

An Investigation of the Flipped Learning Method to Physical Education Classes in the University: Systematic Review

Una investigación del método de aprendizaje invertido en las clases de educación física en la universidad: revisión sistemática

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Abstract. This study aims to provide a synthesis of available scientific articles on the use of FL as a promising methodology in university sports teaching through a systematic review. This research is a type of systematic review research using searches from various journal databases such as Science Direct, Pubmed and Web of Science. The inclusion criteria in this research are journals published in the last 5 years that discuss Flipped Learning, physical fitness and physical education. Furthermore, the exclusion criteria in this research are journals that are not reputable or indexed by Scopus and Web of Science. In the first stage, 1538 articles from the Science direct, Pubmed and web of science databases were identified. Next, in the second stage, 49 articles were screened based on the suitability of the title and abstract. In the third stage, 26 articles were ordered for further processing. At this stage we filter based on the complete suitability of the article. Then, in the final stage, 10 articles that met the inclusion criteria were selected and analyzed for this systematic observation. This systematic review study reports that the FL method combined with other new techniques in teaching sports in universities provides good results. In all aspects of learning such as cognitive, affective and motoric learning in several sports disciplines such as basketball, martial arts, gymnastics and dance, FL provides very positive results. Therefore, based on the results of this investigation, it is hoped that more research needs to be carried out on FL in connection with optimizing physical education teaching and of course realizing the higher goals of physical education, namely increasing students' levels of physical activity, knowledge and sports. techniques aimed at encouraging and growing participation. physical activity inside and outside the classroom and throughout their lifespan.

Keywords: Flipped Learning, Physical Fitness, Physical Education

Abstracto. Este estudio tiene como objetivo proporcionar una síntesis de los artículos científicos disponibles sobre el uso de FL como una metodología prometedora en la enseñanza del deporte universitario a través de una revisión sistemática. Esta investigación es un tipo de investigación de revisión sistemática que utiliza búsquedas en varias bases de datos de revistas como Science Direct, Pubmed y Web of Science. Los criterios de inclusión en esta investigación son revistas publicadas en los últimos 5 años que tratan sobre Flipped Learning, aptitud física y educación física. Además, el criterio de exclusión en esta investigación son revistas que no tienen buena reputación ni están indexadas por Scopus y Web of Science. En la primera etapa se identificaron 1538 artículos de las bases de datos Science direct, Pubmed y web of science. A continuación, en la segunda etapa, se seleccionaron 49 artículos en función de la idoneidad del título y del resumen. En la tercera etapa se ordenaron 26 artículos para su posterior procesamiento. En esta etapa filtramos en función de la idoneidad total del artículo. Luego, en la etapa final, se seleccionaron y analizaron para esta observación sistemática 10 artículos que cumplieron con los criterios de inclusión. Este estudio de revisión sistemática informa que el método FL combinado con otras técnicas nuevas en la enseñanza del deporte en las universidades proporciona buenos resultados. En todos los aspectos del aprendizaje, como el cognitivo, afectivo y motor en varias disciplinas deportivas como el baloncesto, artes marciales, la gimnasia y la danza, FL proporciona resultados muy positivos. Por lo tanto, con base en los resultados de esta investigación, se espera que sea necesario realizar más investigaciones sobre FL en relación con la optimización de la enseñanza de educación física y, por supuesto, la realización de los objetivos más elevados de la educación física, es decir, aumentar los niveles de actividad física de los estudiantes. conocimientos y deportes. técnicas destinadas a fomentar y aumentar la participación. Actividad física dentro y fuera del aula y a lo largo de su vida.

Palabras clave: Aprendizaje invertido, aptitud física, educación física

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Introduction

Over the last few decades, with the rapid developments of mobile technology, the advent of Web 2.0 sites, and the expansion of social media, there has been an incremental use of information and communication technology (ICT) as a fundamental means for the development and creation of new spaces dedicated to training and development of innovative learning experiences (Hinojo Lucena et al., 2019). The inclusion of technology in the educational spectrum is necessary so that teaching methodologies can adapt to the times and the concerns of the twenty-first century students (Nurhasanah et al., 2022; Reyes et al., 2021). One result is so-called flipped learning (FL) as one of the approaches for technical integration into the classroom popularized by

Professors Jonathan Bergmann and Aaron Sams in 2012 in the US when they developed online audiovisual materials with content that students had to learn, allowing all students to access the content and customize their learning at their own pace (Hinojo Lucena et al., 2019).

