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Original article

Learning based on the application of the Flipped Classroom model in university students

Aprendizaje basado en la aplicación del modelo de Aula Invertida en estudiantes universitarios

Aprendizagem baseada na aplicação do modelo Flipped Classroom em estudantes universitários

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ABSTRACT
The flipped classroom is a learning methodology that combines e-learning and the face-to-face classroom, its purpose is to improve learning by allowing students to control the time and pace of their online learning and maximize their active learning. The objective was to determine the level of learning of the students of the Continental University using the traditional model compared to the flipped classroom. The methodology was based on the participation of students in two groups, a Control Group who developed their sessions traditionally, and an Experimental Group to whom the flipped classroom model was applied; the population consisted of 240 male and female students from various professional careers; the sample was non-probabilistic, for convenience, with a size of 159 students, 80 (Control Group) and 79 (Experimental Group), for the measurement of learning a pedagogical test of 20 items was applied. Among the results, the learning results of the students of the Control Group based on the traditional method obtained a post-test mean of 13.09, and the Experimental Group based on the flipped classroom obtained 14.44, higher than the Control Group. Regarding the qualifications, the highest score of the post-test corresponds to the Experimental Group (19), and in the Control Group (18); the standard deviation shows that the EG results are lower. In conclusion, there is a significant difference between learning based on the flipped classroom compared to the traditional classroom, corroborated with the p-value of 1.543e-08 less than the significance of 0.05.

Keywords: learning; flipped classroom; traditional teaching model.

RESUMEN

El Aula Invertida es una metodología que combina el *e-learning* y el aula presencial, siendo su propósito mejorar el aprendizaje, al permitir que los estudiantes controlen el tiempo y el ritmo de su aprendizaje en línea y maximicen su aprendizaje activo. El objetivo fue determinar el nivel de aprendizaje de los estudiantes de la Universidad Continental utilizando el modelo tradicional comparado con el Aula Invertida. La metodología estuvo basada en la participación de estudiantes en dos grupos: un Grupo de Control, que desarrolló sus sesiones tradicionalmente, y otro Grupo Experimental, al que se aplicó el modelo de Aula Invertida. La población estuvo compuesta por 240 estudiantes varones y mujeres de diversas carreras profesionales; la muestra fue no probabilística, por conveniencia, con un tamaño de 159 estudiantes, 80 (Grupo de Control) y 79 (Grupo Experimental); para la medición de los aprendizajes se aplicó una prueba pedagógica de 20 items. Entre los resultados se tiene que: el aprendizaje de los estudiantes del GC, basado en el método tradicional, obtuvo una media de la postprueba de 13.09; y el Grupo Experimental, basada en el Aula Invertida, obtuvo 14.44, mayor al Grupo de Control. Respecto a las calificaciones, el mayor puntaje de la postprueba corresponde al Grupo Experiemental (19), y en el Grupo de Control (18); la desviación estándar muestra que los resultados del GE son menores. En conclusión, existe una diferencia significativa entre el aprendizaje basado en el Aula Invertida respecto al aula tradicional, corroborado con el valor-p de 1.543e-08, menor a la significancia de 0.05.

Palabras clave: aprendizaje; Aula Invertida; modelo de enseñanza tradicional.

RESUMO

A Flipped Classroom é uma metodologia que combina o e-learning e a sala de aula presencial, com o objetivo de melhorar a aprendizagem, permitindo que os alunos controlem o tempo e o ritmo da sua aprendizagem online e maximizem a sua aprendizagem ativa. O objetivo foi determinar o nível de aprendizagem dos alunos da Universidade Continental utilizando o modelo tradicional comparado com a Flipped Classroom. A metodologia baseou-se na participação dos alunos em dois grupos: um Grupo de Controlo, que desenvolvia as suas sessões de forma tradicional, e outro Grupo Experimental, ao qual foi aplicado o modelo Flipped Classroom. A população foi composta por 240 alunos e alunas de diversas carreiras profissionais; a amostra foi não probabilística, por conveniência, com tamanho de 159 alunos, sendo 80 (Grupo Controle) e 79 (Grupo Experimental); Para medir a aprendizagem, foi aplicado um teste pedagógico de 20 itens. Dentre os resultados temos que: a aprendizagem dos alunos do GC, com base no método tradicional, obteve média pós-teste de 13,09; e o Grupo Experimental, baseado na Flipped Classroom, obteve 14,44, superior ao Grupo Controle. Em relação às qualificações, a maior pontuação no pós-teste corresponde ao Grupo Experimental (19) e ao Grupo Controle (18); o desvio padrão mostra que os resultados do EG são menores. Concluindo, existe uma diferença significativa entre a aprendizagem baseada na Flipped Classroom em comparação com a sala de aula tradicional, corroborada com o valor de p de 1,543e-08, inferior à significância de 0,05.

