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Analysis of movement during climbing as a strategy for learning the anatomy of the locomotor system in Sport Sciences

Análisis del movimiento durante la escalada como estrategia para el aprendizaje de la anatomía del aparato locomotor en Ciencias del Deporte

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Abstract

The use of information and communications technologies allows the creation of teaching resources that facilitate learning, mainly due to their motivational effect. The study aimed to analyze the use of videos and static images of climbing in the teaching-learning process of the locomotor system in the Functional Anatomy signature in Physical Activity and Sport Science (CAFD). A total of 106 students from the CAFD degree completed this work. For the analysis of the effect on learning, an exam containing five questions on the anatomy applied to climbing was carried out after viewing the videos/images. After the statistical analysis, a percentage of correct answers of 66.9% and 69.2% was observed in questions 1 and 3, respectively, while in questions 2, 4 and 5, a lower percentage of correct answers were observed. This methodology is based on an analysis of the movement that allows a functional anatomical understanding of the locomotor system in specific sports activities.

Keywords: Anatomy of movement; Applied anatomy; Anatomy for athletes; Anatomy CAFD.

Resumen

El uso de las tecnologías de la información y la comunicación permite crear recursos didácticos que facilitan el aprendizaje fundamentalmente por su efecto motivacional. El objetivo del estudio ha sido analizar el uso de videos y de imágenes estáticas de escalada, en el proceso de enseñanza-aprendizaje del aparato locomotor en la asignatura Anatomía Funcional en Ciencias de la Actividad Física y del Deporte (CAFD). Un total de 106 estudiantes del grado de CAFD completaron el presente trabajo. Para el análisis del efecto en el aprendizaje se ha realizado un examen que contenía cinco preguntas sobre la anatomía aplicada a la escalada tras la visualización de los vídeos/imágenes. Tras el análisis estadístico, se observó un porcentaje de aciertos de 66,9% y 69,2% en las preguntas 1 y 3 respectivamente, mientras que en las preguntas 2, 4 y 5 se observó un porcentaje de aciertos inferior. Esta metodología se basa en un análisis del movimiento que permite una comprensión funcional de la anatomía del aparato locomotor en actividades deportivas específicas.

Palabras clave: Anatomía del movimiento; Anatomía aplicada; Anatomía para deportistas; Anatomía CAFD.

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Introduction

The current COVID-19 pandemic has caused numerous and profound changes in our daily lives, including unprecedented challenges to both educational system and teaching-learning processes. Although the scientific literature has previously emphasized on the importance of evolving towards online teaching (Miarso, 2004), the current COVID-19 health crisis, caused by the SARS-CoV2 virus, has forced this process to adapt rapidly to the new digital environment (Crawford et al., 2020). In this context, classroom teaching at universities has been replaced by online education through the use of e-learning platforms (Flores, Correa, & Cervantes, 2020; Srinivasan, 2020). This "emerging" approach is an educational process in which learning is supported by synchronous and asynchronous media resources, involving the internet communication network and other technologies or media such as multimedia technology, video, audio and satellite communication (Hayashi, 2020).

Inevitably, the teaching of anatomy has also been forced to evolve towards virtual teaching (Evans et al., 2020; Ravi, 2020). The study of anatomy has different approaches, such as, for example, the principles of anatomy applied to human movement that is taught in the degree of Physical Activity and Sports Sciences (CAFD). This degree studies a great diversity of contents related to diverse traditional sports, such as football, basketball, or athletics. However, the contents related to physical activities in the natural environment (e.g., climbing, rappelling and orientation) have become increasingly attractive among students, making learning of these disciplines more motivating for them (Baena-Extremera & Granero-Gallegos, 2013a; Granero & Baena, 2011).

Climbing can play an idyllic role as a learning tool to understand the anatomy and biomechanics of the musculoskeletal system. In the teaching and learning process of the Functional Anatomy subject, those sports that allow observing during their practice the complexity and ranges of movement that especially involve the locomotor system's extremities are essential. It allows better analysis and understanding of the muscles' movement that cross the different joint complexes. Accordingly, previous studies have suggested that applying this methodology during climbing practice becomes a vital tool in learning the subject Anatomy in CAFD (Baños et al., 2015; Ferrán 2015).