FL methodology is emerging as a pedagogical and innovative approach, enriching the teaching-learning process through the use digital, internet-based technologies (Østerlie et al., 2022). This is a revolutionary teaching method because it reverses the traditional classroom where activities carried out in the classroom environment in the traditional learning approach (lectures, teaching concepts) are carried out in the classroom with the help of technological means (video), and activities carried out outside the classroom environment in the traditional approach

(homework and projects) (Erbil, 2020). Further reversing the traditional roles of teacher and student, it was traditionally teacher-centred, whereas FL is now student-centred due to the active and cooperative learning methods used when students do group work and reinforcement activities when they apply the knowledge they learned previously (online/video) with teacher guidance during face-to-face meetings which are usually held in the classroom (Erbil, 2020; Østerlie et al., 2022). A study reported that FL is considered a teaching method where teachers require skills for implementation (Moreno-Guerrero et al., 2021). The research also reports that there is a linear relationship between institutional support, technology self-efficacy, teaching confidence, and teaching strategies for the development of FL (Moreno-Guerrero et al., 2021).

Originally, FL as learning methodology was applied and became popular in the subject areas like science, technology, engineering, and mathematics (STEM) (Gopalan et al., 2022). Currently, this training method has been gaining increasing popularity, being carried out in numerous classrooms at all educational levels, as it is very practical and effective in instructional processes (Erbil, 2020). The novelty of this work is to take the use of flipped learning to an area considered as little explored in emerging methodologies, physical education (PE) (Hinojo Lucena et al., 2019). In PE, several research articles have already been written about the impressive contribution of FL to students' physical activity (PA), fitness, motor skills, knowledge/learning, motivation, and interest in Elementary, High School, and the University (Pablo-Lerchundi et al., 2023; H. Wang & Chen, 2022). Likewise, the notable input of FL to the more specific disciplines in PE such as basketball, volleyball, taijiquan, gymnastics, and dance is also undergoing investigation. FL has a positive effect on university students' understanding and learning in PE, and FL produces a positive change on students' autonomy and in how value PE (Hinojo Lucena et al., 2019; Østerlie et al., 2022; Vaughn et al., 2019; Zhang et al., 2021).

Despite the significant positive impact of FL in PE such as on the effects of students' motor skills learning in the flipped classroom on technical action video displays, student technical action feedback videos, and teaching interactions, a study has not provided a strong recommendation that teachers can use the recording method. Videos to display technical actions of motor skills, then students can use video feedback to communicate with teachers about motor skills learning, and flipped classrooms need to pay attention to teaching interactions between teachers and students (Zhang et al., 2021). Likewise, another study reported that positive results were found in a trial of implementing FL in the PE Dance course at the university (Dimarucot, 2022). Although it has been realized that there are some obstacles that need to be addressed like technological and logistical limitations due to the sudden shift to remote learning during the pandemic, lack of readiness of the students to regulate their own learning and exhibit other relevant 21st century skills under pressure and uncertain times, and gap

between the male and female students' performance due to possible latent gender issues in dance education that restrict student's creativity. Thus, the institution needs to provide even more technological, communication, and psychological support for the students to perform better and with more ease whether in a purely online or blended FL environment. More discussions and activities on gender inclusivity in dance classes are also advised to further break barriers against students' artistic freedom and imagination (Dimarucot, 2022). Additionally, a study suggests that more in-depth research is needed to expand understanding of the influence of FL on student outcomes in sport particularly in learning, motivation and motor skills (Østerlie et al., 2022).

This study aims to provide a synthesis of available scientific articles on the use of FL as a promising methodology in university sport teaching through a systematic review.

Materials and Methods

Studi Design

This research is a type of systematic review research using searches from various journal databases such as Science Direct, Pubmed and Web of Science. It is considered a key platform throughout the world as it brings together publications of scientific impact and relevance.

Eligibility criteria

The inclusion criteria in this research are journals published in the last 5 years that discuss Flipped Learning, physical fitness and physical education. Furthermore, the exclusion criteria in this research are journals that are not reputable or indexed by Scopus and Web of Science.

