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<https://doi.org/10.17979/sportis.2025.11.2.11505>

Evaluating university sport science students' perceptions following a service-learning intervention in high schools

Evaluación de las percepciones de los estudiantes universitarios de ciencias del deporte tras una intervención de aprendizaje-servicio en escuelas secundarias

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Editorial Schedule: Article received 16/12/2024 Accepted: 18/02/2025 Published: 01/04/2025

<https://doi.org/10.17979/sportis.2025.11.2.11505>

To cite this article use the following reference:

Pecci, J.; Galiano, C.; Carnero-Díaz, A.; Gil Delgado, J.L. (2025). Evaluating university sport science students' perceptions following a service-learning intervention in high schools. *Sportis Sci J*, 11 (2), 1-13 <https://doi.org/10.17979/sportis.2025.11.2.11505>

Author contribution: All authors contributed equally to the work.

Funding: No funding sources were used for the preparation of this article. The authors did not receive any financial benefit from the preparation of this manuscript.

Conflict of interest: The authors declare that they have no conflict of any kind

Ethical aspects: The study states the ethical aspects.

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Abstract

This study examined university and high school students' perceptions following a biomechanics-focused service-learning intervention. Five sports science students taught biomechanics to five high school students through four sessions combining theory and practice, concluding with a conference presentation. Students were asked how they felt about the program across basic, pedagogical, and organizational dimensions, and self-assessment reliability was calculated. Both groups reported high satisfaction, with scores averaging over 3 out of 4. High school students demonstrated reliable self-assessment, reflecting effective knowledge retention. Findings suggest that service-learning is an effective pedagogy in biomechanics, enhancing comprehension of complex concepts and fostering positive interconnections between university and high school students.

Keywords: education, teaching methods, high school, student engagement, technology.

Resumen

Este estudio examinó las percepciones de estudiantes universitarios y de secundaria tras una intervención de aprendizaje-servicio enfocada en biomecánica. Cinco estudiantes de ciencias del deporte enseñaron biomecánica a cinco estudiantes de secundaria a través de cuatro sesiones que combinaron teoría y práctica, concluyendo con una presentación en una conferencia. Las percepciones se evaluaron en dimensiones básicas, pedagógicas y organizativas, y se calculó la fiabilidad de la autoevaluación. Ambos grupos reportaron una alta satisfacción, con puntajes superiores a 3 de 4. Los estudiantes de secundaria demostraron una autoevaluación fiable, lo que refleja una retención efectiva del conocimiento. Los hallazgos sugieren que el aprendizaje-servicio es una pedagogía efectiva en biomecánica, ya que mejora la comprensión de conceptos complejos y fomenta interconexiones positivas entre estudiantes universitarios y de secundaria.

Palabras claves: educación, métodos de enseñanza, escuela secundaria, compromiso del estudiante, tecnología.

Introduction

Service-learning has emerged as a pedagogical strategy that combines academic content with practical, real-world experiences, allowing students to engage in meaningful activities that benefit both the students and the community (i.e., population receiving the service offered) (Salam et al., 2019). Within this framework, alternative (i.e., from classical lecture in which teacher speaks and students primarily listen) learning methods have demonstrated positive outcomes in various educational fields, including health and sport sciences (Cuenca-Soto et al., 2023; Pecci et al., 2024; Ruiz-Montero et al., 2023). In the context of sport sciences, service-learning offers an ideal

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platform for applying theoretical knowledge to real-world teaching scenarios. Biomechanics, as a subfield of sport sciences, involves the study of the mechanical laws relating to human movement (Izquierdo, 2010). Understanding these principles is essential for students in sport science, as it informs their future roles as coaches, trainers, or sport therapists. However, translating this knowledge into accessible lessons for younger students with limited prior knowledge constitutes a unique challenge. Despite the benefits of service-learning, such as promoting personal and social skills (Simons & Cleary, 2006), several challenges exist in its implementation (Chong, 2014; Matthews & Zimmerman, 1999) such as the possibility that the student may not be motivated (Matthews & Zimmerman, 1999). In this regard, it is important to understand the individual characteristics of the group before implementing this alternative methodology (Chong, 2014; Matthews & Zimmerman, 1999), which could make it challenging to apply in large groups. However, despite the lack of literature supporting service-learning in sport sciences students (Chiva-Bartoll et al., 2019), various advantages have been widely reported, such as creating more engaging learning environments, reinforcing academic content, and fostering the development of social responsibility (Matthews & Zimmerman, 1999; Salam et al., 2019). Specifically, the literature on service-learning in sport science education is relatively limited (Chiva-Bartoll et al., 2019). Furthermore, there is no service-learning methodology application in students of a lower education level (i.e., high school level education) and aiming to develop a final goal such as presenting the obtained knowledge in a formal context. Given the lack of research in these aspects, the present study aimed to evaluate the perceptions of both high school students as learners and university students as teachers for developing a conference in a congress about the content taught in class. Our main hypothesis was that university students would perceive service-learning as a positive tool to improve their knowledge in their sport sciences degree subject, while high school students would perceive the experience of developing the content for the conference as a very positive experience. We hypothesized that university students would perceive service-learning as an effective tool for enhancing their knowledge in sport science, while high school students would view the experience of preparing content for a conference as a highly positive learning opportunity.