The integration of information and communication technologies (ICT) in the teaching-learning process is gradually acquiring a prominent and active education role. In CAFD, teachers mainly use ICT for administrative purposes such as student registration and reporting (Thomas & Stratton, 2006) without actually enhancing the enormous pedagogical role that digital tools provide. Within ICT tools, the blog or weblog is a digital tool that offers to update and structure it periodically according to the teacher's criteria. As stated by Prieto, Smok, and Rojas (2011), its characteristics include the possibility of addressing many people, with or without knowledge of the field, without the need for the teacher to require high technological skills, since it is easy to administer and clarify doubts or queries of Internet users. In addition, according to several previous studies, students perceive that blogs promote greater collaboration, dialogue and active participation (Hemmi, Bayne & Tierra, 2009; Hsu, 2008; Oliver & Maíz, 2008). Hastie, Casey and Tarter (2010) highlight that the use of blogs in Physical Education leads to a more significant learning experience than that obtained using traditional methodologies; due to the preparation of the following sessions can be more anticipatory and collaborative with the students. Boulos and Wheeler (2007) define collaborative intelligence as the process by which students actively participate in the blog, with a serious and constant commitment of all students, being able to produce a series of conversations in which they design and build their own learning of the course.

In summary, the relevance and impact on educational innovation of the use of blogs as pedagogical tools in the learning process of university students is increasingly important. Thus, in the Functional Anatomy subject at the University of Murcia, a specific blog for the subject was created with their respective YouTube, Twitter and Facebook accounts as digital teaching tools.

Based on the preceding, the present study aimed to analyze the anatomical knowledge of the locomotor system achieved by CAFD students during the execution of climbing movements by employing videos and static images managed through the blog.

Materials and Methods

Study Desing

A non-experimental, descriptive and cross-sectional study was designed. A total of 106 students participated in the study, 78 men and 28 women, enrolled in the Functional Anatomy subject in the CAFD degree at the University of Murcia, between 19 and 49 years (21.6 ± 4.7 years).

Instruments

To evaluate the knowledge acquired, five questions of the analysis of movement during climbing were included in the final exam of the subject. It was composed of a total of 60 multiple choice questions with a single valid answer. The subject coordinator prepared the exam with a total duration of 90 minutes to answer the test. The questions related to the climbing based on Figure 1 were the following:

1) Question 1 (**arrow 1**). Choose the CORRECT option about the indicated joint and region. Possible answers: A) The supraspinatus muscle participates in the observed rotation. B) The latissimus dorsi muscle allows retroversion of the shoulder. C) The lower portion of the trapezius muscle is the adductor of the arm. D) The trapezoid ligament stabilizes the sterno-costo-clavicular joint.
2) Question 2 (**arrow 2** of the image): Which of the following muscles is NOT involved in the position observed in the indicated joint (elbow)? Possible answers: A) Extensor carpi radialis longus. B) Palmaris longus. C) Flexor digitorum profundus. D) Flexor carpi radialis.
3) Question 3 (**arrow 3** of the image): Choose the INCORRECT option on the indicated limb. Possible answers: A) The adductor minimus muscle favors the position observed. B) The gluteus maximus muscle favors the position observed. C) The quadriceps femoris muscle favors the observed position. D) The popliteus acts in opposition to the position observed.
4) Question 4 (**circle 4** of the image): Choose the INCORRECT option on the indicated joint. Possible answers: A) The inferior gemellus muscle acts in opposition to the rotation observed at the hip. B) The semimembranosus muscle favors the position observed in the hip. C) The gluteus minimus muscle favors the position observed at the hip. D) The pectineus muscle opposes the position observed at the hip.
5) Question 5 (**arrow 5** of the image): Choose the CORRECT option on the indicated region and joint. Possible answers: A) Lumbricals muscles are located in a deep plane. B) The abductor digiti minimi muscle lies in a deep plane. C) The extensor digitorum brevis extends the proximal phalanges. D) The flexor hallucis brevis lies in a superficial plane.

Procedure

All participants were taught with the same Functional Anatomy contents, included in the teaching guide, with a duration of four months and a credit load of 6 ECTS credits. Following the teaching guide, three theoretical hours a week of classroom time were given using the PowerPoint presentation format and one weekly teaching hour of practical class.

The Teaching Innovation Group in Human Anatomy of the University of Murcia (GINDAH) designed a blog as a didactic resource, which mainly uses videos of different sports (https://functionalanatomysite.wordpress.com/). Students first became familiar with the blog tasks in the classroom, highlighting the learning possibilities and benefits. These resources were used both in face-to-face classes and autonomously by the student at home. This lets students evaluate the understanding of the Functional Anatomy subject's contents by applying them to the sport of climbing in a more real and didactic context.

How the students could evaluate themselves through the blog was the visualization of video and selected static images. The video was deliberately stopped for a few seconds at some key moment of the technical-sports action. At this time, a question was asked concerning the anatomical movements and the joint complexes involved during the execution of the action by the climber. Finally, the contents acquired by the students were evaluated through a multiple-choice theoretical exam.

