahoo.fr

This imbalance may adversely affect physical performance and cognitive functions. A balanced diet that meets nutritional standards is crucial for optimizing both learning and physical performance.

Keywords: *Nutritional Balance, Major Nutritional Elements, University Dining Halls, Physical Activity, Student Health*

INTRODUCTION

Physical inactivity is recognized as the fourth leading risk factor for global mortality, contributing to 6% of deaths worldwide (Martín-Valero, Rodríguez-Martínez, Cantero-Tellez, Villanueva-Calvero, & Fernández-Martín, 2014; Kesari & Noel, 2024). It is estimated to be a major cause of several significant health conditions, including diabetes (27%), breast and colon cancers (21-25%), and ischemic heart disease (30%)(Kyu et al., 2016).

Physical activity involvement has been confirmed to be beneficial to human physiology because it improves oxygen retention capacity of the lungs and blood circulation, and increases lung capacity (Adel et al., 2019; Qin, Peng, & Wang, 2021). The World Health Organization (WHO) advises that adolescents and young adults engage in moderate to vigorous physical activity daily to counteract sedentary behavior (Bull et al., 2020).

The relationship between physical activity and diet and health has been studied for many years, and the results confirm that regular physical activity and a balanced diet have a direct effect on the prevention of chronic non-communicable diseases(Benchehida et al., 2021; Serrano-Gallén, Arias-Palencia, González-Víllora, Gil-López, & Solera-Martínez, 2022; Yacine et al., 2020).

The predominance of the so-called Western diet (rich in fats, sugars and refined foods, and low in complex carbohydrates and fibre) in various countries and regions of the world, and the progressive decline in the practice of physical activity, have contributed to the increase in the incidence of obesity in recent decades (Beboucha, Belkadi, Benchehida, & Bengoua, 2021; Kopp, 2019). In Algeria, malnutrition was for a long time a primary health risk factor, but in recent decades there has been a transition from deficits to excessive food consumption (Bencharif, Sersar, Touati-Mecheri, Agli, & Oulamara, 2021). In the specific case of obesity, the factors associated with this occurrence are high energy density diets and reduced energy expenditure due to a sedentary lifestyle (Bazshahi, Sheikhhossein, Amini, & Shab-Bidar, 2021; Mahmoud, 2022). Obesity itself is a determining factor in type 2 diabetes, dyslipidemias and hypertension,

as well as increasing the risk of cardiovascular diseases and certain types of cancer (Boudehri, Belkadi, Dahoune, & Atallah, 2023; Fava, Fava, & Agius, 2019). There is evidence that the earlier obesity is established, the greater the risk of obesity in adulthood (Drozdz et al., 2021; Adel Belkadi et al., 2025).

Adequate and healthy nutrition is vital for human growth, survival, and overall well-being. Food serves as fuel, supplying the energy necessary for daily activities(Chrara, Raoui, Belkadi, Hocine, & Benbernou, 2018). Nutritional requirements vary depending on individual factors such as age, activity level, and specific life stages, whether for children, athletes, adults, pregnant women, the elderly, or patients each of whom has unique dietary needs (Amawi et al., 2024).

Assessing nutritional status is essential for evaluating metabolic health and clinical nutrition. This can be achieved through various methods, including anthropometric measurements, biochemical markers, clinical evaluations, and subjective questionnaires (Taberna, Navas-Carretero, & Martinez, 2019).

Indicated that nutritional status of a community is important, as it helps to identify the nutritional level and widespread problems of malnutrition among its individuals. The World Health Organization has cited that malnutrition is the greatest threat to public health. Consequently, some organizations have begun to work with teachers, decision makers, and food service contractors to improve the nutritional content and increase food resources in school cafeterias and canteens, from elementary school to university level. It has been proven that nutrition has a close relationship with success in the educational process in general (Behrman, 1996; Senouci, Asli, Belkadi, Bouhella, & Koutchouk, 2024).

In Algeria, a recent study by Asli (Saddek, Houcine, & Hichem, 2019) evaluated the prevalence of physical activity among the adult population. The findings indicated a relatively low prevalence of leisure-time physical activity (11.0%), with only 4.3% of the population studied accumulating 30 minutes of daily physical activity on five or more days of the week (Hichem, Houcine, & Sadek, 2015).

Scientific research over the past twenty years has confirmed the importance and benefits of proper nutrition and its positive impact on athletic performance (Cherara, Belkadi, Mesaliti, & Beboucha, 2022; Obesity, 2000). There is no doubt now that what an athlete eats and drinks will affect their health, weight, body composition, and fuel sources during and after exercise, especially during sports competitions(A Belkadi & Mime, 2019; Adel Belkadi, Alia, & Mohammed, 2020; Benhammou et al., 2022). Optimal nutrition improves physical activity and athletic performance. Wyszyńska et al (2020) mentioned that nutrition plays a significant role in achieving the desired athletic achievement (Adel Belkadi et al., 2015; Berria, Bachir, Eddine, & Adel, 2018).

In our study, we will examine the dietary system in boarding schools for male students at the Institute of Physical Education and Sports residing in university dormitories "S2," "S5," and "S1." This developmental stage is marked by substantial growth changes, and a balanced diet is crucial for supporting physiological, mental, and motor development. Ferry (2010)Therefore, any imbalance in the diet (quantitative or qualitative) leads to malnutrition, whether it be excess or deficiency (O'Sullivan & Sheffrin, 2003). Melchior (2009) confirms that malnutrition is the lack of compliance of the dietary system with recommended standards, whether they are major or minor nutritional elements. *Malnutrition* refers to deficiencies or excesses in nutrient intake, imbalance of essential nutrients or impaired nutrient utilization (Morales, Montserrat-de la Paz, Leon, & Rivero-Pino, 2024), Studies have also shown that malnutrition is one of the causes of stunted growth (Millward, 2017; Budzulak, Majewska, & Kędzia, 2022; Willya Achmad Et Al., 2023; Adel Belkadi et al., 2025). Based on this context, the authors conducted an analytical study to assess the food provided in university dining facilities and its relationship with the basal metabolic rate and energy expenditure of physical activity among male students from the Institute of Physical Education and Sports residing in dormitories "S2," "S5," and "S1." The study aimed to achieve the following objectives:

- Evaluate the Nutritional Balance: Assess both the qualitative and quantitative aspects of the meals distributed to the students to determine their overall nutritional adequacy.
- Assess Energy Consumption: Compare the energy intake of the study sample with established standards from the World Research Center to identify any discrepancies.
- Compare Energy Expenditure and Intake: Analyze the relationship between the energy expended through physical activity and the energy consumed from meals on a daily basis.

MATERIALS AND METHODS

Participants

From April to June 2024, this observational, descriptive, and cross-sectional study was carried out at the Sports University in Oran, Algeria. 134 students between the ages of 18 and 25 made up the sample, who were chosen at random by the general population.

Exclusion criteria: Restrictive diet for health reasons, recovering from injury or illness, Dietary practices and level of physical activity were the main

factors, with BMI acting as the dependent variable. Gender was also considered as an adjustment variable. This study was approved by the Research Ethics Committee of sports institute of physical education and sports (IEPS: 20052024.1.003).

Anthropometric assessment

Instruments used were a flexible steel tape, 7 mm wide, and a counterweight scale with a capacity of 150 kg and an accuracy of 100 g, with a stadiometer included.

The International Physical Activity Questionnaire, short format, was used to estimate energy expenditure in physical activity.

Assessment of dietary habits

A survey was constructed based on the recommendations of the current dietary guide for the Algerian population. This consisted of two rating scales: one considered food selection and frequency of weekly consumption, and the other considered the dietary behaviours that accompanied the intakes. Eating habits were categorized as healthy, moderately healthy and unhealthy based on the totality of responses. In the rating scale of food selection and frequency of food consumption, foods were divided into three meals (breakfast, lunch, and dinner) according to their recommended consumption. The first meal group included foods consumed in the morning five times a week, the second meal group included foods consumed in the middle of the journey (lunch) five times a week, and the third meal group included dinner at the evening. On the scale assessing eating behaviours, these were divided into seven items, based on healthy recommendations, and were given a score of 1 for each behaviour selected.

Basal Energy Expenditure (BEE)

Refers to the amount of energy that your body requires at rest to maintain basic bodily functions such as breathing, circulation, and cell production. The most used equation to estimate BEE is the Harris-Benedict equation, which takes into account age, sex, weight, and height.

The formula is as follows:

For men: BEE = 88.36 + (13.4 x weight in kg) + (4.8 x height in cm) - (5.7 x age in years)
For women: BEE = 447.6 + (9.2 x weight in kg) + (3.1 x height in cm) – (4.3 x age in years)
level of physical activity using the following factors:
Sedentary (little or no exercise): BEE x 1.2

Lightly active (light exercise/sports 1-3 days/week): BEE x 1.375
Moderately active (moderate exercise/sports 3-5 days/week): BEE x 1.55
Very active (hard exercise/sports 6-7 days a week): BEE x 1.725
Extra active (very hard exercise/sports or physical job): BEE x 1.9

By multiplying your BEE by the appropriate activity factor, you can estimate your Total Energy Expenditure (TEE), which refers to the total amount of calories you burn in a day, including both BEE and physical activity.

MyFitnessPal

Is a mobile app and website that offers users tools to track their diet and exercise habits. It allows users to log their food intake, track their daily calorie intake, and set nutrition goals. The app provides a database of over six million foods, including popular restaurant items, and allows users to scan barcodes for quick and easy logging. MyFitnessPal also offers features to track physical activity, set weight loss goals, and connect with friends for support and motivation.

This work was authorised by the sports Research Ethics Committee (SREC) of the Institute of Physical Education and sports.

Statistical analysis

Variables were expressed as mean and standard deviation, and ANOVA was used for comparison of means. For association of categorical variables, chi-square test was used, and Fisher's test was applied when necessary. A value of $p<0.05$ was considered significant. Statistical analysis was performed using SPSS 22 version 2016. Data were collected in a group setting in a classroom without time control, with the permission of each student by means of an informed consent letter.

RESULT

Table 1. Body Mass Index (BMI), normal weight and overweight, in total sample and according to sex, in students Institute of Physical Education (IEPS)

	Total (n=134)	**Women (n=60)**	**Men (n=74)**
BMI (Mean ± SD)	23.35 ± 3.08	23.08 ± 3.03	23.56 ± 3.06
Normal weight (BMI < 24.99) (FA, %)	104 (78)	48 (80)	56 (76)
Overweight (BMI > 25) (FA, %)	30 (22)	12 (20)	18 (24)

Table 2. Distribution of dietary habits and physical activity level with Body Mass Index (BMI) in students of the Institute of Physical Education (IEPS)

Variables	AF (%)	BMI (Mean ± SD)
Food selection		
Healthy	87 (65)	23.09 ± 2.79
Moderately healthy	43 (32)	23.67 ± 3.54
Unhealthy	10 (8)	23.25 ± 4.07
Eating behaviour		
Healthy	97 (72)	23.37 ± 2.83
Moderately healthy	26 (20)	22.78 ± 3.15
Unhealthy	4 (3)	25.49 ± 3.69
Level of Physical Activity		
High	97 (72)	23.64 ± 2.89
Medium	29 (22)	22.47 ± 2.51
Under	8 (6)	24.52 ± 4.72

Note: Variables are expressed as absolute frequency (AF): percentages of cases (%), BMI as Mean ± Standard Deviation (SD).

The population studied had a higher prevalence of normal weight, especially females. Most students made moderately healthy food choices and exhibited healthy eating behaviour. Moreover, a higher proportion of both genders engaged in high physical activity. However, it is important to note that some students consumed ultra-processed foods or bakery products, and some lacked essential macronutrients. Additionally, the educational establishments where the students studied did not offer healthy food alternatives. It should be noted that the measurements were taken at the beginning of the degree course, before the students had incorporated more advanced eating habits.

Table 3 provides information on the macronutrient composition of three daily meals, measured in kilocalories (kcal) and grams (g), for a period of five days. The macronutrients considered are fats, protein, and carbohydrates. The average macronutrient intake across the five days is also provided, along with the standard deviation, maximum, and minimum values.