Original article. Evaluating university sport science students' perceptions following a service-learning intervention in high schools. Vol. 11, n.º 2; p. 1-13, April 2025.
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Methods

Experimental Design

The current study was conducted within the curriculum of the "Biomechanics of Physical Activity and Sport" subject. This subject is part of the Sport Science degree program at the University of Seville (Seville, Spain) and was part of the first semester of the second year. However, the present intervention was conducted during the second semester, with the subject finalized. The methodology employed within the course was a combination of flipped learning and classical teaching with masterclasses, but service-learning was not previously used in the subject. Furthermore, the students involved in the present study had any experience with this learning methodology.

During the present intervention, sport science students assumed the role of teachers, whereas the high school students served as students for assimilating biomechanical-related contents. Given this context, sport sciences degree students had to teach biomechanical contents about strength-related abilities such as. jumping, strength and speed (i.e., learned during the subject in the first semester), thus adapting the content to the level of high school students. The final goal of the lessons was preparing a conference in which the high school students would present the results of the service-learning process, as well as the obtained knowledge about biomechanics.

Participants

Five Sport Science degree students (age range: 19 to 22 years old; men (n) = 4; women (n) = 1) and five high school students (age range: 15-16 years old; boys (n) = 3; girls (n) = 2) were involved in the present study. High school students belonged to different schools of Andalucía (Spain), whereas all involved sport sciences students belonged to the University of Seville (Seville, Spain). All participants were volunteers, and the activity had no repercussion on both sport sciences and high school students, thus avoiding conflict of interests. This study did not require ethical committee approval as it did not involve direct medical or psychological intervention, the collection of sensitive data, or expose participants to any significant risks. All participants provided informed consent prior to their involvement in the study.

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Procedure

Four sessions were conducted to prepare the final conference, celebrated in Córdoba (Andalucía, Spain). For the first three lessons, sport science students prepared the content about jumping, strength and speed biomechanics (one lesson per content). In the fourth session, sport science students and high school students prepared the conference talk. All sessions had five hours of duration and consisted of a first part of theory in addition to a practical session. High school students had to employ technological tools to assess their own performance in the three biomechanical dimensions (i.e., jumping, strength and speed), thus integrating the theoretical part into the practical session. In the fourth session, preparation of slides and the speech for the presentation in the conference, in addition to a working memory of the previous sessions was carried out. All this process was supervised by Sport Science degree teachers and a high school tutor.

After the intervention (i.e., the fourth session and the presentation in the final conference), both sport science and high school students filled out a previously validated rubric to assess their perceptions of the process carried out (Serrano et al., 2015). This questionnaire evaluated basic, pedagogical and organizational dimensions, rating each item from 1 to 4, 1 representing the lowest value and 4 highest value. Basic dimension evaluated project needs, service offered, sense of the project and learning obtained. Pedagogical dimension assessed degree of participation, teamwork, reflection on the different points of the work, recognition of knowledge and evaluation of knowledge. Organizational dimension evaluated collaboration between centers, consolidation of centers and consolidation of entities. This organizational dimension was completed only by the tutor, since high school students did not participate in the organizational tasks for the session. In addition, reliability of the students assessing their own performance in jumping, strength and speed performance was calculated. For this purpose, high school students performed each learned test two times. This measure of reliability and consistency was obtained to assess whether secondary school students have truly acquired the knowledge about biomechanics that was taught, as greater reliability will demonstrate a higher retention of content (i.e., a better and more consistent evaluation).

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Statistical Analysis

A descriptive analysis was performed on the scores of each group (i.e., high school and sport sciences students), with scores reported as mean $\pm$ standard deviation. Additionally, the reliability of the students in performance tests was tested using coefficient of variations (CVs), intra-class coefficient correlation (ICC (2,1)) and Chronbach's α . Statistical analysis was performed using the Jamovi software (The Jamovi project, 2019, Version 2.3.18), with significance set at $\alpha < 0.05$.

Results

Perceptions of both high school and university students are presented in Tables 1, 2 and 3.

Table 1. Basic dimension results of the perceptions of university (sport science bachelor) and high school students after service-learning intervention.