Figure 1.

Climbing image included in the final exam of Functional Anatomy (Source: Extracted from blog https://functionalanatomysite.wordpress.com/).

Statistics Analysis

After coding and tabulating the data, a descriptive analysis of the frequencies was carried out, which has been selected for its orientation in the sociological field and has enabled the implementation of the present study's statistical technique. Statistical analysis was performed with SPSS (Statistical Package for Social Sciences, v. 20.0, for Windows; SPSS Inc, Chicago).

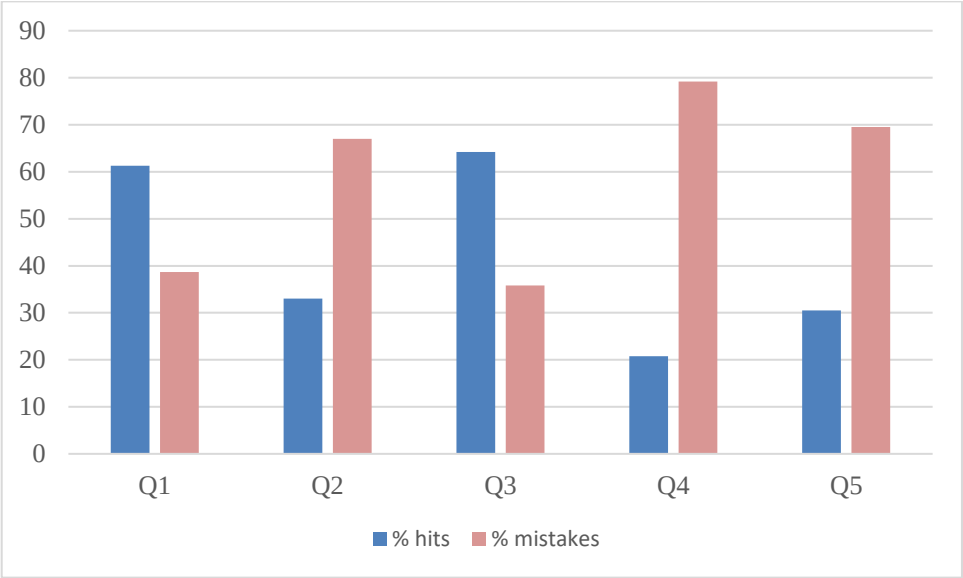
Results

Percentage of right and wrong answers

In questions 1 and 3 a higher percentage of right answers was observed (61.3% and 64.2%, respectively), while in questions 2, 4 and 5, the percentage of errors was higher (67.0%, 79.2% and 69.5%, respectively), as described in Figure 2.

Figure 2.

Percentage of right and wrong answers in the exam.

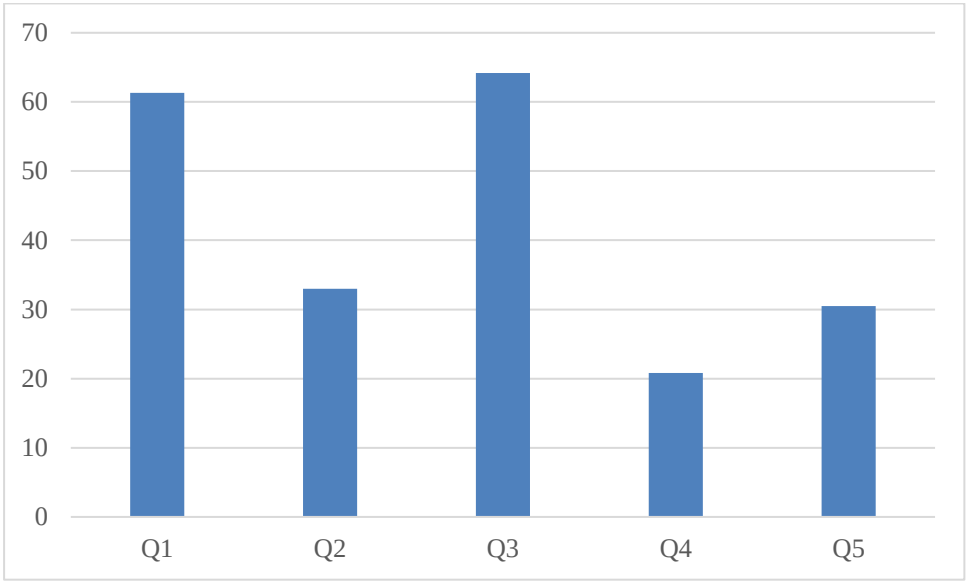


Answers from question 1

As shown in Figure 3, 61.3% of students chose the right answer B: "*The latissimus dorsi muscle allows retroversion of the shoulder*", while a 21.7% chose option C: "*The lower portion of the trapezius muscle is the adductor of the arm*", 9.4% chose option A: "*The supraspinatus muscle participates in the observed rotation*", and 6.6.% chose option D: "*The trapezoid ligament stabilizes the sterno-costo-clavicular joint*"

Figure 3.