Table 3. Macronutrient Composition of Three Daily Meals

Days	Fats (kcal)	Fats (g)	Protein (kcal)	Protein (g)	Carbohydrate (kcal)	Carbohydrate (g)
Sunday	626.66	69.62	278.392	69.59	2908.58	727.14
Monday	1415.18	27.6	628.72	157.18	1970.84	492.7
Tuesday	1003.29	111.48	445.88	111.47	2229.81	557.34
Wednesday	412.35	45.82	183.242	45.81	1374.46	343.61
Thursday	723.32	80.37	321.48	80.37	1616.61	404.19
Average	836.36	92.506	371.544	92.084	1792.66	445.18
STDEV	357.51	50.9	156.940	28.766	414.31	148.5
Max	1415.18	157.24	628.72	157.18	2908.58	727.14
Min	626.66	45.82	183.24	69.59	1374.46	343.61

The table shows that the highest fat intake occurred on Monday, with a total of 1415.18 kcal (27.6 g), while the lowest was on Wednesday, with a total of 412.35 kcal (45.82 g). Similarly, the highest protein intake was on Monday, with a total of 628.72 kcal (157.18 g), while the lowest was on Wednesday, with a total of 183.242 kcal (45.81 g). The highest carbohydrate intake occurred on Sunday, with a total of 2908.58 kcal (727.14 g), while the lowest was on Wednesday, with a total of 1374.46 kcal (343.61 g).

The average macronutrient intake across the five days shows that, on average, the participants consumed 836.36 kcal (92.506 g) of fats, 371.544 kcal (92.084 g) of protein, and 1792.66 kcal (445.18 g) of carbohydrates. The standard deviation values indicate the variability in macronutrient intake across the five days, with the highest variability observed for carbohydrates.

Table 4 shows the evaluation of animal protein and vegetable ratio of the total protein found in the three meals. The table includes the percentage of protein from animal and vegetable sources, the calories and grams of protein from each source.

Looking at the data, we can see that the average percentage of protein from animal sources is 84.48%, while the average percentage of protein from vegetable sources is 15.52%. The standard deviation for both percentages is relatively high, indicating a wide variation between the meals.

Table 4. Evaluation of animal Protein and vegetable ratio of total Protein found in the value of the three meals

Days	Protein Animal (%)	Protein Animal (kcal)	Protein Animal (g)	Protein Vegetal (%)	Protein Vegetal (kcal)	Protein Vegetal (g)
Sunday	60.55	242.20	60.55	39.44	157.76	39.44
Monday	94.57	207.90	51.98	5.42	11.92	2.98
Tuesday	97.31	396.40	99.10	2.68	10.92	2.73
Wednesday	79.56	303.20	75.80	20.43	77.88	19.47
Thursday	90.38	130.08	32.52	9.61	13.84	3.46
Average	84.48	255.88	71.39	15.52	54.46	15.07
STDEV	14.98	100.32	24.23	14.98	64.37	15.54
Max	97.31	396.40	99.10	39.44	157.76	39.44
Min	14.98	100.32	32.52	2.68	10.92	2.73

The maximum percentage of protein from animal sources is 97.31%, while the minimum is 14.98%. On the other hand, the maximum percentage of protein from vegetable sources is 39.44%, while the minimum is 2.68%.

Overall, this table provides valuable information on the sources of protein in the three meals, showing a clear predominance of animal protein. However, it's important to note that the quality of protein from animal and vegetable sources can vary, and that a balanced and varied diet is key to meeting nutritional needs.

Table 5. Evaluation of animal fat and vegetable ratio of total fats found in the value of the three meals

Days	Fats animal (%)	Fats animal (kcal)	Fats animal (g)	Fats vegetal (%)	Fats vegetal (kcal)	Fats vegetal (g)
Sunday	27.37	254.07	28.23	72.62	674.1	74.90
Monday	13.55	96.66	10.74	86.44	616.59	68.51
Tuesday	15.01	66.51	7.39	84.98	376.38	41.82
Wednesday	12.68	83.79	9.31	87.31	576.63	64.07
Thursday	21.99	245.97	27.33	78.00	872.1	96.90
Average	19.33	149.4	16.6	80.66	623.16	69.24
STDEV	34.11	92.51	10.27	65.88	178.65	19.85
Max	22.56	254.07	28.23	77.43	872.1	96.90
Min	14.98	100.3	32.52	84.98	376.38	41.82

Table 5 provides information on the percentage and amount of animal fat and vegetable fat found in the three meals on different days. The table shows that on average, 19.33% of the total fat intake was from animal sources, while 80.66% was from vegetable sources. The highest percentage of animal fat was found on Thursday at 21.99%, while the lowest was on Wednesday at 12.68%. On the other hand, the highest percentage of vegetable fat was found on Thursday at 78.00%, while the lowest was on Tuesday at 84.98%.

The average amount of animal fat consumed per day was 16.6g, while the average amount of vegetable fat consumed per day was 69.24g. The highest amount of animal fat was consumed on Sunday at 28.23g, while the lowest was on Tuesday at 7.39g. The highest amount of vegetable fat was consumed on Thursday at 96.90g, while the lowest was on Tuesday at 41.82g.

Overall, the table shows that the majority of fat intake came from vegetable sources, with only a small percentage coming from animal sources. This suggests that the meals consumed were likely plant-based or low in animal products.

Table 6. Correlation between Age, Height, Weight, Energy Intake and Expenditure, and Recommended Energy Intake for students

Sample	Age	Height	Weight	Energy Intake	Energy Expenditure	Pearson Correlation Coefficient	Recommended Intake Energy
(n=134)	21.8 ± 1.2	175.3 ± 6.2	72.6 ± 8.1	2729.93	3277.66	-0.09*	3521.6

Note: *$p < .05$

Table 6 shows the correlation between age, height, weight, energy intake, energy expenditure, and recommended energy intake for a sample of 120 students. The data indicates that the average age of the students in the sample is 21.8 years, with a standard deviation of 1.2 years. The average height is 175.3 cm, with a standard deviation of 6.2 cm, and the average weight is 72.6 kg, with a standard deviation of 8.1 kg.

The average energy intake of the students is 2729.93 kcal, and the average energy expenditure is 3277.66 kcal. The Pearson correlation coefficient between energy intake and expenditure is -0.09, indicating a weak negative correlation between the two variables.

The recommended energy intake for the students is 3521.6 kcal. It is important to note that this value may vary depending on factors such as physical activity level, body composition, and overall health status. Therefore, individualized recommendations should be provided based on a comprehensive assessment of each individual's needs.

DISCUSSION

According to the results, it was found that the population studied had a percentage of normal weight above the representative values of the Algerian population. In this sense, it should be borne in mind that the measurements of those assessed correspond to the beginning of the degree course, when they may not yet have incorporated the eating habits of a more advanced student (Benbernou, Bennama, Belkadi, Boukchiche, & Koutchouk, 2022; Mohamed, Mohamed, Mohammed, Mokrani, & Belkadi, 2019). On the other hand, food choices were mostly moderately healthy, sometimes consuming ultra-processed foods or bakery products and, in other cases, lacking essential macronutrients such as meat, eggs, vegetables, fruit and seeds. It is important to note that in the educational establishments where the students studied, the canteens available do not offer more or less healthy alternatives, which would suggest that the pattern of food selection is the same as outside the aforementioned establishments. In turn, eating behaviours were mostly healthy, respecting 4 minimum daily intakes, ensuring breakfast and lunch, and avoiding prolonged fasting, as the most prominent. This result did not coincide with the findings obtained by (Oulamara, Agli, & Frelut, 2009), referring to changes in lifestyle, reflected in eating habits and diet quality, respectively. In the same vein, in the city of Oran, Algeria, several studies recognized higher or lower than recommended daily intake and a low level of physical activity as variables related to overweight (Berria et al., 2018; Chrara et al., 2018; Okati-Aliabad, Ansari-Moghaddam, Kargar, & Jabbari, 2022; Youcef, Mokhtar, & Adel, 2022). With regard to this discrepancy with the results found in the present study, it should be added that the Physical Education curriculum does not include specific content related to healthy eating habits (Cherara et al., 2022; McLoughlin et al., 2019), which would suggest that the behaviours shown are acquired spontaneously from childhood and adolescence (Abdelhafez, Akhter, Alsultan, Jalal, & Ali, 2020; Mokémiabéka, Ombeni, & Mabossy-Mobouna*, 2022; Warburton, 2006; Yahia, Wang, Rapley, & Dey, 2016). In relation to the level of physical activity, most of the students evaluated showed a high level of physical activity. Possibly in this case, the strict contents related to human movement, which the academic training in Physical Education presents, are the cause of the high level of physical activity observed in the population analysed (Aidoud, Elahcene, Bravo, & Ugartemendia, 2021; Stranges, 2019). By the same assumption, the contrast of the marked sedentary lifestyle of Algerian university students could be seen (Abbes & Bereksi-Reguig, 2016; Moussa, Belkadi, Benhammou, Dairi, & Benbernou, 2025).

The study revealed that the canteens available in the educational establishments where the students studied do not offer healthy alternatives, which suggests that the pattern of food selection is similar to that outside the establishments (Boudaoud, Karoune, Adjali, & Dahel, 2019) . However, the eating behaviours of the students were mostly healthy, with adequate minimum daily intakes, breakfast, lunch, and avoiding prolonged fasting (Saker, Merzouk, Merzouk, Ahmed, & Narce, 2011).

The level of physical activity among the students evaluated was high, with an average of 5 sessions per week which is in accordance with (Di Noia, 2010; Reiner, Niermann, Jekauc, & Woll, 2013; Nwankwo-Ezika, 2020; Manar, Adel, Lalia, & Saddak, 2023) studies . The present study suggests that the high level of physical activity observed in the population analysed may be due to the strict contents related to human movement presented in the academic training in Physical Education (Golubeva, Martinov, & Nazymok, 2022; Mokémiabéka et al., 2022).

However, the study also revealed poor nutrition among the students, with non-compliance of the quantity and variety of protein (animal-plant) and fats (animal-plant) in the meals distributed in the university restaurant with the recommended standards. The quantity of carbohydrates in the meals was also found to be non-compliant. This poor nutrition can have a negative impact on physical performance and academic learning abilities. Good learning is associated with a balanced diet, which affects learning abilities and memory capacity.

CONCLUSION

In conclusion, the study found that the population evaluated had a high level of physical activity but poor nutrition. The canteens available in educational establishments do not offer healthy alternatives, and the meals distributed do not comply with the recommended standards. It is essential to improve the nutrition of students to enhance their physical and academic performance. Nutrition education should be provided to students to enable them to make healthier food choices. Moreover, physical education should be accompanied by healthy meal plans to achieve physical education and sports objectives.

REFERENCES

Abbes, M. A., & Bereksi-Reguig, K. (2016). Risk factors for obesity among school aged children in western Algeria : Results of a study conducted on 293 subjects. *La Tunisie Medicale*, *94*(1), 23-28.

Abdelhafez, A. I., Akhter, F., Alsultan, A. A., Jalal, S. M., & Ali, A. (2020). Dietary Practices and Barriers to Adherence to Healthy Eating among King Faisal University Students. *International Journal of Environmental Research and Public Health*, *17*(23), 8945. https://doi.org/10.3390/ijerph17238945

Adel, B., Abdelkader, B., Alia, C., Othman, B., Mohamed, S., & Houcin, A. (2019). The Effect of High-Intensity Exercise on Changes of Blood Concentration Components in Algerian National Judo Athletes. *Acta Facultatis Educationis Physicae Universitatis Comenianae*, *59*(2).

Aidoud, A., Elahcene, O., Bravo, R., & Ugartemendia, L. (2021). Nutritional status and dietary behaviours of Northern Algeria university students. *Acta Universitatis Sapientiae, Alimentaria*, *14*(1), 1-13. https://doi.org/10.2478/ausal-2021-0001

Amawi, A., AlKasasbeh, W., Jaradat, M., Almasri, A., Alobaidi, S., Hammad, A. A., … Ghazzawi, H. (2024). Athletes' nutritional demands: A narrative review of nutritional requirements. *Frontiers in Nutrition*, *10*, 1331854. https://doi.org/10.3389/fnut.2023.1331854

Bazshahi, E., Sheikhhossein, F., Amini, M. R., & Shab-Bidar, S. (2021). The association of dietary energy density and the risk of obesity, type 2 diabetes and metabolic syndrome: A systematic review and meta-analysis of observational studies. *International Journal of Clinical Practice*, *75*(10). https://doi.org/10.1111/ijcp.14291

Beboucha, W., Belkadi, A., Benchehida, A., & Bengoua, A. (2021). The Anthropometric and Physiological Characteristics of Young Algerian Soccer Players. *Acta Facultatis Educationis Physicae Universitatis Comenianae*, *61*(1).