Basic dimension	Project needs		Service offered		Sense of the project		Learning obtained	
	High school	Sport science bachelor	High school	Sport science bachelor	High school	Sport science bachelor	High school	Sport science bachelor
N	5	5	5	5	5	5	5	5
Average	4	3	3.8	3.20	3.8	3.40	4	3.60
SD	0	0.7	0.4	0.84	0.4	0.55	0	0.55
Min.	4	2	3	2	3	3	4	3
Max.	4	4	4	4	4	4	4	4

Table 2. Pedagogical dimension results of the perceptions of university (sport science bachelor) and high school students after service-learning interventions.

Pedagogical dimension	Degree of participation		Teamwork		Reflection on the different points of the work		Recognition of knowledge		Evaluation of knowledge	
	High school	Sport science bachelor	High school	Sport science bachelor	High school	Sport science bachelor	High school	Sport science bachelor	High school	Sport science bachelor
N	5	5	5	5	5	5	5	5	5	5
Average	3.80	3	4	2.80	3.60	3.20	3.60	2.60	4	3.40
SD	0.45	0.70	0	1.10	0.55	0.45	0.55	1.34	0	0.9
Min.	3	2	4	1	3	3	3	1	4	2
Max.	4	4	4	4	4	4	4	4	4	4

Original article. Evaluating university sport science students' perceptions following a service-learning intervention in high schools. Vol. 11, n.º 2; p. 1-13, April 2025.
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Table 3. Organizational dimension results of the perceptions of university (sport science bachelor) and high school students after service-learning interventions.

Organizational dimension	Collaboration between centers		Consolidation of centers		Consolidation of entities	
	High school	Sport science bachelor	High school	Sport science bachelor	High school	Sport science bachelor
N	1	5	1	5	1	5
Average	4	3.60	3	3	2	3.20
SD	-	0.55	-	0.70	-	0.84
Min.	4	3	3	2	2	2
Max.	4	4	3	4	2	4

Figure 1 summarizes both individual and group results, reflecting a high satisfaction in all assessed domains.

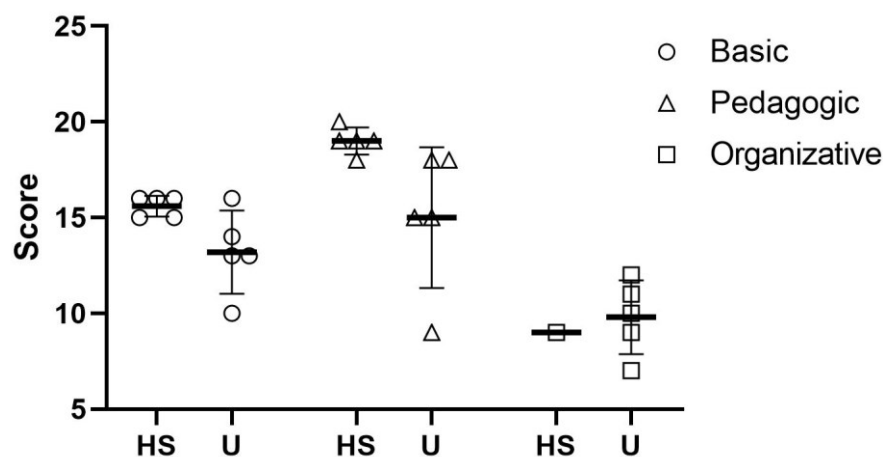


Figure 1. Summary of group and individual results of basic, pedagogical and organizational dimension for both university and high school students.

Reliability and consistency of the high school students assessing their own performance is presented in Table 4.

Original article. Evaluating university sport science students' perceptions following a service-learning intervention in high schools. Vol. 11, n.º 2; p. 1-13, April 2025.

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Table 4. Results of the reliability and consistency showed by high school students measuring their own performance in biomechanical tests.

Test	CV	ICC	Cronbach's α
Hand grip Right	10.7 $\pm$ 12.0	0.47	0.57
Hand grip Left	8.3 $\pm$ 7.3	0.71	0.81
Grip Force Max.	16.7 $\pm$ 17.2	0.47	0.78
Grip RFD	37.5 $\pm$ 42.9	0.04	0.37
CMJ	5.8 $\pm$ 3.3	0.94	0.99
Squat Jump	3.7 $\pm$ 2.1	0.95	0.98
Drop Jump	3.6 $\pm$ 1.9	0.97	0.99
CMJ Abalakov	2.2 $\pm$ 2.5	0.97	0.98

CV = coefficient of variation; ICC = Intraclass coefficient of correlation; RFD = rate of force development; CMJ = countermovement jump.