Selected answers from question 1.

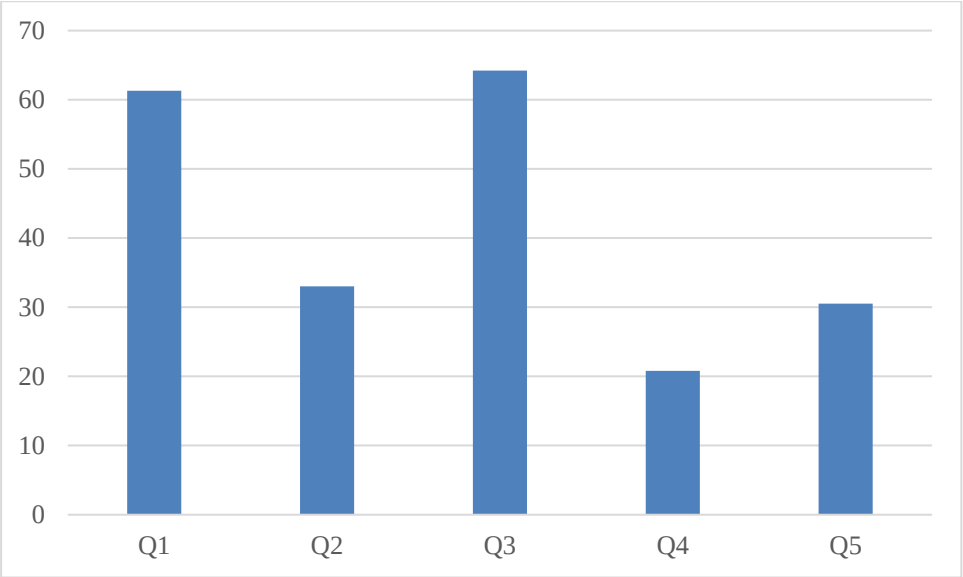


Answers from question 2

In question 2, 38.7% of students chose the wrong option A: *Extensor carpi radialis longus*. The right answer was C: *Flexor digitorum profundus*, and it was selected by 33.0% of participants. The other 14.2% and 13.2% chose B: *Palmaris longus* and D: *Flexor digitorum profundus*, respectively, as can be observed in Figure 4

Figure 4.

Selected answers from question 2.

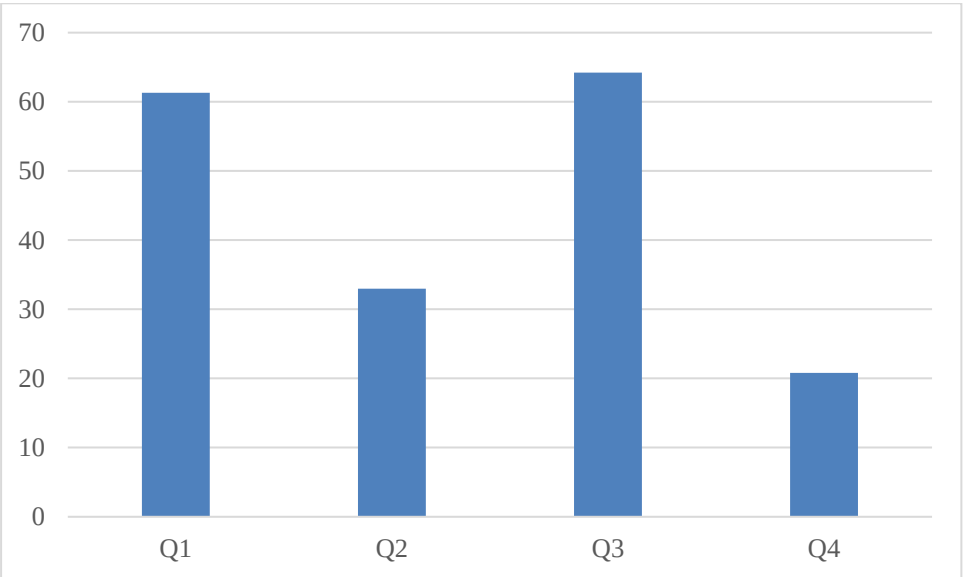


Answers from question 3

In question 3 most of students (64.2%) chose the right option A: *The adductor minimus muscle favors the position observed*, followed by option C: *The quadriceps femoris muscle favors the observed position* (17.9%), while only a small number of students answered D: *The popliteus acts in opposition to the position observed* (9.4%) and B: *The gluteus maximus muscle favors the position observed* (8.5%) (Figure 5)

Figure 5.