Behrman, J. R. (1996). THE IMPACT OF HEALTH AND NUTRITION ON EDUCATION. *The World Bank Research Observer*, *11*(1), 23-37. https://doi.org/10.1093/wbro/11.1.23

Belkadi, A, & Mime, M. (2019). Effects of tow protocol cold water immersion on the post match recovery and physical performance in youth handball players. *International Journal of Sport Culture and Science*, *7*(2), 1-12.

Belkadi, Adel, Alia, C., & Mohammed, Z. (2020). Algerian Judo Competition Modality and its Impacts on Upper and Lower Limbs Strength Perseverance and Limitations. *Orthopedics and Sports Medicine: Open Access Journal*, *3*(4), 293-299.

Belkadi, Adel, Beboucha, W., Benhammou, S., Moussa, M., Bouzoualegh, M., & Dairi, A. (2025). Effects of concurrent in-season training on physiological functions required for top handball performance athletes. *Scientific Journal of Sport and Performance*, *4*(1), 40-54. https://doi.org/10.55860/JIXW8099

Belkadi, Adel, Othman, B., Mohamed, S., M, B. H., Gleyse, J., Adel, B., … Gleyse, J. (2015). Contribution to the Identification of the Professional Skills Profile of Coaches in the Algerian Sport Judo System. *International Journal of Sports Science*, *5*(4), 145-150.

Benbernou, O., Bennama, F., Belkadi, A., Boukchiche, S., & Koutchouk, S. M. (2022). Analysis of the Professional Competency Indicators of University Physical Trainer Students. *Acta Facultatis Educationis Physicae Universitatis Comenianae*, *62*(1), 53-71.

Bencharif, M., Sersar, I., Touati-Mecheri, D., Agli, A., & Oulamara, H. (2021). An update of the nutritional situation in eastern Algeria. *The North African Journal of Food and Nutrition Research*, *4*(9), S54-S62. https://doi.org/10.51745/najfnr.4.9.S54-S62

Benchehida, A., Belkadi, A., Zenati, Y., Benbernou, O., Cherara, L., & Sebbane, M. (2021). Implementation of An Adapted Physical Activity Therapy Protocol for Patients with Low Back Pain. *Gymnasium*, *22*(1), 83-96.

Benhammou, S., Mourot, L., Coquart, J., Belkadi, A., Mokkedes, M. I., & Bengoua, A. (2022). The 180/20 intermittent athletic test: A new intermittent track test to assess the maximal aerobic speed in middle-distance runners. *Revista andaluza de medicina del deporte*, *15*(1), 6-11.

Berria, M., Bachir, K., Eddine, S. N., & Adel, B. (2018). Study of LDH adaptations associated with the development of Speed endurance in basketball players U19. *International Journal of Applied Exercise Physiology*, *7*(3), 35-43.

Boudaoud, C., Karoune, R., Adjali, W., & Dahel, C. (2019). Perception of body image and weight status in Algerian adult population: A wrong self-evaluation. *Saudi Journal of Obesity*, *7*(1), 8. https://doi.org/10.4103/sjo.SJO_1_22

Boudehri, M. E. amine, Belkadi, A., Dahoune, O., & Atallah, A. (2023). The effects of circuit exercise training strategy on health-related physical fitness level and biomarkers in elderly people with cardiovascular diseases. *Quality in Sport*, *11*(1), 16-31. https://doi.org/10.12775/QS.2023.11.01.002

Budzulak, J., Majewska, K., & Kędzia, A. (2022). Malnutrition as the cause of growth retardation among children in developed countries. *Annals of Agricultural and Environmental Medicine*, *29*(3), 336-341. https://doi.org/10.26444/aaem/148010

Bull, F. C., Al-Ansari, S. S., Biddle, S., Borodulin, K., Buman, M. P., Cardon, G., … Willumsen, J. F. (2020). World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *British Journal of Sports Medicine*, *54*(24), 1451-1462. https://doi.org/10.1136/bjsports-2020-102955

Cherara, L., Belkadi, A., Mesaliti, L., & Beboucha, W. (2022). Characteristics of Handgrip (Kumi-Kata) Profile of Georgian Elite Judo Athletes. *GYMNASIUM*, *23*(1), 54-66.

Chrara, L., Raoui, R. A., Belkadi, A., Hocine, A., & Benbernou, O. (2018). The impact of caloric restriction on anthropometrical and specific performance in highly-trained judo athletes. *Arab Journal of Nutrition and Exercise (AJNE)*, *3*(3), 105-118.

Di Noia, J. (2010). Dietary Stages of Change and Decisional Balance: A Meta-Analytic Review. *American Journal of Health Behavior*, *34*(5). https://doi.org/10.5993/AJHB.34.5.11

Drozdz, D., Alvarez-Pitti, J., Wójcik, M., Borghi, C., Gabbianelli, R., Mazur, A., … Wühl, E. (2021). Obesity and Cardiometabolic Risk Factors: From Childhood to Adulthood. *Nutrients*, *13*(11), 4176. https://doi.org/10.3390/nu13114176

Fava, S., Fava, M.-C., & Agius, R. (2019). Obesity and cardio-metabolic health. *British Journal of Hospital Medicine*, *80*(8), 466-471. https://doi.org/10.12968/hmed.2019.80.8.466

Ferry, M. (2010). Nutrition, vieillissement et santé: *Gérontologie et société*, *33 / n° 134*(3), 123-132. https://doi.org/10.3917/gs.134.0123

Golubeva, V., Martinov, Yu., & Nazymok, V. (2022). The Influence of Physical Education Lessons on the Development of Applied Physical Qualities in Students of Non-Physical Specialties. *Scientific Journal of National Pedagogical Dragomanov University. Series 15. Scientific and pedagogical problems of physical culture (physical culture and sports)*, (12(158)), 25-27. https://doi.org/10.31392/NPU-nc.series15.2022.12(158).05

Hichem, L., Houcine, A., & Sadek, Z. (2015). An Investigation into Food Balance and Its Relationship to the Physical Activity Practised within the School Context for Both Males and Females Aged 10-13 Years. *Journal of Sports Science*, *3*. https://doi.org/10.17265/2332-7839/2015.05.007

Kesari, A., & Noel, J. Y. (2024). Nutritional Assessment. In *StatPearls*. Treasure Island (FL): StatPearls Publishing. Consulté à l'adresse http://www.ncbi.nlm.nih.gov/books/NBK580496/

Kopp, W. (2019). How Western Diet and Lifestyle Drive the Pandemic of Obesity and Civilization Diseases. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, *12*, 2221-2236. https://doi.org/10.2147/DMSO.S216791

Kyu, H. H., Bachman, V. F., Alexander, L. T., Mumford, J. E., Afshin, A., Estep, K., … Forouzanfar, M. H. (2016). Physical activity and risk of breast cancer, colon cancer, diabetes, ischemic heart disease, and ischemic stroke events: Systematic review and dose-response meta-analysis for the Global Burden of Disease Study 2013. *BMJ*, i3857. https://doi.org/10.1136/bmj.i3857

Mahmoud, A. M. (2022). An Overview of Epigenetics in Obesity: The Role of Lifestyle and Therapeutic Interventions. *International Journal of Molecular Sciences*, *23*(3), 1341. https://doi.org/10.3390/ijms23031341

Manar, B., Adel, B., Lalia, C., & Saddak, B. (2023). Investigating the Impact of Physiological and Neuromuscular Performance in Highly Trained Judo Athletes of Different Weight Categories. *Slobozhanskyi Herald of Science and Sport*, *27*(3), 118-127. https://doi.org/10.15391/snsv.2023-3.002

Martín-Valero, R., Rodríguez-Martínez, M. C., Cantero-Tellez, R., Villanueva-Calvero, E., & Fernández-Martín, F. (2014, juillet 16). *Advances in Comprehensive Pulmonary Rehabilitation for COPD Patients* (R. J. Panos, Éd.). InTech. https://doi.org/10.5772/57563

McLoughlin, G. M., Graber, K. C., Woods, A. M., Templin, T., Metzler, M., & Khan, N. A. (2019). The Status of Physical Education Within a Nationally Recognized School Health and Wellness Program. *Journal of Teaching in Physical Education*, *39*(2), 274-283. https://doi.org/10.1123/jtpe.2019-0052

Melchior, J.-C. (2009). Évaluation de l'état nutritionnel. *EMC - Endocrinologie - Nutrition*, *6*(2), 1-9. https://doi.org/10.1016/S1155-1941(09)50479-9

Millward, D. J. (2017). Nutrition, infection and stunting: The roles of deficiencies of individual nutrients and foods, and of inflammation, as determinants of reduced linear growth of children. *Nutrition Research Reviews*, *30*(1), 50-72. https://doi.org/10.1017/S0954422416000238

Mohamed, K. S., Mohamed, K., Mohammed, S., Mokrani, D., & Belkadi, A. (2019). The Effect of Heavy Weight Training on Physiological Abilities of Soccer Players Under the Age 21 Years Old. *Acta Facultatis Educationis Physicae Universitatis Comenianae*, *59*(1), 33-43. https://doi.org/10.2478/afepuc-2019-0004

Mokémiabéka, N. S., Ombeni, J. B., & Mabossy-Mobouna*, G. (2022). Physical activities, dietary profile and nutritional status of students from the Higher Institute of Physical and Sports Education (ISEPS), Marien Ngouabi University in Congo-Brazzaville. *Research Journal of Food Science and Nutrition*, *7*(4), 95-110. https://doi.org/10.31248/RJFSN2022.150

Morales, F., Montserrat-de la Paz, S., Leon, M. J., & Rivero-Pino, F. (2024). Effects of Malnutrition on the Immune System and Infection and the Role of Nutritional Strategies Regarding Improvements in Children's Health Status: A Literature Review. *Nutrients*, *16*(1), 1. https://doi.org/10.3390/nu16010001

Moussa, M., Belkadi, A., Benhammou, S., Dairi, A., & Benbernou, O. (2025). Comparative analyses of implementation of connected sensors on heart rate variability in middle school judo athletes versus non-athletes. *Sustainability and Sports Science Journal*, *3*(2), 112-124. https://doi.org/10.55860/WXUS7730

Nwankwo-Ezika, A. (2020). Transtheoretical model as a framework for promoting cardiovascular health through behaviour change: A systematic review. *Health*, *4*, 46.

Obesity, W. C. on. (2000). Obesity: Preventing and managing the global epidemic. Report of a WHO consultation. *World Health Organization technical report series*. Consulté à l'adresse https://www.semanticscholar.org/paper/Obesity%3A-preventing-and-managing-the-global-Report-Obesity/a1c743e2fd294d37b71333c4a4e3f093e32efed4

Okati-Aliabad, H., Ansari-Moghaddam, A., Kargar, S., & Jabbari, N. (2022). Prevalence of Obesity and Overweight among Adults in the Middle East Countries from 2000 to 2020: A Systematic Review and Meta-Analysis. *Journal of Obesity*, *2022*, 1-18. https://doi.org/10.1155/2022/8074837

O'Sullivan, A., & Sheffrin, S. M. (2003). *Economics: Principles in action*. Needham, Mass.: Prentice Hall.