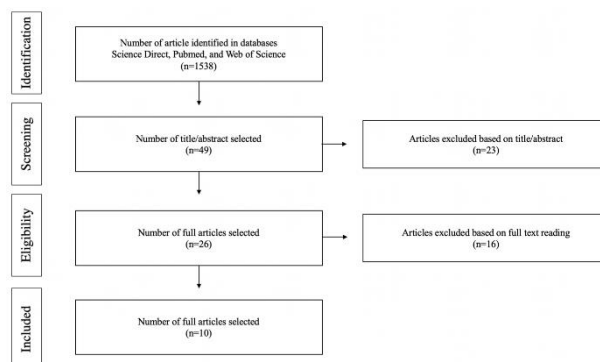


Figure 1. PRISMA flowchart of the article selection process

Procedure

The title, abstract and full text of the screening articles were then saved and stored in Mendeley software. In the first stage, 1538 articles from the Science direct, Pubmed and web of science databases were identified. Next, in the second stage, 49 articles were screened based on the suitability of the title and abstract. In the third stage, 26 articles were ordered for further processing. At this stage we filter based on the complete suitability of the article. Then, in the final stage, 10 articles that met the inclusion criteria were

selected and analyzed for this systematic observation.
For operational standards, this study followed the Pre

ferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) assessment.

Table 1.

Research results used in the systematic review

Author	Research Focus	Research Objective	Result
(Vaughn et al., 2019)	Impact FL/FC model on students' knowledge, skills, and PA	The purpose of this study was to examine the impact of a flipped classroom model on students' knowledge, skills, and physical activity in a collegiate physical activity course.	The findings demonstrated that students' health knowledge and exercise skills were significantly improved, and the course allowed students to be engaged in various types of physical activity inside and outside the classroom.
(Zhang et al., 2021)	Motor Skills	This paper builds a research model on the basis of literature review. This model is used to analyze the influence factors of flipped classroom on the learning effect of college students' motor skills.	The results show that video technical action display, video feedback of students' technical action, and teaching interaction have a significant positive impact on the learning effect of college students' motor skills in the flipped classroom, while video theory teaching has no significant impact.
(Xu et al., 2021)	FL based on Neural Network Technology to accurately predict sports performance	This paper investigates the use of neural network technology in the sports flip classroom to improve communication between teachers and students, strengthen interaction and cooperation between the two, provide timely and comprehensive sports skill learning for students, improve students' sports skills, and stimulate students' interest in learning sports skills.	Neural networks are used in the model. The particle swarm optimization algorithm optimizes the variance and weights of the neural network to improve the accuracy of college students' sports performance predicted by the neural network by updating the particle position and speed through the two extreme values of individual extreme values and global extreme values. Teachers always play the role of the facilitator and helper in the teaching process, which realizes the transformation of teachers' and students' self-positioning, allows students to better play the lead role and stimulates students' interest in learning.
(H. Wang & Chen, 2022)	FL/FC model based on Few-Shot Learning	It analyzes the conceptual advantages of the flipped classroom teaching model based on few-shot learning, combining its benefits with the current common college environment.	The flipped classroom teaching model has given rise to new ideas for the construction of a physical education model: 1) students' physical learning is no longer limited to the physical education classroom, thanks to the use of network technology to change the learning environment. Teaching resources have been expanded to include many online sports resources, so students' physical learning is no longer limited to the physical education classroom. Students can learn anytime and anywhere, which allows them to continue their education throughout their lives; 2) flipped classrooms increase teacher-student interaction and play an important role in re-establishing a harmonious teacher-student teaching relationship; and 3) online courses help students develop their skills. Autonomous learning's ability to shape students' personalized learning is better suited to the development of students' core literacy.
(Zhao, 2022)	FC Teaching based on Multi Media Network Data Fusion	This article is mainly to study the flipped teaching of college physical education, through the use of multimedia network data fusion, to monitor college students' physical classroom activities to a certain extent.	The analysis results showed that the enthusiasm of the students in the improved education model was greatly mobilized. College students' physical education classes are no longer the way they were doing nothing in the past, but they started to learn and exercise with interest. This phenomenon can be said to be rare in college physical education classes, and the physical fitness of students can be improved to varying degrees after exercise.
(Wu & Liu, 2022)	PE based on Deep Learning on Student's Mental Health and Social Adaptability	On the basis of deep learning, this article studies physical education. First, this article analyzes and explains the related concepts and current situation of physical education and explains the measurement and definition of the mental health. Then, the function analysis algorithm of deep learning is explained and analyzed, in which the algorithm of the convolution neural network of deep learning is mainly described.	Through experimental analysis, it shows that the research performance of deep learning in the physical education on college students' mental health is relatively high. At the same time, through investigation and analysis, it is proposed that physical education in deep learning can improve mental health and social adaptability relatively high. And the content of physical education should focus on increasing physical psychological education and physical practice education, which can improve college students' mental health and social adaptability compared with other teaching contents. Therefore, when introducing deep learning, universities should strengthen the physical education of college students.
(Wei et al., 2021)	FC based on WebChat Public Platform Basketball	The article analyzes the Flipped Classroom Based on WebChat Public Platform in Basketball Physical Education Teaching.	Flipped classroom based on wechat public platform has practical significance for sports learning. It is an important part of basketball physical education teaching process. The reasonable implementation of wechat public platform flipped classroom can improve students' subjective initiative and promote the development of students' sports learning at all levels. There are also some problems in the application of wechat flipped classroom in basketball course, such as emphasizing form, ignoring content, unreasonable design of classroom resources. The implementation of the new teaching mode requires full use of video, micro classroom and other teaching methods to improve students' interest in learning, explore more knowledge of teaching content, fully understand the connectivity of knowledge, and improve the overall efficiency.
(HanLiang & LiNa,	FC/Flipped based on	This paper intends to investigate the	The study found that the majority of students see virtual reality