Selected answers from question 3.

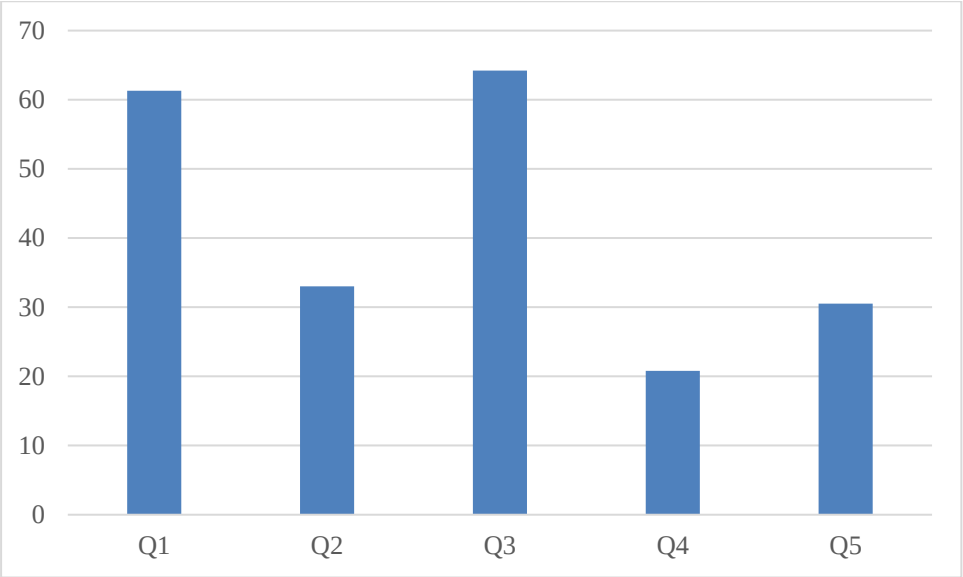


Answers from question 4

In question 4, only 20.8% of subjects chose the right option A: *The inferior gemellus muscle acts in opposition to the rotation observed at the hip.* 48.1% chose wrongly the option B: *The semimembranosus muscle favors the position observed in the hip*. 24.5% chose option D: *The pectineus muscle opposes the position observed at the hip,* and 5.7% chose option C *The gluteus minimus muscle favors the position observed at the hip* (Figure 6)

Figure 6.

Selected answers from question 4.

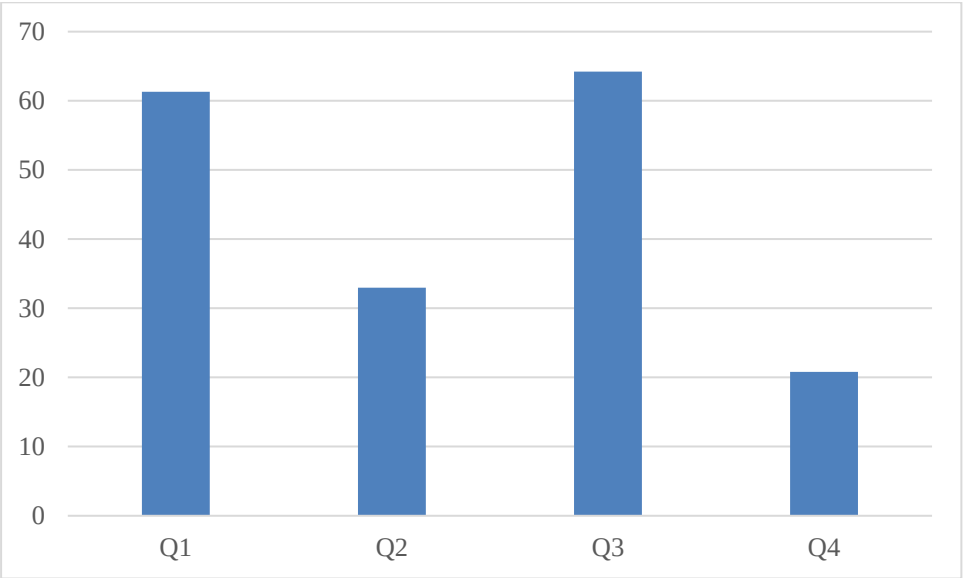


Answers from question 5

Figure 7 shows the results from question 5. 32.1% of students chose option A: *Lumbricals muscles are located in a deep plane*, 30.2% chose option C: *The extensor digitorum brevis extends the proximal phalanges*, 29.2% chose option D: The flexor hallucis brevis lies in a superficial plane, and 8.5% chose option B: *The abductor digiti minimi muscle lies in a deep plane.*

Figure 7.