Oulamara, H., Agli, A. N., & Frelut, M. L. (2009). Changes in the prevalence of overweight, obesity and thinness in Algerian children between 2001 and 2006. *International Journal of Pediatric Obesity*, *4*(4), 411-413. https://doi.org/10.3109/17477160802596163

Qin, M., Peng, C., & Wang, Q. (2021). Physical Activity to Improve the Physiological Index of Cardiovascular Effect. *Revista Brasileira de Medicina Do Esporte*, *27*, 773-775. https://doi.org/10.1590/1517-8692202127082021_0372

Reiner, M., Niermann, C., Jekauc, D., & Woll, A. (2013). Long-term health benefits of physical activity – a systematic review of longitudinal studies. *BMC Public Health*, *13*(1), 813. https://doi.org/10.1186/1471-2458-13-813

Saddek, Z., Houcine, A., & Hichem, L. (2019). Designing software to calculate the value of the macro-nutrients and its relationship with the calorie expenditure of the daily physical activity of the individual. *Gazzetta Medica Italiana Archivio per le Scienze Mediche*, *178*. https://doi.org/10.23736/S0393-3660.18.03732-4

Saker, M., Merzouk, H., Merzouk, S., Ahmed, S., & Narce, M. (2011). Predictive Factors of Obesity and their Relationships to Dietary Intake in Schoolchildren in Western Algeria. *Maedica*. Consulté à l'adresse https://www.semanticscholar.org/paper/Predictive-Factors-of-Obesity-and-their-to-Dietary-Saker-Merzouk/1f7cb560345fd7622764a10f537baf90a7e7768d

Senouci, A., Asli, H., Belkadi, A., Bouhella, H., & Koutchouk, S. M. (2024). The Effect of Cold Therapy on Delayed Onset Muscle Soreness and Quadriceps Femoris Strength After High-Intensity Eccentric Training. *GYMNASIUM*, *25*(2), 34-50. https://doi.org/10.29081/gsjesh.2024.25.2.3

Serrano-Gallén, G., Arias-Palencia, N. M., González-Víllora, S., Gil-López, V., & Solera-Martínez, M. (2022). The relationship between physical activity, physical fitness and fatness in 3–6 years old boys and girls: A cross-sectional study. *Translational Pediatrics*, *11*(7), 1095-1104. https://doi.org/10.21037/tp-22-30

Stranges, S. (2019). Epidemiological and nutritional transition in low- and middle-income countries. *European Journal of Public Health*, *29*(Supplement_4), ckz185.199. https://doi.org/10.1093/eurpub/ckz185.199

Taberna, D. J., Navas-Carretero, S., & Martinez, J. A. (2019). Current nutritional status assessment tools for metabolic care and clinical nutrition. *Current Opinion in Clinical Nutrition & Metabolic Care*, *22*(5), 323-328. https://doi.org/10.1097/MCO.0000000000000581

Warburton, D. E. R. (2006). Health benefits of physical activity: The evidence. *Canadian Medical Association Journal*, *174*(6), 801-809. https://doi.org/10.1503/cmaj.051351

Willya Achmad Et Al. (2023). Malnutrition, Parenting, Poverty: Construction and Stunting Phenomena in Indonesia. *Russian Law Journal*, *11*(2s). https://doi.org/10.52783/rlj.v11i2s.565

Wyszyńska, J., Ring-Dimitriou, S., Thivel, D., Weghuber, D., Hadjipanayis, A., Grossman, Z., … Mazur, A. (2020). Physical Activity in the Prevention of Childhood Obesity: The Position of the European Childhood Obesity Group and the European Academy of Pediatrics. *Frontiers in Pediatrics*, *8*, 535705. https://doi.org/10.3389/fped.2020.535705

Yacine, Z., Othmane, B., Adel, B., Mohamed, S., Aabdelkader, B., & Lalia, C. (2020). Functional movement screening as a predictor of injury in highly trained female's martial arts athletes. *Polish Hyperbaric Research*, *71*(2), 67-74.

Yahia, N., Wang, D., Rapley, M., & Dey, R. (2016). Assessment of weight status, dietary habits and beliefs, physical activity, and nutritional knowledge among university students. *Perspectives in Public Health*, *136*(4), 231-244. https://doi.org/10.1177/1757913915609945

Youcef, K., Mokhtar, M., & Adel, B. (2022). Effects of different concurrent training methods on aerobic and anaerobic capacity in u 21 soccer players. *Sports Science & Health/Sportske Nauke i Zdravlje*, *12*(1).

STUDIA UBB EDUCATIO ARTIS GYMN., LXX, 1, 2025, pp. 81-92
(RECOMMENDED CITATION)
DOI:10.24193/subbeag.70(1).07

Use the PLS Micro-Squares Method for Measuring the Teaching Competence of Professors of Physical and Sports Education

Abderahmane BENGUENAB[1*], Hadj SAYAD[1], Rachid RAZALI[1], Ahmed ATALLAH[2]

Article history: Received 2025 January 08; Revised 2025 March 04; Accepted 2025 March 06; Available online 2025.03.30; Available print 2025.05.30

ABSTRACT. The research aimed to build a tool to measure the teaching efficiency of physical education and sports teachers in the school environment in the intermediate education stage, and this by verifying its validity and applicability, as the tool includes in its final form 33 standards that meet the standards of honesty and stability, and covers 6 main dimensions, namely scientific knowledge competencies, and the efficiency of planning and formulation competencies, and the efficiency of implementation, the efficiency of evaluation and follow-up, the competencies of effective communication management and class, and the efficiency of professional development. The model was applied to 355 teachers of intermediate education in the national west and the value of stability was 0.63, and from it we say that this measure has an acceptable constant, and the value of the GoF standard is equal to 0.42, which is greater than 0.36. Which shows a great matching quality of the study model. The researcher also concluded that all predictive units are more than zero, as their maximum value on the axis of planning competencies and goal formulation was 21%. The lowest value was also recorded on the professional development axis at 11% that can be judged to have an acceptable predictive

[1] University of Science and Technology of Oran – Mohamed Boudiaf, Laboratory of Physical Activity and Sports Children-LAPESA, Bir El Djir, Algeria
[2] Institute of Physical Education and Sports, University of Abdelhamid Ibn Badis, Mostaganem, Algeria
[*] Corresponding author: abdarahmane.bengueneb.etu@univ-mosta.dz

ability. By calculating the effect size 2R and through the test results, we notice that all variables have values of "f2" that exceed 0.35≤ Es, the effect size is large in all variables. In light of these results, we recommend that you take advantage of this tool to measure and evaluate the teaching competence of the physical education and sports teacher in the school environment.

Keywords: *Factorial structure, measurement, teaching efficiency, Professor of physical education and sports*

INTRODUCTION

In light of the current modernization of information and the terrible technological development that the world is witnessing in all fields in general and in the field of educational curricula in particular, we note that the educational process has become a prominent place among the priorities of this development and this is an issue of interest to the issue of preparing professors and studying their teaching competencies at the present time due to the importance of the role of Professor Guy of the teaching process Diouf (2007). where this preparation requires a special priority to demonstrate their abilities, skills and the extent to which they use the art of teaching from developments and changes (Benguenab, 2021). This movement has become an effective force in the reality of the wheel of the educational process and in the preparation and preparation of the future teacher and raise his career level, and this process requires a broad and comprehensive view where the necessary competencies are determined for the teacher of sports education to exercise his role to the fullest (Laroua, 2015). Since the change is an important, objective and orderly process, the professor within his class and during his class has been given full freedom to act using what he sees as appropriate educational methods to achieve the technical and scientific competencies required by the good conduct of the course, in addition to the opinions and beliefs that accompany the subject of the lesson.

Many experts in physical education and sports believe that those who teach physical education and sports in the middle and secondary school must possess the necessary teaching competencies to teach different sports skills, so there must be basic educational competencies of the teacher of physical education and sports in both stages (intermediate and secondary) qualify him to perform his role efficiently and effectively, in addition to personal competencies,

there is no doubt that the properties of teachers educational competencies will develop their abilities and enrich their experiences and help them to achieve educational goals, within the framework that facilitates meeting their needs, so disclosure of their availability is crucial, because it will help to identify their weaknesses and strengths, and then address them.

Recent studies in physical education and sports have ensured that the subject of physical education and sports is based on teaching competencies as stated in the recommendations of the Conference on Teacher preparation between globalization and the requirements of the development plan in the State of Kuwait (2003). the second conference on teacher preparation in the Kingdom of Saudi Arabia (1993), which called for the need to conduct studies to determine the necessary competencies of teachers in all disciplines in accordance with the cognitive development of each subject.

The intermediate education stage is an important stage in which the personality of the learner is formed, and he acquires many basic skills that help him to continue education and move to the university level, so it needs a teacher who can practice teaching skills and various competencies so that he can deal with students.

Therefore, it is necessary to focus on the performance of the physical education and sports teacher to carry out his duties toward his students as well as provide him with the basic knowledge he needs to carry out his duty to the fullest.

Based on the lack of studies that dealt with exploratory and confirmatory factor analysis as a statistical method in educational and psychological studies and the need to know the scientific bases for the methods of extracting factors and the statistical basis for methods of determining the number of factors and methods of rotation, often the researcher is satisfied with the default methods found in the statistical software packages without knowing the appropriateness of these methods for the nature of the research and its objectives, so the researcher studied the construction of the worker, for this reason, several tools have been developed to measure the efficiency of teaching and the quality of the teaching process, which relied on a set of criteria to measure them and determine their indicators and come up with a tool that is credible in measuring the quality of the teaching process, and this research came to answer the following question.

MATERIAL AND METHODS

Participants

1. The method followed in the study: This descriptive methodology is defined by Bachir Saleh Al-Rachidi as a set of research procedures that integrate to describe the phenomenon based on collecting facts and data, classifying and analyzing them thoroughly and sufficiently in order to reach results and generalizations about the phenomenon in question. Soysal (2018).

2. Research community: The original community of research was represented by professors of physical education and sports in the school community (middle stage) from four states in western Algeria, whose number was (757) professors.

3. Sample search: To complete this study, we selected a random sample of 355 physical education and sports teachers for intermediate education.

4. Data collection tools: ***Arab and foreign sources and references.***

Measure: After the student has been briefed on several studies related to the research topic, he has built a measure on the teaching efficiency of physical education and sports teachers in the school environment, the **scale of the following dimensions:**

5. Statistical Tools : SPSS v.23

- The arithmetic means to see how high or low the responses of the study subjects to each of the statements of the study variables
- Standard deviation (standard deviation) has been used to identify how skewed individual responses are.
- Kolmogorov-Smirnov.
- The half-hash coefficient of confirmation of the instrument.
- Smart PLS Version 3.3.3

RESULTS

Analyze the results of the study testing the standard model and the structural model of the study.

Analysing the convergent truth Internal consistency

Table 1. Shows *Results of statements saturation for all dimensions of the study form after deletion*

Factor Loading						
Calendar and follow-up competencies	**Competencies for effective communication and class management**	**Professional development**	**Efficiency of implementation**	**Competencies in planning and formulating goals**	**Cognitive and scientific competencies**	**Phrases**
0.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.59**	**Knowledge and science 1**
0.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.63**	**Knowledge and science 2**
0.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.74**	**Knowledge and knowledge 5**
0.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.64**	**Knowledge and knowledge 6**
0.00	**0.00**	**0.00**	**0.00**	**0.52**	**0.00**	**Planning and formulation of objectives 1**
0.00	**0.00**	**0.00**	**0.00**	**0.70**	**0.00**	**Planning and formulation of objectives 2**
0.00	**0.00**	**0.00**	**0.00**	**0.51**	**0.00**	**Planning and formulation of objectives 3**
0.00	**0.00**	**0.00**	**0.00**	**0.62**	**0.00**	**Planning and formulation of objectives 4**
0.00	**0.00**	**0.00**	**0.00**	**0.72**	**0.00**	**Planning and formulating objectives 5**
0.00	**0.00**	**0.00**	**0.00**	**0.64**	**0.00**	**Planning and formulating objectives 6**
0.00	**0.00**	**0.00**	**0.00**	**0.62**	**0.00**	**Planning and setting goals 7**
0.00	**0.00**	**0.00**	**0.47**	**0.00**	**0.00**	**Operational competence 1**
0.00	**0.00**	**0.00**	**0.60**	**0.00**	**0.00**	**Capacity of Executive 2**
0.00	**0.00**	**0.00**	**0.70**	**0.00**	**0.00**	**Efficiency of operation 3**

0.00	**0.00**	**0.00**	**0.71**	**0.00**	**0.00**	**Capacity of Executive 4**
0.00	**0.00**	**0.00**	**0.70**	**0.00**	**0.00**	**Capacity of Executive 5**
0.00	**0.00**	**0.00**	**0.40**	**0.00**	**0.00**	**Efficiency of operation 6**
0.00	**0.00**	**0.67**	**0.00**	**0.00**	**0.00**	**Professional development 1**
0.00	**0.00**	**0.65**	**0.00**	**0.00**	**0.00**	**Professional Development 2**
0.00	**0.00**	**0.41**	**0.00**	**0.00**	**0.00**	**Professional development 3**
0.00	**0.00**	**0.70**	**0.00**	**0.00**	**0.00**	**Professional development 4**
0.00	**0.00**	**0.73**	**0.00**	**0.00**	**0.00**	**Professional development 5**
0.00	**0.70**	**0.00**	**0.00**	**0.00**	**0.00**	**Effective communication competencies manage page 1**
0.00	**0.77**	**0.00**	**0.00**	**0.00**	**0.00**	**Competencies of effective communication page manage-ment 2**
0.00	**0.75**	**0.00**	**0.00**	**0.00**	**0.00**	**Efficiency of effective communication page manage-ment 3**
0.00	**0.70**	**0.00**	**0.00**	**0.00**	**0.00**	**Competencies of effective communication page manage-ment 4**
0.69	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**Follow-up Calendar Competencies 1**
0.77	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**Follow-up Calendar Competen2**
0.69	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**Follow-up Calendar Competen3**
0.58	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**Efficiency of the calendar 4**
0.70	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**Performance of the calendar 5**

Source: Prepared by the student based on Smart PLS outputs

Through table number (01) we see that the phrases of the variable cognitive and scientific competencies have increased their coefficient by a small amount after deleting the phrases that were less than the required standard, the values of the statements of the other variables increased by a small percentage, and some of them remained the same as it should be noted that we have kept the statements below 0.70 for necessity. Benguenab (2022) points out that indicators with external loads between 0.40 and 0.70 should only be removed when the deletion of the indicator increases the value of composite reliability or derived variance (p.161).