Palavras-chave: aprendizagem; Sala de aula invertida; modelo de ensino tradicional.

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INTRODUCTION

Currently, with the development of Information and Communication Technologies, personal computers and mobile information platforms such as smartphones and tablets have made e-learning become part of Higher Education in many fields.

The Flipped Classroom (IL) is a pedagogical model first described by Lage, Platt and Treglia in 2000 and later popularized by Bergmann and Sams in 2012 (Tucker, 2012). According to Hu (2019), AI is one of the blended learning methodologies that combines *e-learning* and face-to-face classroom. Its goal is to improve the effectiveness of classroom learning by allowing students to control the time and pace of their online learning and maximize their opportunity for active learning by engaging in class discussions and collaborative exercises with their peers and teachers.

Likewise, Tucker (2012) refers to the use of techniques used by the teacher to convey information to their students. Prior to the class session, with the use of technology, the student is presented with lectures, presentations and readings, among others, as support material for learning outside the classroom. Consequently, the AI became a pedagogical method that changed the traditional learning model, since it gives greater weight to individual practice, generating significant and collaborative learning between students and teachers (Vidal *et al.*, 2016), managing time of the student and thus enhancing the effectiveness of the class session with a better understanding of the content presented and developed (Roig-Vila, 2017).

Also, AI has become a leading teaching strategy and has a transition effect on students to change their learning styles (Belfi, 2015). In this new educational teaching method, students learn the basic content independently before the class, such as previewing the chapters to be taught in class in advance and watching a learning video on the online platform or a multimedia presentation before class time (King, 2019).

The advantage of AI is that it compensates for the lack of teachers, and students can access online courses anytime, anywhere without geographical and time restrictions (Sandrone, 2019). A growing body of literature shows that AI is an increasingly common educational strategy in Higher Education, with promising results in improving student performance on assessments (Chen, 2018; Day, 2018), and can increase the student engagement in courses, improve their content knowledge, which provides an impetus for students to review the material and thus helps promote self-regulated behavior (Hughes, 2017). The disadvantage is that it takes more time, but this favors the strengthening of knowledge (Appleyard, 2020).

In the same sense, authors such as Martinez (2019) mention that the AI is perceived as a powerful tool that allows students to have control of their own learning, since they are responsible for watching the videos or presentations and for formulating appropriate questions in around them. It is recommended that the videos have a duration of less than fifteen minutes, they are previously worked on at home and discussed in class, in addition to proposing research projects and activities aimed at solving problems, among other options.

Several recent systematic reviews have found that compared to traditional lecture-based classrooms, students in the Flipped Classroom consistently report higher

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satisfaction and more positive academic outcomes, motivation, and engagement.

University classrooms, particularly at the Continental University in Peru, are considered scenarios where teachers and students interact with technological resources; Thus, since 2015 this institution has been promoting the implementation of the Flipped Classroom, adapting to the trends of this century and the advancement of technology that demands different skills and competencies from students. Indeed, this methodology also allows the Teaching-Learning Process to be generated outside the classroom, in order to enhance and strengthen investigative skills through the Research Methodology subject in the students of the Continental University.

Ausubel (1983), referring to meaningful learning, argues that student learning depends on the previous cognitive structure that will be related to the new information, understanding "Cognitive structure" as the concepts and grouped ideas that the student has of a certain field of knowledge and its organization. This type of learning occurs when the contents are related to some existing and relevant aspect of its cognitive structure, such as an image, a symbol, a concept or proposition that serves as an anchor to the first knowledge. For this reason, it intends to know and explain that meaningful learning is realistic and scientifically possible, where verbal and symbolic learning occupies a complex and significant character when giving meaning to each of the elements and factors that are affected for this purpose (Ausubel, 2002). Meaningful learning must complement the logical accommodation of the new knowledge, concepts, ideas and representations that the student has formed, with the aim of generating knowledge of him and for him (Viera, 2003).