2022)	Deep Learning and Big Data Analytics in Teaching Taijiquan	use of virtual reality technology in martial arts education - "Taijiquan". The architecture of virtual reality based on the deep learning algorithm is suggested.	technology-assisted martial arts education favorably, and their passion for studying martial arts has greatly increased.
(Huang & Yu, 2022)	Deep Learning based on FC in Microcourse Teaching of Gymnastics	This study investigates focuses on various teaching methods and design teaching modes with the continuous advancement of the reform of university physical education. This design introduces the FC and studies the DL model. Based on this, the DL theory is combined with the microcourse of college sports gymnastics. The reform of the microcourse teaching of physical gymnastics is achieved through the optimization design of the teaching model.	The results show that the current utilization of microcourse teaching resources is too low. Interest-oriented teaching microcourses cannot improve students' interests. Teachers generally believe that the current gymnastics microcourse needs further optimization and improvement. The poor quality of microvideos and the lack of supervision and reward mechanism in the course are the main reasons for the insufficient students' interest. The complexity of the videos and the liveliness of the discussions are the main problems of low resource utilization. The student's interest in learning is greatly improved after the application of the designed model. The effect on ordinary college students is the most obvious, and the effect of microvideo
(Dimarucot, 2022)	FL model – College Dance Education Course	The study would like to shed light on the answer to the question: Does the flipped learning model have a significant effect to improve the conceptual understanding and procedural fluency of the students? Also, this study aims to discover if the first-ever FL model in the program and in the university has indeed a place in a PE Classroom.	Through the pilot implementation of FL in the PE course in the university yielded generally positive outcomes, some obstacles need to be addressed like technological and logistical limitations due to the sudden institution needs to provide more technological, communication, and psychological support for the students to perform better and with more ease whether in a purely online or blended FL environment.

Discussion

Based on this systematic review, there is a lack of topics that discuss the FL method in teaching sports at universities. This is supported by (Østerlie et al., 2022) that FL in PE is a topic that is rarely researched by scholars. Only ten articles considered focused on (1) the impact of FL/ Flipped Classroom (FC) on students' knowledge, skills, motor skills and PA; (2) more focused and new teaching methodologies such as neural network technology, multiple learning, multimedia network fusion, and deep learning (DL) on students' mental health and social adaptability; and (3) FL combined with DL in teaching Taijiquan and Gymnastics, the use of a webchat public platform in teaching Basketball, and the FL model in teaching Dance and Sports Dance.

A study reported that the flipped classroom model had a positive impact on students' knowledge, skills and physical activity in college physical activity courses (Vaughn et al., 2019). In this study, findings showed that students' health knowledge and exercise skills improved significantly, and enabled students to engage in various types of physical activity inside and outside the classroom. Likewise, other studies report that motor learning with technical action video displays, student technical action video feedback, and teaching interactions have a significant positive influence on the learning effect (Zhang et al., 2021).