Composite Reliability

The Composite reliability Standard measures the sum of the underlying variable factor loads relative to the sum of factor loads plus error variance and the recommended value must be 0.7 and above Hair (2014). The results of composite reliability (CR) and Table (02) can be illustrated as follows:

Table 2. Shows the reliability results of the CR

Composite Reliability (CR) Reliability of the vehicle	Alpha Cronbach	Dimensions	Variable
0.75	0.57	**Cognitive competence and scientific**	**Teacher's teaching competence**
0.81	0.73	**Competencies in planning and formulating goals**	
0.77	0.64	**Efficiency of implementation**	
0.77	0.65	**Professional development**	
0.82	0.71	**Competence of effective communication and class management**	
0.82	0.73	**Calendar and follow-up competencies**	

The average variation extracted (AVE)

The AVE is one of the most popular metrics to validate convergence at the structural model level. This measure is defined as the large average value of the square loads of indicators associated with the factor, i.e. the sum of the square loads divided by the number of indicators (paragraphs). Using the same logic used in individual indicators an AVE value of 0.50 or more refers to the

construction (factor) that explains on average more than half the variance in its indicators. By contrast, an AVE value below 0.50 indicates that on average there is still greater variation in element error rather than the explained variance in construction.

Table 3. Shows the average variance extracted (AVE)

AVE	Dimensions	Variable
0.315	Cognitive and scientific competencies	Teacher's teaching competence
0.320	Competencies in planning and formulating goals	
0.399	Efficiency of implementation	
0.569	Professional development	
0.399	Competencies for effective communication and class management	
0.569	Calendar and follow-up competencies	

Discriminant Validity

Table 4. Shows the results of the Vernerlanker standard

Efficiency of implementation	Follow-up calendar competencies	Competencies in planning and formulating goals	Competencies of effective communication class management	Scientific knowledge skills	Professional development	
					0.642	Professional development
				0.658	0.259	Scientific knowledge skills
			0.735	0.204	0.276	Competencies of effective communication class management
		0.624	0.296	0.325	0.271	Competencies in planning and formulating goals
	0.690	0.326	0.444	0.147	0.240	Follow-up calendar competencies
0.647	0.294	0.508	0.299	0.478	0.323	Efficiency of implementation

Source: SmartPLS output

In order for the study tool to have differential validity, the Vernerlacker criterion for each underlying variable must be greater than the study variables, i.e., as much as possible compared to the rest of the variables, i.e. the variable represents itself more than it represents the rest of the variables.

DISCUSSIONS

Its constant value as 0.46 and it was subjected to the correction coefficient of Sperman and Brown, and its value was 0.63, Razali (2024) points out that as long as the value of Alfa Kronbach for the first and second halves is not equal or close, we rely on the GITman correction coefficient of 0.63 and from which we say that this measure is an acceptable constant : CR", cross Loading(HTMT) Fornell and Larcker (1981). Efficiency of implementation, efficiency of evaluation and follow-up, competencies of effective communication management and class, efficiency of professional development.

CONCLUSION

The contemporary world is witnessing a growing interest in quality work, especially in the fields of education and educational work.

This interest comes from the full conviction that the quality of education is in the presence of specific and accurate standards that reach in their ambition and accuracy to a degree that suggests what needs to be learned and acquired and the level to be reached in each of the fields associated with the educational process. Meeting the professional and personal needs of teachers and providing them with public services in the educational institution will strengthen the bonds of familiarity and belonging and improve their job satisfaction toward their educational institutions, and this is in line with the basic objective for which the educational administration found itself, namely the development of the educational process and the provision of services to all employees, including teachers. respond to their physical and moral needs and improve the school organizational climate to help them improve their performance and educational effectiveness.

For all this, this study came to build a tool to measure the teaching competencies of teachers of physical education and sports in the school community, starting from the problem identified in what is the working structure of the tool to measure the teaching competencies of the professor of physical education and sports in the middle education stage? And as the objectives of the

study, we tried to identify or build the model of teaching competencies and to conduct this research we have studied familiarization with the research and studies that dealt with such a problem, which dealt with the search for the professional reality of the professor of physical education and sports, and his teaching competencies.

We concluded a set of results that summarized that this measure is an acceptable constant, and that there is no overlap between the variables of the study has achieved the study tool differentiated truthfulness according to the criterion of Verner Lancro as well as the results of the current study concluded the existence of discrimination issues of validity and each unique structure and this indicates the quality of the model

REFERENCES

Armstrong, D., & Savage, T. (2000). Effective Teaching in Elementary Studies, 2nd, ed. Macmillan company. https://www.semanticscholar.org/paper

Atallah, A., & Benguenab , A .(2021) .The competence of professors of the physical and sports education in the use of modern teaching strategies for middle school under the second generation curriculum. *Journal Acta Facultatis Educationis Physicae Universitatis Comenianae, 61*(01), 52-61. https://doi.org/10.2478/afepuc-2021-0005

Baron, R. M., & Kenny, D. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology, 51*(06), 11-73 http://dx.doi.org/10.1037//0022-3514.51.6.1173

Benguenab, A., & Atallah, A. (2022). Factor analysis of a tool for measuring the teaching competence of Algerian university professors. *Journal Fizicko vaspitanje i sport kroz vekov 9*(01*)* ,55-72. https://doi.org/10.5937/spes2201055A

Benguenab, A., Atallah, A., & Djourdem, B.(2021). The competence of professors of physical and sports education in the use of modern teaching strategies for middle school under the second generation curriculum. Journal Physical education and sport through the centuries, *8*(01), 68-79. https://doi.org/10.5937/spes2101068A

Bicker, F. (2000). Évaluation du stress. chez le personnel de l'ANPE .thèse présentée pour le déplome de docteur en médecine . Université de Louis pasteur, Faculté de medecine de Strasbourg, France. https://doi.org/10.1016/j.admp.2008.06.014

Comrey, A ., & Lee, H .(1992) .*A* first course in Factor Analysis of Change. Washinghton: American Psychological Association. http://www.sciepub.com/reference/224116

Diouf, J. (2007). Representations des competences professionelles d'enseignants d'E.P.S du moyen et secondaire au Senegal. senegal: Universite Cheikh Anta Diop. https://beep.ird.fr/collect/inseps/index/assoc/MI07-13.dir/MI07-13

laroua, H., & Gleyse, J. (2015). Professional competence requirements: the views of several physical and sports education teachers. *European Journal of Physical Education and Sport, 9*(3), p. 156-163. https://elibrary.ru/item.asp?id=25412187

Lance, M., & Butts, M. (2006). The sources of Four common reported cutoff criteria: What did they really say? *Organizational Research Methods.* 202-220, (2) *9.* http://dx.doi.org/10.1177/1094428105284919

Fabrigar, L. (1999). Evaluating the use of Exploratory Factor Analysis in Psychological Research Psychological Methods. *Journal Psychological Methods 4*(3), 272-299. https://psycnet.apa.org/doi/10.1037/1082-989X.4.3.272

Geffen, D. (2005). A practical guide to factorial validity using PLS-Graph: tutorial and annotated example. Communication. https://aisel.aisnet.org/cais/vol16/iss1/5

Gorsuch, R. (1983). Factor Analysis (2nd *ed.).* Hillslade NJ: Lawerence Erlbum. https://doi.org/10.4324/9780203781098

Hayton, J., Allen, D., & Scrpello, V. (2004). Factor Retention Decisions in Exploratory Factor Analysis A tutorial on Parallel Analysis. Journal *Organizational Research Methods, 6*(03), *191-205*. https://doi.org/10.1177/1094428104263675

Horn, L. (1965). A rationale and test for the number of factor in factor analysis . *Journal Psychomertika, 30*(02), 179-185. https://doi.org/10.1007/bf02289447

Hair, J. F. (2014). Primer on Partial Least Squares Structural Equation Modelling (PLS-SEM). Thousand Oaks: Sage. https://doi.org/10.54055/ejtr.v6i2.134

Razali, R., Benguenab, A & Atallah, A. The Critical Thinking in Physical Education and Sports Teachers. Journal Studia Universitatis Babes Bolyai Educatio Artis Gymnasticae, 69(01), 59-74. http://dx.doi.org/10.24193/subbeag.69(1).04

Kovac, M., Sloan, S., & Starc, G. (2014). Competencies in physical Education Teaching: Slovenian Teachers Views and Future Perspectives. *Journal European Physical Education Riview, 4* (3), 299-323. https://doi.org/10.1177%2F1356336X08095668

Laroua, H. (2016). Contribution du Programme de Formation de Master <MHM> dans la Perspective de Devloppement des Competences Professionnelles chez les enseignants d'EPS du secondaire. Mostaganem. http://e-biblio.univ-mosta.dz/handle/123456789/1131

Mrayeh, M., Carlier, G., & Feki, Y. (2013). Formation initiale et appropiation des competences professionnelles par les ensignants stagiaires en education physique et sportive(EPS). *IOSR Journal of Research Method in Education (IOSR-JRME), 1* (6), 1-12. https://www.researchgate.net/publication/315317468

Soysal, Y., & Radmard, A. (2018). An Exploration Of Turkish Prospective Teacher's Teaching Competencies Through the Analysis of Their Pedagogical Content Knowledge Documentations. *Journal Of Education, 198* (2), 165-180 https://doi.org/10.1177/0022057418811127

Stevens, J. (2002). Applied Multivariate Statistically based tests for the social Sciences (4th ed.). Hillsdale: Lawrence Erlbaum Associates. http://dx.doi.org/10.2307/1164712

Velicer, F., & Jackson, N. (1990). Component Analysis Versus Common Factor Analysis: Some Further Observations. *Journal Multivariate Behavioral Research, 25*(01), 97-114. https://psycnet.apa.org/doi/10.1207/s15327906mbr2501_12

Vinzi, V. E., Chin, W., Hensel, J., & Huiwen, W. (2010). Handbook of Partial Least Squares. New York: Springer Heidelberg Dordrecht. https://link.springer.com/book/10.1007/978-3-540-32827-8

Wetzels, M., & Odekerken, G. (2009). Using PLS path modelling for assessing hierarchical construct models: guidelines and empirical illustration. *Journal MIS Quarterly. 33* (1), 177-195/March 2009 Retrieved from http://dx.doi.org/10.2307/20650284

Yuan, K. H., & Bentler, P. (1998). Robust Mean and covariance structure analysis. *Journal of Mathematical and Statistical Psychology, 51*(01), 63-88. https://psycnet.apa.org/doi/10.1111/j.2044-8317.1998.tb00667.x

STUDIA UBB EDUCATIO ARTIS GYMN., LXX, 1, 2025, pp. 93-103
(RECOMMENDED CITATION)
DOI:10.24193/subbeag.70(1).08

Increasing the Explosive Power Through Plyometric Training in Athletes Under 18 Years Old

Cristian SANTA[1*], Andrei CRISAN[2], Onela SANTA[3]

Article history: Received 2024 December 20; Revised 2025 February 12; Accepted 2025 March 03; Available online 2025.03.30; Available print 2025.05.30

ABSTRACT. Increasing the explosive power through plyometric training is one of the most important aspects of sports, especially in team sports, regardless of players' training level. Explosive power represents muscles' ability to generate force quickly and is crucial for achieving a high vertical jump. Plyometric training, also known as jump training or explosive power training, is an essential method in preparing athletes to improve their physical performance, particularly in sports that require explosive strength and speed. **Methods:** The testing was conducted on two junior groups from the "School Sports Club" and BC 2B Sports Zalău, from the sports disciplines of volleyball and basketball, over a period of two and a half months. **Objective:** The objective of this study are to prove that the explosive power can be increased through plyometric training in athletes under 18 years old. **Results:** The analysis of the results was conducted after doing both the initial tests and the final tests for test 1, Sargent Jump Test from standing position, and test 2, Sargent Jump Test with full approach. Both teams completed the same tests, and the results were as follows: Volleyball team's first test showed increasing numbers - from 1 centimeters to 11 centimeters; Basketball team's first test showed increasing numbers- from 1 centimeters to 16 centimeters; Voleyball team's second test showed improved numbers - from 3 centimeters to 15 centimeters; Basketball team's second test showed improved numbers - from 0 centimeters to 19 centimeters. **Conclusion:** In summary, based on the results, this research has shown that plyometric training is an essential and efficient method for increasing the explosive power, developing the vertical jump and boosting the physical

[1] Faculty of Physical Education and Sport, Babeş-Bolyai University, Cluj-Napoca, Romania
[2] Faculty of Physical Education and Sport, Babeş-Bolyai University, Cluj-Napoca, Romania
[3] Onisifor Ghibu High School, Cluj-Napoca, Romania
* Corresponding author: cristian.santa@yahoo.com

performance of young athletes. Some subjects achieved good results in both tests, while others excelled in only one; however, the average results indicated that the hypothesis was confirmed.