Sanchez-Cruzado *et al.* (2019), in a research carried out at the Primary Education level of the Faculty of Educational Sciences of the University of Malaga, made the investment of classrooms of two different subjects in different courses: Didactics of Measurement and Measurement Technologies. Information and Communications for Education. He made a triangulation of results through an exhaustive qualitative and quantitative analysis, based on the data obtained from interviews and questionnaires. The results obtained conclude that: the students are satisfied with the introduction of a methodology that provides them with greater participation in the classroom, which facilitates access to didactic content in a closer format, which they can consult when and how they want, adapting to their needs. learning needs and pace. They consider that time in the classroom is more efficient, they estimate that they make better use of time and that, in addition, it improves their learning and understanding of content. These results are added to various studies carried out by other researchers, at different educational stages.

Likewise, Dominguez *et al.* (2017), in a research carried out in Colombia, presented an Extended Inverted Classroom (AIE) model to describe its effect on student learning perceptions; To this end, he designed an AIE for teaching clinical skills for the management and resuscitation of traumatized patients, aimed at medical students.

In this study, pre- and post-intervention learning perceptions were assessed using the *Flipped Classroom Perception Instrument*, which was validated in Spanish. Comparisons were made with Mann-Whitney and t-tests ($p < .05$), and the effect size of the intervention was calculated with Cohen's d test. As secondary outcomes, academic performance and student satisfaction were calculated. A total of 75 students participated in the study,

and the global perception of learning was 3.98 ± .58 (1.5-5.0) (pretest) versus 4.24 ± .64 (1.38-5.0) (posttest) (p < .05). The effect size was d = .42 (95% CI .094-.75). High academic performance and student satisfaction were identified. In conclusion, the AIE model, involving clinical simulation for the management of the traumatized patient, has a positive effect on student learning perceptions in the short term.

Also, Sablan and Prudente (2022) performed a meta-analysis based on the selection of 15 articles using the PRISMA model. The analysis yields a p-value of 0.000, which means that there is a statistically significant effect of the intervention of the Flipped Classroom model on the academic performance of the students. The hedges g-value of 0.93 has a great verbal interpretation effect.

Through subgroup analysis, it was found that the AI model has a positive effect on the academic performance of students in Physics and Mathematics subjects, with a p value of 0.000. This is also true for the Geographic Location (Eastern and Western countries) subgroup, which yields a p-value of 0.000. In addition, a moderator analysis on class size and intervention duration was also performed. A significant p-value was found for moderator implementation duration, but not significant for moderator class size. The analysis favors the longitudinal use of the Flipped Classroom model to improve student academic achievement over the traditional reading model in Physics and Mathematics subjects, regardless of the students' class size and the regions where the studies were conducted.

Due to the above, the authors raised the problem: how is learning based on traditional classes and inverted class manifested in students of the Research Methodology subject at the Continental University of Huancayo? For this purpose, the objective was set: to determine the differences regarding the learning of the Research Methodology subject using the methods of traditional classes and Inverted Classroom in students of the Continental University.

MATERIAL AND METHODS

The research is based on the quasi-experimental design, since an experimental group and a control group were taken, in a non-random way, from the participating subjects. A pre-test was applied to each group, then the Inverted Classroom method was applied to the Experimental Group, and the Control Group developed its activities with the traditional method. At the end of the academic period, a post-test was carried out on both groups to determine if better learning had been achieved through traditional classes or the Flipped Classroom.

The population was made up of 240 students, men and women, from professional careers in Health Sciences, Engineering, Business Sciences and Humanities, who were studying between the second and fourth year of training during the 2019 academic period, between March and July. The size of the group was non-probabilistic, for convenience (Hernández, 2014), made up of 159 students; the Experimental Group was made up of 79 students, of which 40 were male and 39 females; the Control Group was made up of 80 students, 59 male and 21 females (figure 1).

The pedagogical test applied in the pre-test and post-test was a questionnaire of 20 questions about the approved contents of the current syllabus; each question had five alternatives and a score of one point per correct answer, totaling a maximum score of 20. The pre-test was the diagnostic test that

is applied to all students and is regulated by the institution; the post-test was the final test applied to all students and is also regulated.
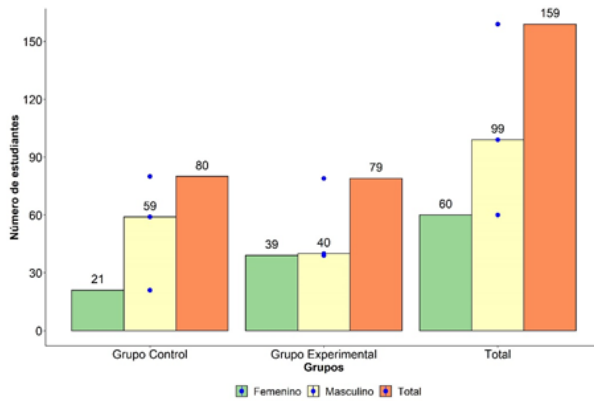