New techniques regarding LF in relation to sports teaching have also been revealed. Investigation of the use of neural network technology in sports flip classes to improve communication between teachers and students, to strengthen interaction and cooperation between the two, to provide timely and comprehensive sports skills learning for students, improve students' sports skills, and stimulate students' interest in learning skills sports (Xu et al., 2021). Intensively, the research reports that the particle swarm optimization algorithm optimizes the variance and weights of

the neural network to improve the accuracy of student sports performance predicted by the neural network by updating the position and speed of particles through two extreme values, namely individual extreme values and global extreme values. Teachers always act as facilitators and helpers in the teaching process, which realizes the transformation of the positions of teachers and students, allowing students to play more of a leading role and stimulating students' interest in learning (Darling-Hammond et al., 2020). In addition, other studies report that regarding the multiple-step learning-based FC teaching model has given rise to new ideas for the construction of physical education models, namely, students' physical learning is no longer limited to physical education classrooms, thanks to the use of network technology to change the learning environment. Teaching resources have been expanded to include many online sports resources so that students' physical learning is no longer limited to physical education classes (C. Wang et al., 2023). Students can learn anytime and anywhere, allowing them to continue their education throughout their lives (Huda et al., 2022). Furthermore, flipped classrooms increase teacher-student interaction and play an important role in re-establishing a harmonious teacher-student teaching relationship and online courses help students develop their skills. The ability of autonomous learning to shape students' personal learning is more suitable for the development of students' core literacy (H. Wang & Chen, 2022).

Regarding teaching certain sports disciplines with the support of FL, it was also found from several available articles that FL combined with several other techniques proved to be effective. In Basketball teaching, a study reported that FC based on wechat public platform has practical significance for sports learning (Wei et al., 2021). This is an important part of the basketball physical education teaching process. Reasonable application of the WeChat public platform's flipped classroom can improve students' subjective

initiative and promote the development of students' sports learning at all levels. There are also some problems in the application of WeChat flipped classroom in basketball courses, such as emphasizing form, ignoring content, unreasonable design of class resources but the implementation of the new teaching mode requires full use of video, micro-class and other teaching methods to increase learning interest students, explore more knowledge of teaching content, fully understand the interconnectedness of knowledge, and improve overall efficiency. Likewise, in Taijiquan teaching the use of virtual reality technology, it has been found that the majority of students view virtual reality technology-assisted martial arts education as good, and their enthusiasm for learning martial arts has greatly increased (Zhang et al., 2021). Furthermore, in learning gymnastics, it was revealed in another study which reported that students' interest in learning greatly increased after implementing the designed model, namely DL theory combined with micro course theory in college sports gymnastics (Huang & Yu, 2022). In Investigation of Dance Sports, several studies reported that the use of the FL model produced positive results (Dimarucot, 2022). The results of research experiments show that the application of FL in sports courses in universities generally produces positive results, some obstacles that need to be overcome such as technological and logistical limitations because institutions suddenly need to provide more technology, communication and psychological support for students to perform better and more easily in either a pure online or mixed FL environment (Dimarucot, 2022).

Thus, the findings of this systematic review illustrate that the FL method combined with other new techniques in teaching sports in universities provides good results. In all aspects of learning such as cognitive, affective and motoric learning in several sports such as basketball, martial arts, gymnastics and dance, FL provides very positive results. The large number of sports that have not been discussed in relation to flipping learning and the lack of references are limitations of our research. Therefore, based on the results of this research, it is hoped that further research needs to be carried out regarding FL in connection with the optimization of physical education teaching and of course the realization of the goals of higher education physical education, namely to advance students, the level of physical activity, knowledge and training techniques of students which aims to encourage and foster physical activity participation inside and outside the classroom and throughout their lifespan.

Conclusion

It can be concluded that the FL method combined with other new techniques in teaching sports at universities gives good results. In all aspects of learning such as cognitive knowledge, affective, and motor learning in several sports disciplines such as basketball, martial arts, gymnastics, and dance, FL provides very positive results.

Therefore, it is hoped that more research needs to be

carried out on FL in connection with the optimization of physical education teaching and of course the realization of the goals of higher education physical education, namely to advance students, the level of student's physical activity, knowledge and training techniques aimed at encouraging and growing participation. physical activity inside and outside the classroom and throughout their lifespan.

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Conflicts of Interest

The authors declare no conflict of interest

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