Keyword: *Basketball, Voleyball, Sargent Jump Test, Explosive Power, Vertical Jump*

REZUMAT. ***Dezvoltarea detentei prin intermediul antrenamentelor de pliometrie la grupele de sportivi de sub 18 ani.*** Dezvoltarea detentei prin antrenamente pliometrice este unul dintre cele mai importante aspecte ale sportului, mai ales în sporturile de echipă, indiferent de nivelul de pregătire al jucătorilor. Forţa explozivă reprezintă capacitatea muşchilor de a genera forţă rapid şi este crucială pentru obţinerea unei sărituri verticale cât mai înalte. Antrenamentul pliometric, cunoscut şi sub numele de antrenament cu sărituri, este o metodă esenţială în pregătirea sportivilor pentru a-şi îmbunătăţi performanţele fizice, în special în sporturile care necesită forţă explozivă şi viteză. **Metode:** Testarea a fost realizată pe două grupe de juniori de la "Clubul Sportiv Şcolar" şi BC 2B Sports Zalău, din disciplinele sportive volei şi baschet, pe o perioadă de două luni şi jumătate. **Obiective:** Obiectivul acestui studiu este de a demonstra că detenta se poate dezvolta prin intermediul antrenamentelor de pliometrie la grupele de sportivi de sub 18 ani. **Rezultate:** Analiza rezultatelor a fost efectuată după finalizarea ambelor teste iniţiale şi finale pentru testul 1, Sargent Jump Test de pe loc şi testul 2, Sargent Jump Test din deplasare. Ambele echipe au efectuat aceleaşi teste, iar rezultatele au fost următoarele: Echipa de volei a prezentat o creştere a valorilor la primul test - de la 1 centimetru la 11 centimetri; Echipa de baschet a prezentat o creştere a valorilor la primul test - de la 1 centimetru la 16 centimetri. Echipa de volei a prezentat o îmbunătăţire a valorilor la al doilea test - de la 3 centimetri la 15 centimetri. **Concluzie**: Pe baza rezultatelor obţinute, cercetarea realizată a demonstrat că antrenamentul pliometric este o metodă esenţială şi eficientă pentru creşterea detentei şi îmbunătăţirea performanţei fizice generale a tinerilor sportivi. Rezultatele testelor pot varia, unii subiecţi obţinând rezultate bune la ambele teste, în timp ce alţii au excelat doar la unul; cu toate acestea, valorile medii crescute au indicat confirmarea ipotezei.

Cuvinte-cheie: *Baschet, Volei, Sargent Jump Test, Detentă, Săritură în înălţime*

INTRODUCTION

The increase of explosive power through plyometric training has been, is, and will remain one of the most important aspects of sports, particularly in team sports, regardless of the players' skill levels. Explosive strength and

explosive power are essential in most sports. Explosive power is the ability of muscles to generate force quickly and is crucial for achieving high vertical jumps. Bompa (2001) emphasizes the importance of explosive power in vertical jump development, stating that training focused on explosive power can significantly enhance this motor skill (Bompa, 2001). Recent studies also support this, showing that plyometric and explosive power exercises can significantly improve vertical jump performance (Markovic & Mikulic, 2010). Vertical jump is the ability of an athlete to elevate their center of gravity during a jump through a rapid and explosive action of the lower limb muscles (Dragnea & Teodorescu-Mate, 2002). The coordination between the muscles involved in jumping and the execution technique influences vertical jump performance. A well-developed jumping technique can maximize the efficiency of the force generated by the muscles (Alexe, 1993).

Research published in the Journal of Sports Medicine highlights the benefits of plyometric exercises on the elastic properties of muscles and jump performance (Komi & Gollhofer, 1997). Different types of plyometric exercises can have varying effects on sports performance. For example, vertical jumps and throwing exercises can be more effective for improving high jumps, while long jumps and sprint exercises can be more beneficial for developing lateral speed and agility (Moran et al., 2018).

The duration and intensity of a plyometric training program play a crucial role in muscular and neuromuscular adaptations. A training program of 6-12 weeks, with sessions 2-3 times per week, has been proven effective in improving sports performance (Ramirez-Campillo et al., 2014). The effectiveness of plyometric training can vary depending on the age and fitness level of the athletes. Young athletes and those with advanced fitness levels tend to benefit more from intense plyometric training compared to novice or older athletes (Lloyd et al., 2012).

Another study indicates that developing vertical jump through predominantly plyometric exercises increases musculo-tendinous stiffness, allowing better utilization of elastic energy stored during the amortization phase of the jump (Wilson et al., 1991). Plyometric training, also known as jump training or explosive power training, is an essential method in preparing athletes to improve their physical performance, especially in sports requiring explosive strength and speed. This type of training is based on exercises that combine speed and strength to develop muscular power (Chu, 1998).

These trainings replaced general physical preparation workouts, which were conducted twice a week. Thus, on Tuesdays and Thursdays, the volleyball and basketball subjects followed these experimental training plans with plyometric exercises. After the training period, tests were performed to determine if the

experiment was successful. For testing the subjects (initial and final) regarding vertical jump, we chose the following tests: the Sargent Jump Test from a standing position and the Sargent Jump Test with a run-up.

OBJECTIVE

The objective of this study is to demonstrate that the explosive power can be increased through plyometric training in athlete groups under 18 years old. The tests used involved vertical jumps from a standing position and with a run-up. By analyzing the results following plyometric training, we could assert with confidence that our desired objective is achieved in the case of significant improvements.

METHODS

The testing was conducted on two junior groups from the School Sports Club and BC 2B Sports Zalău, representing the sports disciplines of volleyball and basketball, over a period of two and a half months. A total of 20 male athletes participated in the study, 10 volleyball players from the School Sports Club and 10 basketball players from BC 2B Sports Zalău, aged between 13 and 15 years. All participants were registered athletes actively involved in local and regional competitions. The study was carried out in the training facilities of the two clubs, located in the city of Zalău. Participation in the study was based on informed consent provided by the athletes' parents.

The Vertec is a device for measuring vertical jump. It can be mobile or attached to an installation. The device provides rods at different heights, which athletes touch through jumping, providing real measurements of the subjects' vertical jump. Both tests will be conducted using the Vertec device. The first test will be the Sargent Jump Test from a standing position, conducted as follows: the athlete stands under the Vertec device and raises their arm as high as possible, reaching for the marked rods to determine the starting height, measured from the fingertips to the ground. After measuring, from a standing position, the athlete performs a maximal vertical jump, trying to touch the highest rod possible. The difference between the last rod touched by the subject and the starting height measured represents the subject's vertical jump (from a standing position). Each subject will have three attempts, with the best value being recorded. The second test will be the Sargent Jump Test with a run-up. The starting height measurements from the first test remain valid. This test will be conducted as

follows: from a standing position, face-to-face with the Vertec device and 5 meters away from it, the athlete performs a maximal vertical jump with a run-up, trying to touch the highest rod possible. Given the differences in sport techniques, the volleyball team will perform the run-up with the specific volleyball approach, while the basketball team can choose between jumping off both lower limbs or off one lower limb, both options being present in basketball. This choice was left open as the athletes already had a preferred technique they used more often, with which they obtained better results. The difference between the last rod touched by the subject and the starting height measured represents the subject's vertical jump (with a run-up). As with the other test, subjects will have three attempts, with the best value being recorded.

Fig. 1. Standing Sargent Jump Test
1.a. initial standing; **1.b.** standing jump; **1.c.** jump.

Fig. 2. Sargent Jump Test with approach
2.a. approach; **2.b.** jump take off; **2.c**. jump.

RESULTS

Table 1. Initial and final test results of the volleyball team

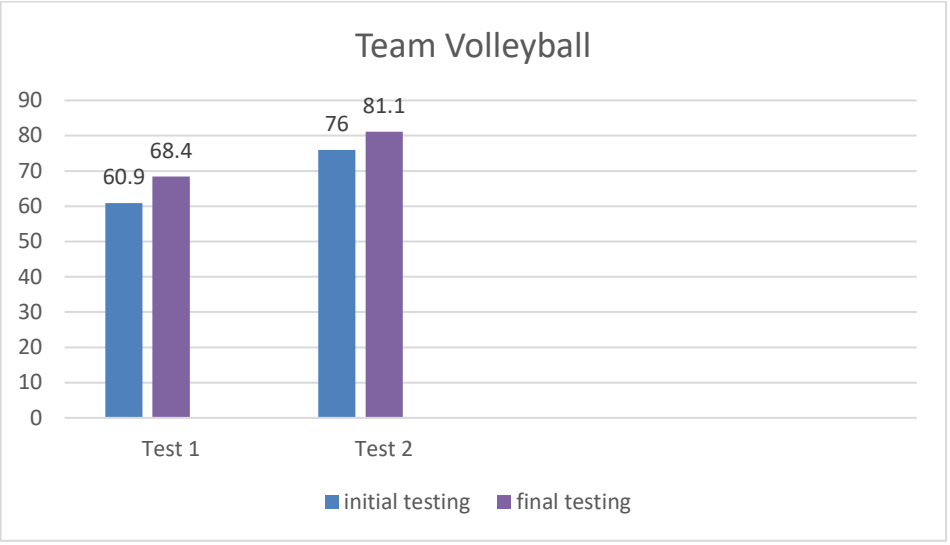
Name	Test No. 1 (cm)		Test No. 2 (cm)	
	T.i.	T.f.	T.i.	T.f.
A.S.	50	56	63	75
A.D.	57	62	70	74
C.R.	49	60	61	64
C.D.	56	62	76	80
C.G.	61	70	80	86
D.B.	60	67	83	89

Name	Test No. 1 (cm)		Test No. 2 (cm)	
	T.i.	T.f.	T.i.	T.f.
E.C.	75	82	93	95
F.C.	79	85	90	92
G.E.	64	75	75	82
G.D.	58	65	69	74
Mean	**60,9**	**68,4**	**76**	**81,1**
SD	**9,68**	**9,56**	**10,7**	**9,61**

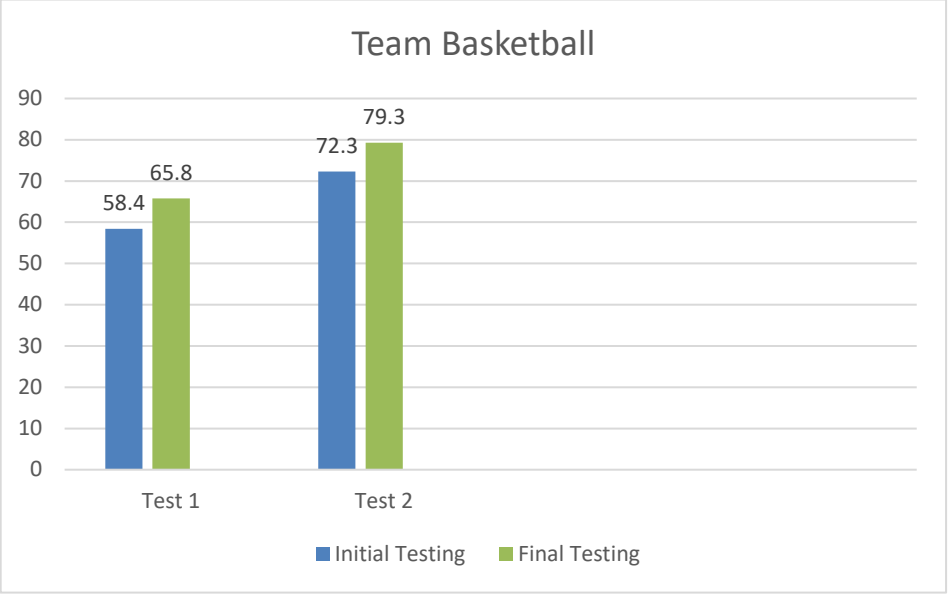
Table 2. Initial and final test results of the basketball team

Name	Test No. 1 (cm)		Test No 2 (cm)	
	T.i.	T.f.	T.i.	T.f.
I.R.	61	67	70	79
L.T.	40	55	60	65
L.S.	78	84	89	93
L.D.	49	62	66	76
M.S.	68	69	76	76
M.A.	59	70	74	79
P.C.	60	61	72	72
P.A.	48	56	67	77
R.I.	50	56	63	75
R.C.	71	78	86	92
Mean	**58,4**	**65,8**	**72,3**	**79,3**
SD	**11,82**	**9,75**	**9,39**	**8,46**

The results demonstrated a significant improvement in the physical performance of the athletes. For the volleyball team, the arithmetic mean of the initial and final values of Test No. 1 increased from 60.9 cm to 68.4 cm, and for Test No. 2 from 76 cm to 81.1 cm. Similarly, the basketball team recorded an increase from 58.4 cm to 65.8 cm for Test No.1 and from 72.3 cm to 79.3 cm for Test No. 2.