Fig. 1- Sample design

The pedagogical test was developed by the team of researchers and, to guarantee its validity, it was evaluated by three experts in the field, managing to comply with the suggestions for improving the test. To demonstrate its reliability, Cronbach's Alpha coefficient was applied to the instrument with 20 items and 159 subjects, reporting a Cronbach's Alpha of 0.81, a value that indicates that the instrument is reliable.

RESULTS

Level of learning of the students of the Control and Experimental Groups

The learning results of the students of the Control Group (CG), which developed its sessions with the Traditional Method, and the Experimental Group (EG), which carried out its sessions with the Flipped Classroom, show that the CG obtained an average of post-test of 13.09, and the EG obtained 14.44, higher than the CG. Regarding the grades, the

highest post-test score corresponds to the EG (19), and the CG obtained 18; Likewise, the variability of the EG grades is lower (2.63) compared to the CG (3.38), determined through the standard deviation, that is, the EG students finished their studies with higher grades and with more homogeneous scores (table one).

Also, according to Figure 2, it is shown that in the CG there is evidence of a growth in the mean grades from 6.16 to 13.09, with an increase of 6.93; while in the GE it grows from 6.62 to 14.44, with an increase of 7.82, clearly higher than the CG.

Table 1- Statistical Measures of Student Grades

	Group Control		Experimental group	
	pretest	posttest	pretest	posttest
Minimum	0.00	0.00	0.00	0.00
Maximum	16.00	18.00	15.00	19.00
Half	6.16	13.09	6.62	14.44
Median	7.00	13.00	8.00	15.00
v	27.81	11.40	24.73	6.89
S	5.27	3.38	4.97	2.63
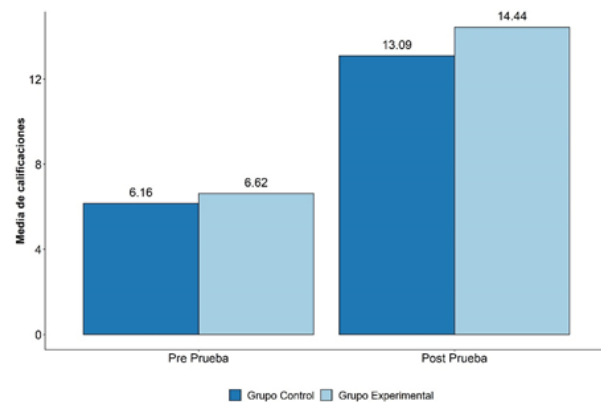
Fig. 2 - Average student grades by group and test

Number of approved and disapproved students by groups

In the CG that studied with the traditional method, it is shown that 75% failed in the pre-test, and 11.3% in the post-test. Regarding those approved, they went from 25% in the pre-test to 88.8% in the post-test (table 2).

In the EG that they studied with the application of the Flipped Classroom, it is evident that 75.9% failed in the pre-test, and in the post-test it was reduced to 2.5%. Regarding those approved, they went from 24.1% in the pre-test to 97.5% in the post-test (table 2).

Table 2- Number of failed and approved students

Ratings	Control group				Experimental group			
	pretest		posttest		pretest		posttest	
	No.	%	No.	%	No.	%	No.	%
00 – 10	60	75.0%	9	11.3%	60	75.9%	2	2.5%
11 – 20	20	25.0%	71	88.8%	19	24.1%	77	97.5%
Total	80	100.0%	80	100%	79	100%	79	100%

Regarding the number of students who developed their learning sessions with the traditional method (CG), those who passed (11-20) in the post-test increased from 20 to 71 students (figure 3).
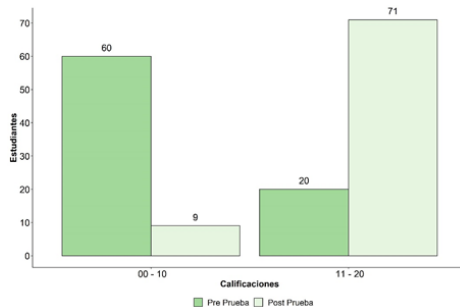

Fig. 3- Number of failed (00-10) and approved (11-20) students in the Control Group

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Then, in the number of students who developed their sessions with the Flipped Classroom (GE), those who passed (11-20) in the post-test increased from 19 to 77 students (figure 4).