Selected answers from question 5.



Discussion

Only a few studies directly relate the learning of the anatomy of the locomotor system with the analysis of movement during a practice of a sport. One of the current challenges of The European Higher Education Area (EHEA) in university education is to ensure that the knowledge acquired by the university students has an immediate application in the workplace. Aiming at improving anatomy learning, we have

developed digital resources to facilitate the acquisition of knowledge by the students. Thus, the aim of the present study was to analyze the knowledge of the anatomy of the locomotor system achieved by students from the Physical Activity and Sport Science degree during execution of climbing movement, using for learning videos and static images posted in the blog of the subject.

In the questions 1 and 3 of the multiple-choice test, a high percentage of correct answers was obtained (61.3% and 64.2%, respectively) comparing with the wrong answers. These results indicate that this type of anatomical concepts imply a low level of difficulty for the students. A similar project developed by the University of Granada (https://www.ugr.es/~dlcruz/) raises the needed of transversality among the different disciplines (anatomy, volleyball and football), whose scientific and didactic contexts seem to be separate. This project is based in the publication of anatomical content in the website. In contrast to this theoretical approach, our methodology targets the understanding of the locomotor system in motion, as the different activities, carried out using videos and images, are fully developed in real sports contexts.

On the other hand, a lower percentage of correct answers was achieved in questions 2, 4 and 5. Regarding question 2, the option to choose implied a high level of knowledge, being within the group of the 15% of most complex questions, implying on the part of the student having or not having knowledge about the specific action that these muscles exert on the elbow when their predominant function in any of them is on the carpus or phalanges. Questions 4 and 5 also needed a high level of knowledge and moreover, the ability to think indirectly about the anatomical concepts, since they asked about the incorrectness around functions that are not often highlighted with respect to these muscles. Both questions were also part of the 15% high-difficulty questions, which usually have a success rate lower than the obtained here. Therefore, the lower rate of correct answers might be due to the complexity of the concept evaluated. Furthermore, these data suggest that students find more difficult to apply these concepts and thus failing more in the answers. This point is currently being addressed by our group with the design of 5 different levels of complexity of anatomical concepts that will be evaluated using the same strategy. In this way, it will be possible to assess the degree of learning reached in each level of complexity and students will also gain skills to apply the theoretical concepts more successfully.

Due to the reduced number of studies analyzing the application of the information and communication technologies in functional anatomy teaching in relation to sports, it is needed to discuss the present results with other strategies for teaching anatomy in degrees different than Physical Activity and Sport Science. The results observed here are similar than those found by Fonseca and Fonseca (2010) in the field of pathological anatomy. They applied a teaching methodology based on making diagnosis by the observation of different images, and according to the authors, it was novelty and aroused great interest among the students. Also, in the field of pathological anatomy, it was confirmed that the use of digital pedagogical tools such as virtual microscopy can effectively replace traditional methods for learning pathology (Alós et al., 2015). Otherwise, in the field of the study of the anatomy of the placenta, other authors have concluded that blog allow teachers to have a more individualized model focus on the students (Prieto, Smok, & Rojas, 2011).

Interestingly, other studies have investigated about the use of the iBook as a didactic tool for the study of anatomy in Secondary Education and they reported high levels of satisfaction among the students with this innovative material. However, they keep teaching traditional theoretical contents without practical applications to the teaching of anatomy on sports contexts, a point that our proposal would contribute to promote (Baena-Extremera & Granero-Gallegos, 2013b). Also, in the area of Compulsory Education, authors such as Molina, Castillo, Rodríguez and Díaz (2010) have highlighted that learning anatomy applied to Physical Education is more efficient and lasts longer when it has a practical perspective comparing with purely theoretical contents. Our proposal implies the application of the anatomical theoretical contents of the locomotor system in a real context, for a better functional understanding of a sporting activity.