Graph No 1. Initial and final results of volleyball team in the standing Sargent Jump Test



Graph No. 2. Initial and final results of the basketball team in the Sargent Jump Test with approach.

DISCUSSION

The data collected in this study support the effectiveness of plyometric training in enhancing lower-body explosive strength in athletes under the age of 18. These findings are consistent with prior research by Markovic and Mikulic (2010), who demonstrated that structured plyometric programs lead to several beneficial neuromuscular adaptations. These include: Improved muscle activation and coordination between muscle groups; Enhanced mechanical efficiency of the muscle–tendon system; Increased effectiveness of the stretch-shortening cycle (SSC), which is critical for explosive actions such as jumping and sprinting

The improvements observed in vertical jump performance among both volleyball and basketball players in this study reflect these underlying physiological changes. The rise in jump height following the training intervention aligns with mechanisms previously identified in older or more experienced athletic populations, indicating that similar responses can be expected in adolescents.

To evaluate athlete progress, this study utilized the My Jump smartphone application. The accuracy and reliability of this tool were previously examined by Yingling et al. (2018), who compared it to the more traditional Vertec system. Given these findings, the My Jump app can be considered a viable and accessible tool for field-based assessment, particularly in settings where advanced equipment is not available. However, to maintain consistency in repeated measurements, it is recommended that the same tool be used throughout the assessment period, rather than switching between devices.

Although average group performance improved, the degree of progress varied considerably between individuals. This variation highlights the need for more personalized approaches to training. Markovic and Mikulic (2010) emphasize that an athlete's response to plyometric exercises depends on several factors, including:

- Initial fitness level and physical maturity
- Training load and intensity
- Prior experience with explosive training methods

These differences reinforce the importance of tailoring training programs to the individual rather than relying solely on uniform routines. Personalized adjustments may help optimize gains while reducing the risk of overtraining or injury.

CONCLUSIONS

Based on test results, both plyometric and explosive strength exercises can significantly improve vertical squat performance. This experiment aimed to investigate the effectiveness of plyometric training in the increasing of the explosive power of athletes under 18 years of age, through studies conducted on two teams, volleyball and basketball. Throughout the research, initial and final data were collected to evaluate the athletes' progress, utilizing various methods and specific plyometric training techniques. This process allowed for a detailed analysis of how plyometric exercises influence the jumping ability and explosive power of young athletes. For the volleyball team, the arithmetic mean of the initial and final values of Test No. 1 increased from 60.9 cm to 68.4 cm, and for Test No. 2 from 76 cm to 81.1 cm. Similarly, the basketball team recorded an increase from 58.4 cm to 65.8 cm for Test N0.1 and from 72.3 cm to 79.3 cm for Test No. 2. These improvements confirm the effectiveness of plyometric training in the increasing of the explosive power and support the research hypothesis. The detailed analysis of the athletes' progress also revealed that the improvements were not uniform, with significant individual variations, highlighting the importance of tailoring training programs to the specific needs of each athlete. Therefore, considering the obtained results, we can conclude that the objective was achieved, with significant improvements observed. This indicates that the explosive power can be increased through plyometric training in athletes under 18 years of age.

REFERENCES

Alexe, N. (1993). *Teoria şi metodica antrenamentului sportiv*. Editura Didactică şi Pedagogică.

Bompa, T. (2001). *Periodizarea: Teoria şi metodologia antrenamentului sportiv*. Editura EX PONTO.

Chu, D. A. (1998). *Jumping into plyometrics*. Human Kinetics.

Dragnea, A., & Teodorescu-Mate, S. (2002). *Teoria sportului*. Editura FEST.

Komi, P. V., & Gollhofer, A. (1997). Stretch reflex can have an important role in force enhancement during SSC-exercise. *Journal of Applied Biomechanics, 13*(4), 451–460. https://doi.org/10.1123/jab.13.4.451

Lloyd, R. S., Oliver, J. L., Hughes, M. G., & Williams, C. A. (2012). The effects of 4-weeks of plyometric training on reactive strength index and leg stiffness in male youths. *Journal of Strength and Conditioning Research, 26*(10), 2812–2819.

Markovic, G., & Mikulic, P. (2010). Neuromuscular and performance adaptations to lower-extremity plyometric training. *Sports Medicine, 40*(10), 859–895. https://doi.org/10.2165/11318370-000000000-00000

Moran, J., Sandercock, G. R., Ramírez-Campillo, R., Meylan, C., Collison, J., & Parry, D. A. (2018). Age-related variation in male youth athletes' countermovement jump following plyometric training. *Journal of Strength and Conditioning Research, 32*(2), 567–576.

Ramírez-Campillo, R., Meylan, C., Alvarez, C., Henríquez-Olguín, C., Martínez, C., Cañas-Jamett, R., & Izquierdo, M. (2014). Effects of in-season low-volume high-intensity plyometric training on explosive actions and endurance of young soccer players. *Journal of Strength and Conditioning Research, 28*(5), 1335–1342.

Wilson, G. J., Newton, R. U., Murphy, A. J., & Humphries, B. J. (1991). The optimal training load for the development of dynamic athletic performance. *Medicine and Science in Sports and Exercise, 25*(11), 1279–1286.

Yingling, V. R., Castro, D. A., Duong, J. T., Malpartida, F. J., Usher, J. R., & Ong, J. (2018). The reliability of vertical jump tests between the Vertec and My Jump phone application. *Journal of Physical Therapy Science, 30*(9), 1341–1346. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5912202/

STUDIA UBB EDUCATIO ARTIS GYMN., LXX, 1, 2025, pp. 105-114
(RECOMMENDED CITATION)
DOI:10.24193/subbeag.70(1).09

Craiova's Sports Facilities and Their Effect on Sports Performance

Sándor VIZI[1]*, István BALOGA[1]

Article history: Received 2025 March 06; Revised 2025 April 29; Accepted 2025 April 30; Available online 2025.03.30; Available print 2025.05.30

ABSTRACT. This study explores the correlation between investments in sports infrastructure and sport performance in the city of Craiova, Romania. Known for its rich cultural history and sporting tradition, Craiova has undergone significant infrastructural transformations over the past two decades. The article reviews key facilities and their influence on local, national and international sporting achievements, highlighting public investment, access to modern amenities, and community engagement.

Keywords: *Craiova, sports infrastructure, public investment, urban development, Romania*

INTRODUCTION

Craiova, known as the capital of the historic Oltenia region, is located on the Jiu River, in the centre of this region, in a relatively low-lying lowland area, a city with rich historical tradition, which was first mentioned in 1475.

Craiova is an important urban Centre with a well-developed infrastructure, hosting numerous sporting events, and is a recognized Centre of Romanian sport with traditional teams and high-quality sports facilities. In the last two decades there have been major investments in sports infrastructure.

[1] Faculty of Physical Education and Sport, Babeş-Bolyai University, Cluj-Napoca, Romania
* Corresponding author: sandorvizi@yahoo.com

AIM

This article aims to analyze the relationship between the development of sports infrastructure and athletic performance in Craiova, Romania. It investigates how recent public investments in facilities such as stadiums, sports halls, swimming pools, and recreational parks have influenced both professional and amateur sports.

Sports Infrastructure: Sports Facilities and Investments

Craiova currently has an extensive network of modern sports facilities serving both professional and amateur athletes. These include football stadiums, multi-purpose halls, swimming pools and various pitches, many of which have been recently built or rehabilitated with public support.

Ion Oblemenco Stadium (Stadionul Ion Oblemenco)

It is one of the most impressive sports arenas in Romania, with a capacity of 30944 seats.

The construction of the stadium, started in 2015 on the site of the old stadium of the same name, cost €52 million, financed by public funds, and was inaugurated in 2017.

The stadium is home to the football teams C.S. Universitatea Craiova (Universitatea Craiova, 2025), one of the top-ranked teams in the national championship (Liga I), and FCU 1948 Craiova Fotbal Club, currently playing in Liga II, both teams consider themselves the successor of the successful University team. We observed that football clubs consider spending money on their team as a consumption activity. As consumers, club owners act as if they are maximizing a utility function where other variables, beside profits, appear as arguments; this might include playing success, stadium attendance, competitive balance, community building, et cetera (Baloga, et. al., 2011, p. 33).

C.S. Universitatea Craiova has won the Romanian Cup twice in recent years (2018, 2021) and was national vice-champion in the 2019-2020 season (Universitatea Craiova, *Stadionul, 2025*).

The first stadium in this location was inaugurated in 1967 with an international match between Romania and Poland (2-2). Famous teams such as Bayern Munich (1981-1982 season) and Benfica Lisbon (1982-1983 UEFA Cup semi-final) have played on the pitch.

Since 1996 the stadium has been named after Ion Oblemenco, known as "The Gunner of the Bănie", a former legend of Universitatea Craiova.

Between 2015-2017 the original stadium was demolished and completely rebuilt; the works being completed in just two years. The new stadium was inaugurated on November 10, 2017, in a match in which Universitatea received the visit of Slavia Prague (friendly match).

The newly built stadium has a capacity of 30,944 seats, all covered, and is one of the largest and most modern stadiums in Romania, with a modern architecture and a distinctive roof that mimics the shape of a volcano (Universitatea Craiova, *Stadionul, 2025*).

Fig. 1. Ion Oblemenco

The stadium is mainly used for football matches but can also host other sporting events or occasionally concerts or other cultural events.

Craiova Sport Hall (Sala Polivalentă Craiova)

Craiova's Sala Polivalentă is used for handball, basketball, volleyball and other indoor sports. It also hosts cultural events and is a source of attraction for the local community.

The venue was opened in 2012, after the old Sports Hall was destroyed by fire in 1994, and quickly became a focal point for sporting and cultural events.

The hall has a seating capacity of 4,215, including 109 VIP seats for sports events, and can be expanded to over 5,000 seats for concerts and other types of events, with state-of-the-art technological equipment, including high-performance lighting and sound systems (RAADPFL, 2025).

The hall is used for basketball, volleyball and handball competitions, hosting teams participating in national competitions in women's handball (Liga Florilor, 6th place, season 2023-2024), men's basketball (National League, 11th place, season 2023-2024), men's volleyball (A1 Division, 9th place, season 2023-2024) and women's volleyball (A1 Division, 9th place, season 2023-2024).

Craiova's Sala Polivalentă is also ideal for organizing international sports, in January 2025 Romania's tennis team will receive the visit of the Bulgarian team in the Davis Cup (Digi Sport, 2025).

In addition to sports competitions, the hall hosts concerts (during the We Love Retro event, the largest retro party in Romania, in 2019 (Gazeta de Sud, 2025) Captain Hollywood Project, No Mercy, Mr. President, Rednex, and Brooklyn Bounce Dj), theatre performances, exhibitions, wedding fairs and other events.

Among the modern facilities of the hall, we can mention the multifunctional court, which allows adaptation for various sports, with interchangeable surfaces, the electronic table with LED screens for displaying scores and information

Carol I Swimming Pool (Bazinul de înot "Carol I")

The "Carol I" swimming pool was rehabilitated and inaugurated in 2020 (Hantea, 2025), after a period of inactivity of more than two decades, with swimming lessons for students aged 6 to 18 years have been organized since November 2022.