Descriptive statistics measures were calculated using Microsoft Excel functions. For the minimum value we used: MIN (); maximum value: MAX (); arithmetic mean: AVERAGE (); median: MEDIAN (); variance: VAR (); standard deviation: STDEV ().
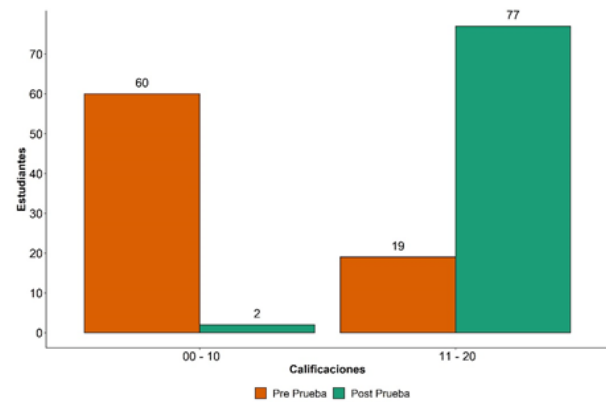

Fig. 4 - Number of failed (00-10) and approved (11-20) students of the Experimental Group
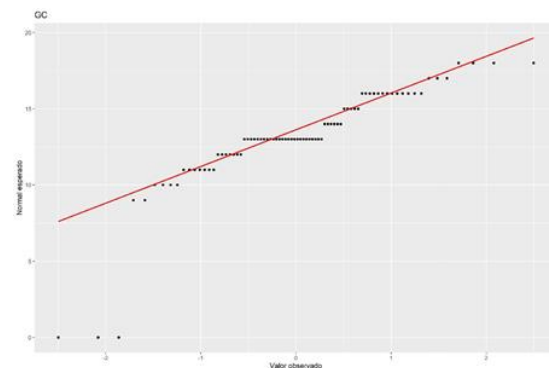
Hypothesis contrast

Fig. 5- QQ plot for normality analysis of GC data

The results of the CG (80) and EG (79) samples were analyzed to determine their

normality, using the Kolmogorov Smirnov test with its Lilliefors modification, obtaining a p-value for the CG of 1.239e-08, and for the EG from 1.099e-07, values less than á=0.05, determining that both samples fit the normal; this statement is also corroborated with the support of the respective QQ graphs (figures 5, 6).
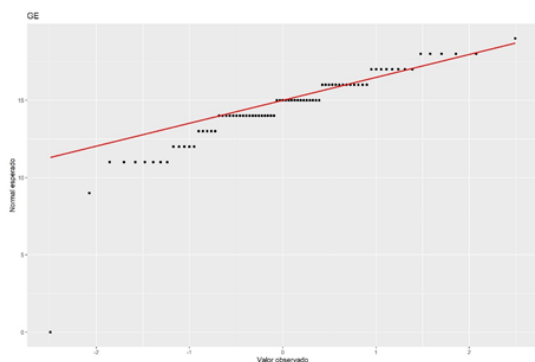

Fig. 6- QQ graph for normality analysis of EG data

The hypothesis test was carried out through the following steps:

a) Hypothesis:

Ho: ì $_1$ = ì $_2$ There are no differences between learning with the traditional method and learning using the Flipped Classroom.

Ha: ì $_1$ `" ì $_2$ Learning with the traditional method is different from learning based on the Flipped Classroom.

b) Significance level: á = 0.05

c) Test statistic: z test for two independent means.

d) Decision and conclusion: The p-value = 1.543e-08 is less than á=0.05; therefore, the Ho is rejected and it is concluded with a significance of 5% that learning based on the traditional method is different from learning based on the Flipped Classroom.

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DISCUSSION

The learning results of the CG students who developed their learning sessions with the Traditional Method and those of the EG, who conducted their sessions with the Flipped Classroom, show that the CG obtained a post-test mean of 13.09, lower than the EG that he got 14.44.