Discussion

The present study aimed to evaluate the perceptions of both high school students and university students in a service-learning setting, particularly within the context of teaching and learning biomechanics. The results demonstrated positive perceptions from both groups, as can be seen in almost all dimensions showing average values over 3 out of 4 points. Specifically, high school students reported very favorable perceptions of their service-learning experience, showing that the project significantly enhanced their understanding of complex biomechanical concepts such as jumping, strength, and speed. This is consistent with studies in other subject areas, where service-learning has been shown to facilitate more profound learning by engaging students and learners in practical tasks that require them to apply theoretical knowledge. For example, a meta-analysis by Conway et al. (Conway et al., 2009) in the social context found moderate changes for academic outcomes, small for personal outcomes and citizenship outcomes, and in between for social outcomes. This reveals that service-learning has its best effect for academic purposes. Therefore, this alternative methodology should be employed in educational contexts with the primary aim of increasing students' academic performance. However, our study shows that students employing this methodology have a great degree of satisfaction. In this context, establishing connections between university and high schools as performed in our study could be highly beneficial for

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both group of students. Furthermore, Yorio & Ye (Yorio & Ye, 2012) reported in a meta-analysis that high school students in environmental science courses who participated in service-learning projects not only retained more content but also developed a stronger sense of responsibility toward the subject matter. This shows that service-learning, independently of the subject matter, could be successfully applied, since it has demonstrated working in very different subjects and in very different learning environments.

In the context of biomechanics, this study suggests that the practical application of the concepts taught by university students contributed to the high school students' ability to retain and apply knowledge. This is supported by the reliability and consistency scores in the students' self-assessments, where they showed a high degree of accuracy in evaluating their own performance in biomechanical tasks. This is in line with research in other disciplines, with some studies revealing that students involved in service-learning projects across various subjects displayed improved academic outcomes, increased civic engagement, and enhanced personal growth (Celio et al., 2011). These benefits were especially pronounced in settings where students could directly apply what they had learned to real-world situations, making the learning process more tangible and engaging (Celio et al., 2011). The advantages of service-learning can be obtained even with technological devices in the educational process (Jia et al., 2018; Waldner et al., 2012), which is essential given the current environment in which technology is present in day-to-day students' life (Almarzooq et al., 2020; Pecci et al., 2024), especially after the COVID-19 pandemic (Almarzooq et al., 2020; Torres Martín et al., 2021). Anyway, the high level of satisfaction reported by university students in this study can be attributed to the active learning components inherent in service-learning. Active learning, as opposed to passive learning, has been shown to enhance student engagement, improve retention of information, and foster a sense of responsibility toward the material being learned (Bringle et al., 2010; Scales et al., 2000). This study demonstrates that the benefits of service-learning could be optimized if the service is offered to other members of the educational community (i.e., lower education levels such as high school students). Despite service-learning usually involves members out of the educational community or people at risk of social exclusion (Chiva-

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Bartoll et al., 2021; Claes et al., 2022), our study provides insights into the application of this alternative methodology in the educational environment with more students being benefited from service-learning (i.e., higher levels reinforcing subject contents through teaching them and lower levels breaking the routine and learning new contents). This methodology could also serve for orienting high school students, which could be introduced to the sport sciences contents and having a more in-depth understanding of what is the university context.

This study has several limitations that should be considered when interpreting the results. First, the sample size was small, with only five students from each educational level, limiting the generalizability of the findings. Moreover, the study was conducted within a specific context (i.e., biomechanics in sports science), which may not reflect the effects of service-learning in other disciplines or with different content. The study duration was also limited to four sessions, which might have affected the depth of learning and knowledge acquisition among high school students. Additionally, the self-assessment approach used by students may have introduced bias, as students might overestimate or underestimate their performance. However, performance assessment was standardized and using technological devices, which makes this process as objective as possible. Future studies could address these limitations by expanding the sample size, incorporating multiple disciplines, and extending the intervention period to assess longer-term effects on learning outcomes. Future research could also explore the impact of service-learning on different age groups and educational levels (e.g., younger students) to better understand how this pedagogical approach influences various learners. Moreover, investigating the use of digital tools and technology in service-learning contexts could provide insights into how modern resources can enhance this methodology. Finally, longitudinal studies would be beneficial to determine whether the positive perceptions and learning outcomes reported in this study are sustained over time and lead to lasting academic or personal development.

Conclusions

The findings of this study underscore the effectiveness of service-learning as a pedagogical strategy within the context of biomechanics education. Both high school

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and university students reported positive perceptions of the experience, highlighting enhanced understanding and engagement with complex biomechanical concepts. The active teaching approach adopted by university students facilitated meaningful learning for high school participants, allowing them to apply theoretical knowledge in practical settings. Additionally, the high reliability and consistency in self-assessments performed by high school students indicated a successful transfer of knowledge. This study not only supports the implementation of service-learning in sport sciences but also demonstrates its potential benefits in fostering connections between educational levels.

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Original article. Evaluating university sport science students' perceptions following a service-learning intervention in high schools. Vol. 11, n.º 2; p. 1-13, April 2025.

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