Originally built in 1978, the pool was closed in 1996-1997 due to deterioration and lack of funds. The total value of the rehabilitation works that started in 2019 amounted to 2,380,800 lei, with funding coming from the local budget. These works included changing the floor tiles, redoing the interior and exterior installations as well as the central heating system.

The pool is 25 meters long, 9.6 meters wide and between 1.4 and 1.9 meters deep, with five swimming lanes. The building has changing rooms, showers, toilets and is equipped with modern dehumidification and water treatment systems.

Initially, the pool was intended exclusively for the students of the "Carol I" National High School for physical education and sports classes. Later on, access was extended to other children and students from Craiova, by appointment, and swimming lessons were organized.

In Romania some of the swimming pools after the pandemics were still closed, therefore most of the children who were attending swimming classes have switched to basketball,football, tennis and track and field practices (Negru et al., 2020, p.50).

The Carol I pool exemplifies how local investment can bring abandoned sports infrastructure back to life.

Nicolae Romanescu Park Sports Center (Centrul Sportiv din Parcul Nicolae Romanescu)

The Nicolae Romanescu Park Sports Center offers facilities for recreational activities, including football pitches, outdoor fitness areas and running tracks, and is one of the largest and most beautiful natural parks in Romania, with various facilities for sports and leisure activities.

Inside the park you can enjoy a variety of activities in the following categories:

Tennis

There are four professional tennis courts within the Pro Tennis Club, covered with a bubble heated up to 20°C, so tennis can be practiced all year round. The tennis complex has a training room, bar and terrace, showers, changing rooms, coaches, a physical trainer and nurse.

Equestrian sports

The park is also home to one of the largest racecourses in the country, covering more than 17 hectares and containing three horse stables and a wooden gazebo.

As the largest in the country, the racecourse was built in 1903 for equestrian competitions. After World War II, show jumping competitions were organized. In 1957 the equestrian section restarted its activities, founding the Club Sportiv Orășenesc, the section being registered in the Romanian Equestrian Federation in 1960. In 1969 a stable for 12 horses was built, replaced in 1970 with a new one for 21 horses (D.Z. Arena Constructiilor, 2017).

The racecourse has hosted numerous show jumping competitions in the past, including the first Balkan equestrian championship in Romania. Unfortunately, however, due to its state of repair, no more competitions were organized after 2000.

In recent years there have been reports that the local authorities plan to modernize the racecourse to bring it up to international standards, with the aim of organizing major sports competitions.

Other sport activities

Along with tennis and equestrian sports, Nicolae Romanescu Park is a popular place for other sport and leisure activities, the park's alleys offer ideal jogging and cycling trails, and it also hosts a Zoo which is one of the oldest in Romania (opened in 1906) and has a lot of exotic animals.

Nicolae Romanescu Park is a national monument, one of the most representative examples of landscape art in Romania.

Parcul Tineretului (Youth Park)

Parcul Tineretului has a long history, being established in 1882 on the Mofleni estate, as a place to combine relaxation with physical activity. The local authorities invested in modernizing the park's sports infrastructure and the

park was given its current name in 2009, with the inauguration of the tennis courts being carried out by former tennis legends Ilie Năstase and Mansour Bahrami.

Currently the Youth Park is equipped with several sports courts (RAADPFL2, 2025):

- Tennis - 4 approved courts.
- Football - 4 small synthetic grass fields
- Basketball - 2 synthetic surface courts.
- Table Tennis - 10 concrete tables.
- Chess - 10 tables.
- Roller and skate track.
- Mini golf course.
- 12 km of paved jogging and cycling paths.
- Outdoor fitness areas.
- Climbing and extreme sports areas inaugurated in 2022, realized through the project **Basecamp** (Basecamp, 2025)**.**

Fig. 2. Năstase and Bahrami at the inauguration of the tennis courts (*Gazeta de Sud, 2009, https://www.gds.ro/Actualitate/2009-10-31/Ilie-Nastase-si-Bahrami-meci-in-ploaie/*),

The local administration plans to expand the park's sports infrastructure by adding new courts, including for less traditional sports such as rugby or padel or even creating mountain biking trails. More Olympic sports would be interesting to be also included since some Olympic ball games were included in the program, and then taken out from there, either because of their popularity routes are fought their presence in the tournament again. In such sports as tennis or rugby and golf. During the hundred years of Olympics, nearly, a number of interesting sport balls appeared on the program,and has been forgotten (Bíró et. al., 2016, p. 200). There is also talk of installing night lighting so the pitches can be used in the evening.

Craiova's Youth Park offers a modern infrastructure and a pleasant environment for exercise and training. Unfortunately, however, some pitches (football, tennis and minigolf) can only be used by appointment after payment of a fee (football: 65 lei per hour from 08.00-18.00; 75 lei per hour from 18. 00-21.00; tennis: 13 lei per hour from 08.00-13.00 and 15 lei per hour from 18.00-21.00; mini-golf: 6.5 lei per hour from 08.00-18.00 and 7.5 lei per hour from 18.00-21.00).

Fantasy Park

Fantasy Park is a theme park, opening on June 1, 2024, International Children's Day, and is aimed at visitors of all ages, with children's playgrounds inspired by fairy tales and fairy tales.

The park also features a fitness area with outdoor exercise equipment.

Work is currently underway on a skatepark to be completed in the near future. The estimated value of the project is around €2.9 million, which is more expensive than building the park. The tender for the project has attracted great interest with several companies submitting bids.

Once finalized, the skatepark will complete the offer of urban sports (skateboarding, rollerblading, BMX) in the municipality, a category of infrastructure which had been previously missing in Craiova.

Water Park Craiova

Water Park Craiova is a modern leisure and water fun complex in Craiova, opened in 2017 and operating year-round with indoor and outdoor facilities.

Along with the swimming pools, water slides and sauna intended for the public eager to have fun, the water park also contains a fitness room for maintaining health and fitness, and swimming courses are also conducted for those interested. For those who want to swim, there is a 1250 square meter outdoor swimming pool.

Also, for sports, an area with courts for beach soccer, beach tennis and beach volleyball has been set up.

Among the future plans there is information that towards the end of 2024 the University of Craiova has obtained funding through PNRR 8 million euro for the construction of a sports complex that will include an Olympic swimming pool (50x25 meters) and a training pool (25x12.5 meters) (Grosu, 2024). This complex will be intended for the university's students for both sports competitions and recreation.

The major sports clubs in Craiova

Craiova is home to several renowned sports clubs active in various disciplines:

Universitatea Craiova: the football team with a remarkable history, nicknamed "The Champion of One Great Love", is one of the most loved teams in Romania. The club has a strong fan base and has won numerous trophies over the years.

The team's record is impressive: 4 times Romanian champion (1973-1974, 1979-1980, 1980-1981, 1990-1991), 8 times winner of the Romanian Cup (1976-1977, 1977-1978, 1980-1981, 1982-1983, 1990-1991, 1992-1993, 2017-2018, 2020-2021), winner of the Romanian Super Cup in 2021, UEFA Cup semi-finalist in the 1982-1983 season and European Champions Cup quarterfinalist in 1981-1982.

At the beginning of 2025 the team was in title contention, ranking in the top half of the standings.

The club also has a women's soccer team that in the 2023-2024 season was promoted to the second league.

Sport Club Municipal Craiova is a public sports club founded as a public institution subordinated to the City Hall of Craiova and the City Council of Craiova, being established in 2006.

The Municipal Sports Club was established with teams for women's basketball, men's basketball, women's handball, women's and men's volleyball, at the moment operating the teams for women's handball, men's basketball and men's volleyball, respectively boxing, kempo and equestrian sports.

In the 2017-2018 season the women's handball team achieved the notable feat of winning the EHF Cup. In the final, held in Craiova's Sala Polivalenta, SCM Craiova defeated the Norwegian team Vipers Kristiansand 30-25, thus making European handball history (Agerpres, 2018).

More recently, the club stands out for its performances in boxing, with Craiova's sportsmen and sportswomen winning a lot of medals in national competitions and in kempo, both in national and international competitions.

In addition to the big clubs mentioned, Craiova has many private clubs and associations that complete the sports landscape. There are court tennis clubs (e.g. the CSU Craiova tennis section, private clubs of the same profile) that organize courses for juniors, martial arts clubs (karate, judo, taekwondo), sports dance, bodybuilding and fitness, children's football schools, as well as cycling and athletics groups. These smaller entities help popularize sport at the grassroots level and provide opportunities for participation for different segments of the population.

An important role is also played by the Dolj County Directorate for Sport and Youth, which together with the City Hall and the City Council supports the organization of amateur sports competitions and events.

Promotion of sport in Craiova

Craiova City Hall and local sport organizations actively support the development of sport through investments in infrastructure and organization of sport events. The city hosts football competitions, tennis tournaments, handball championships and events for running and cycling enthusiasts.

Craiova has a diversified sports infrastructure and organizes large-scale events, the city demonstrates that sport is a central element of urban life, offering opportunities for all ages and levels of training.

CONCLUSION

Craiova's evolution in terms of sports infrastructure offers a compelling case for urban sports planning in post-socialist Eastern Europe. Continued support for facility expansion and grassroots initiatives remains vital to sustaining this trajectory.

REFERENCES

Agerpres (2018), Handbal feminin: SCM Craiova a cucerit Cupa EHF, https://www.agerpres.ro/sport-intern/2018/05/11/handbal-feminin-scm-craiova-a-cucerit-cupa-ehf--107053

Arena Constructiilor, D.Z. (2017). *Cel mai mare hipodrom din tara propus spre modernizare*, https://arenaconstruct.ro/cel-mai-mare-hipodrom-din-tara-propus-spre-modernizare/

Baloga, I., Pop, G., Tocan, H., (2011). Study regarding maximum profit or maximum utility applied by professional sports organizations. *Studia Universitatis Babes-Bolyai, Educatio Artis Gymnasticae LVI* (4), p. 31-36

Bíró, M., Széles-Kovács, G., Stregova, Z., Baloga, I., Dobay, B., (2016). *Az olimpiák elfeledett labdajátékai, The forgotten Olympics ball games*. Acta Academiae Agriensis, Sectio Sport, 2016. Különszám Nova series tom. XLIII. pp 199—212

Basecamp (2025). Basecamp, https://www.facebook.com/basecamp.craiova/.

Digi Sport (2025). *Cupa Davis: România - Bulgaria 1-3. Filip Jianu a pierdut cu Adrian Andreev, iar românii vor evolua în Grupa Mondială II.* Retrieved on 01.02.2025, https://www.digisport.ro/tenis/cupa-davis-romania-bulgaria-1-3-filip-jianu-a-pierdut-cu-adrian-andreev-iar-romanii-vor-evolua-in-grupa-mondiala-ii-3405551

Gazeta de Sud (2016). Retrieved on 08.04. 2025, https://www.gds.ro/Sport/2006-10-31/Apare-Sport-Club-Municipal-Craiova/

Gazeta de Sud (2025). Retrieved on 08.04. 2025, https://www.gds.ro/Bani-afaceri/publireportaj/2019-04-25/we-love-retro-ii-aduce-si-pe-captain-hollywood-project-la-craiova

Grosu, C. (2024). Bazin de înot la Facultatea de Sport din Craiova, prin PNRR, Retrieved on 07.04.2025, https://www.jurnalulolteniei.ro/2024/04/03/bazin-de-inot-la-facultatea-de-sport-din-craiova-prin-pnrr/

Hantea, O. (2025). Bazinul de înot de la Carol I, tot cu lacătul pe uşă. Explicaţia Olguţei Vasilescu, Retrieved on 07.04.2025, https://www.editie.ro/craiova-bazinul-de-inot-de-la-carol-i-tot-cu-lacatul-pe-usa-explicatia-olgutei-vasilescu.html,

Negru, I.N., Baloga, I., András, Á., (2020), Physical activity level during pandemic-A pilot study. *Studia Universitatis Babes-Bolyai*, *Educatio Artis Gymnasticae 65* (4), p. 49-58, DOI: https://doi.org/10.24193/subbeag.65(4).30

RAADPFL (2025). Craiova, *Sala Polivalenta*. Retrieved on 05.01. 2025, https://raadpflcraiova.ro/sala-polivalenta,

RAADPFL2 (2025). Craiova, *Parcul Tineretului*. Retrieved on 05.01. 2025, https://raadpflcraiova.ro/parcul_tineretului/

Universitatea Craiova, *Stadionul (2025),* Retrieved on 04.29.2025 from https://www.ucv1948.ro/stadion

Universitatea Craiova (2025), Retrieved on 04.29.2025 from https://www.ucv1948.ro/