Conclusions

The digital material developed by The Teaching Innovation Group in Human Anatomy of the University of Murcia (GINDAH) is a novel and interesting tool for learning anatomy in a sporting and

natural context. This methodology is founded on a holistic understanding of the anatomy, allowing students to understand the functional interpretation during climbing execution of descriptive anatomical concepts. It is a novel and innovative teaching model that should continue to be developed in the future creating more didactic contents and optimizing the current material. This way, we encourage anatomists and institutions to prepare high quality material available online for the students (Raikos & Waidyasekara, 2014).

Being aware of some constraints of the present work, it would be interesting for future works to analyze the psychological profiles, the motivation of the students (Baños, Barretos-Ruvalcaba, & Baena-Extremera, 2019; Martínez-de-Ojeda, Méndez-Giménez, Gutiérrez-Sánchez-Osorio, & López-Delgado, 2020; Moreno, Zomeño, Marín, Ruiz, & Cervelló, 2013) and the academic performance (Fernández, 2004) associated to the use of these methodologies.

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Conflict of interest statement: The authors declare no conflict of interest.

References

Alós-i-Hernández, L., Ordi, O., Martínez Pozo, A., Ordi-i-Majà, J., Cuatrecasas-Freixas, M., Ramírez Ruz, J., ...& Díaz Lorca, M. A. (2015). Microscopía virtual en la enseñanza de la Anatomía Patológica en Medicina. *Pòsterpresentat a: Vuitenatrobada de professorat de Ciències de la Salut. Universitat de Barcelona. Facultat de Medicina.*

Baena-Extremera, A., & Granero-Gallegos, A. (2013a). Utilización de iBook en la Enseñanza de Contenidos de Anatomía en Educación Secundaria. *International Journal of Morphology*, *31*(2), 505-511. https://doi.org/10.4067/S0717-95022013000200024

Granero-Gallegos, A., & Baena-Extremera, A. (2013b). El piragüismo en la formación permanente del profesorado como actualización de contenidos en Educación Física. *Espiral. Cuadernos del Profesorado, 6(*11), 3-11. https://doi.org/10.25115/ecp.v6i11.947

Baños, R., Morales, N., López-Iborra, L., Martínez-Armada, C., De la Cruz, E., Escribano, P., Moran, R., Pallares, J., Toval, A., Vera, J., Ferrán J.L. (2015). Análisis dinámico del movimiento en escalada, surf y slackline. Nuevas herramientas para la enseñanza de la anatomía en CAFD. En *XXII Congreso Internacional de la Sociedad Española de Educación Médica*. Universidad de Murcia.

Baños, R., Barretos-Ruvalcaba, M., & Baena-Extremera, A. (2019). Protocolo de estudio de las variables académicas, psicológicas y de actividad física que influyen en el rendimiento académico de adolescentes mexicanos y españoles. *Espiral. Cuadernos del Profesorado*, *12*(25), 89-99. https://doi.org/10.25115/ecp.v12i25.2480

Boulos, M.N.K., &Wheeler, S. (2007). The emerging Web 2.0 social software: An enabling suite of sociable technologies in health and health care education. *Health Information and Libraries Journal*, *24*, 2–23. https://doi.org/10.1111/j.1471-1842.2007.00701.x

Crawford, J., Butler-Henderson, K., Rudolph, J., Malkawi, B., Glowatz, M., Burton, R., ... & Lam, S. (2020). COVID-19: 20 countries' higher education intra-period digital pedagogy responses. *Journal of Applied Learning & Teaching*, *3*(1), 1-20. https://doi.org/10.37074/jalt.2020.3.1.7

De la Cruz, JC., Cueto, M., García, E., Rojas, J., De la Cruz, J. C., De la Cruz, A., (2014). Innovación en la gestión on-line en los procesos de enseñanza-aprendizaje en educación física. Propuesta interdisciplinar para la creación de una herramienta web. En L. M. Jiménez del Barco & M. C. García (coord.), *Innovación docente y buenas prácticas en la Universidad de Granada. Vol. 3* (pp. 61-72). Editorial Universidad de Granada.

Evans, D. J., Bay, B. H., Wilson, T. D., Smith, C. F., Lachman, N., & Pawlina, W. (2020). Going virtual to support anatomy education: A STOPGAP in the midst of the Covid-19 pandemic. *Anatomical Scieces Education, 13*,279–283. https://doi.org/10.1002/ase.1963

Fernández, M. (2004). El clima motivacional de clase en estudiantes adolescentes de Buenos Aires. *Revista Iberoamericana de Diagnóstico y Evaluación Psicológica, 18*(2), 119-136.

Ferrán J.L. (2015). Hacia un enfoque moderno en la enseñanza de la anatomía funcional en CAFD. Priorizando el aprendizaje a partir de sus competencias específicas. En *XXII Congreso Internacional de la Sociedad Española de Educación Médica*. Universidad de Murcia.

Flores, G., Correa, M. E., & Cervantes, M. G. (2020). Deporte, cultura y uso de tecnologías en el tiempo libre de jóvenes universitarios. *Espiral. Cuadernos del Profesorado, 13*(27), 144-150. https://doi.org/10.25115/ecp.v13i27.3491

Fonseca, G. M. & Fonseca, A. C. (2010). Strategies of Education for the Study of Images in Pathology, School of Dentistry, Universidad Nacional de Cordoba, Argentina. *International Journal of Morphology, 28*(4):1113-1123. https://doi.org/10.1080/14759390903579133

Granero, A., & Baena, A. (2011). Juegos y deportes de aventura en la formación permanente del profesorado. *Revista Internacional de Medicina y Ciencias de la Actividad Física y el Deporte, 11*(43), 531-547. Http://cdeporte.rediris.es/revista/revista43/artjuegos224.html.

Hastie, P. A., Casey, A., & Tarter, A. M. (2010). A case study of wikis and student-designed games in physical education. *Technology, Pedagogy and Education*, *19*(1), 79-91. https://doi.org/10.1080/14759390903579133

Hayashi, C. (2020). Tecnologias digitais na Educação a Distância: fases, modelos, plataformas e ferramentas. *Research, Society and Development, 9*(10), 1-30. https://doi.org/10.33448/rsd-v9i10.9295

Hemmi, A., Bayne, S., & Land, R. (2009). The appropriation and repurposing of social technologies in higher education. *Journal of Computer Assisted Learning*, *25*(1), 19–30. https://doi.org/ 10.33448/rsd-v9i10.9295

Hsu, J. (2008). Innovative technologies for education and learning: Education and knowledge-oriented applications of blogs, wikis, podcasts, and more. *International Journal of Web-Based Learning and Teaching Technologies*, *3*(3), 62–81. https://doi.org/10.4018/jwltt.2008070106

Martínez de Ojeda, D., Méndez-Giménez, A., Gutiérrez Sánchez Osorio, M. L., & López Delgado, A. (2020). Efectos del modelo TRIAL classroom en la autorregulación del alumnado de educación primaria frente a la metodología tradicional. *Espiral. Cuadernos del Profesorado, 13*(26), 86-97. https://doi.org/10.25115/ecp.v13i26.2689

Miarso, Y. (2004). *Menyemai benih teknologi pendidikan*. Yakarta.

Molina, J. J. M., Castillo, A. S., Rodríguez, A. I. L., & Díaz, M. Z. (2010). Efecto de dos estilos de enseñanza (cognoscitivo versus tradicional) sobre el aprendizaje de conceptos de anatomía muscular en alumnos de Educación Física de 1° de ESO. *Apunts. Educación física y Deporte*, (100), 23.

Moreno, J. A., Zomeño, T. E., Marín, L. M., Ruiz, L. M., & Cervelló, E. M. (2013). Percepción de la utilidad e importancia de la educación física según la motivación generada por el docente. *Revista de Educación*, 362, 380-401.

Oliver, K.M., & Corn, J. (2008). Student-reported differences in technology use and skills after the implementation of one-to-one computing. *Educational Media International, 45*,215–229. https://doi.org/10.1080/09523980802284333

Prieto, R.; Smok, C. & Rojas, M. (2011). Blog Experiences: Compared Placenta. *International Journal of Morphology*, *29*(2):432-437. https://doi.org/10.4067/S0717-95022011000200022

Raikos, A., & Waidyasekara, P. (2014). How useful is YouTube in learning heart anatomy?. *Anatomical Sciences Education*, *7*(1), 12-18. https://doi.org/10.1002/ase.1361

Ravi, K. S. (2020). Dead body management in times of Covid-19 and its potential impact on the availability of cadavers for medical education in India. *Anatomical Sciences Education*, *13*(3), 316-317. https://doi.org/10.1002/ase.1962

Srinivasan, D. K. (2020). Medical students' perceptions and an anatomy teacher's personal experience using an e-learning platform for tutorials during the Covid-19 crisis. *Anatomical Sciences Education*, *13*(3), 318-319. https://doi.org/10.1002/ase.1970

Thomas, A., & Stratton, G. (2006). What we are really doing with ICT in physical education: A national audit of equipment, use, teacher attitudes, support, and training. *British Journal of Educational Technology, 37,* 617–632. https://doi.org/10.1111/j.1467-8535.2006.00520.x