Regarding the grades, the lowest score in the GC and GE is 0.00, due to the fact that many students did not answer any questions and others answered without taking care of the case, knowing that for the final results of the subject this grade is not considered. The highest score in the post-test qualifications of the CG was 18, and the EG was 19. The means of the CG in the pre-test and post-test are lower than the EG, and the standard deviation of the CG is greater than the EG, which means that the EG qualifications have higher and more homogeneous scores. In relation to the percentage of approved, in the CG there are fewer approved (88.88%) than in the EG (97.5%); then, those disapproved in the CG are more (11.3%), compared to the EG (2.5%).

Even when the differences between the CG and the EG do not show an important difference, favorable opinions have been received from the student body regarding the use of the Flipped Classroom. In the same sense, Sanchez-Cruzado *et al.* (2019) in their research work concludes that students are satisfied with the introduction of a methodology that provides them with greater participation in the classroom, which facilitates access to didactic content in a closer format, which they can consult when and how they want, adapting to your needs and learning pace.

On the other hand, Dominguez *et al.* (2017) in their research with Medicine students identified a high academic performance and

student satisfaction, after implementing the Extended Inverted Classroom model, which involved clinical simulation for the management of the traumatized patient, concluding that this method allowed a positive effect on student learning perceptions in the short term.

Also, Sablan and Prudente (2022) emphasize that the Flipped Classroom model has a positive effect on the academic performance of students in Physics and Mathematics subjects with a p value of 0.000. This is also true for the geographic location subgroup (eastern and western countries), which yields a p-value of 0.000; Consequently, it can be affirmed that according to the studies cited and the findings of this document there is in all cases a positive influence on the use of the Flipped Classroom and that it improves student academic performance.

Among the weaknesses of this work, the following can be mentioned:

1. No strategy has been established to objectively measure the pre-test, this is because this qualification is not considered in the student's final result, and they develop it without the seriousness of the case; that is, they answer the test questions without giving them the minimum time they deserve.

2. The pre-test and post-test are questionnaires made with different reagents for each group; that is, those of the CG have an unequal test to the GE as they are prepared and administered by different teachers.

The strengths of the study are:

1. This work constitutes a first approach to the knowledge of the application of the Flipped Classroom model and evaluates the results in terms of learning; therefore, it will serve to reorient learning strategies.

2. Based on this experience, measurements of the diagnostic test (pre-test) will be carried out with greater objectivity.

3. The same instruments will be used to measure learning for all groups.

4. It will be useful to promote more research in this understudied area in our region, and pertinent, given the situation of the COVID-19 pandemic.

In conclusion, there is a significant difference between the learning of the Control Group based on the traditional model and the Experimental Group based on the Flipped Classroom of the students of the Research Methodology subject of the Continental University, corroborated with the p-value from 1.543e-08 less than the significance of 0.05; that is, the Flipped Classroom has higher learning results than the traditional model.

BIBLIOGRAPHIC REFERENCES

Appleyard, J. W. (2020). Using a flipped classroom approach in medical education: a medical students' perspective. *Med Teach*. 42(7), 839840. https://doi.org/10.1080/0142159X.2019.1700220

Ausubel, D. (1983). *Psicología Educativa: Un punto de vista cognoscitivo*. México: Trillas.

Ausubel, D. (2002). *Adquisición y retención del conocimiento. Una perspectiva cognitiva*. Barcelona: Paidós.

Belfi, L. M., Bartolotta J., Giambrone A. E., et al. (2015). "Flipping" the

Translated from the original in Spanish

Introductory Clerkship in Radiology Impact on Medical Student Performance and Perceptions. Academic Radiology. *22*(6). https://doi.org/10.1016/j.acra.2014.11.003

Chen, K. S., Monrouxe L., Lu, Y. H., et al. (2018). Academic outcomes of flipped classroom learning: a meta-analysis. *Med Educ*. *52*(9), 910924. https://doi.org/10.1111/medu.13616

Day, L. J. (2018). A gross anatomy flipped classroom effects performance, retention, and higher-level thinking in lower performing students. *Anat Sci Educ*. *11*(6), 565 574. https://doi.org/10.1002/ase.1772

Dominguez, L. C., Sierra, D., Pepín, J. J., Moros, G., & Villarraga, A. (2017). Effect of the Extended Inverted Classroom on clinical simulation for the resuscitation of traumapatients: Pilot study of student perceptions of learning. *Scientific and Technological Research*, *45*, 4-11. https://doi.org/10.1016/j.rcae.2017.09.002

Hernández, R., Fernández, C., & Baptista, P. (2014). *Metodología de la Investigación* (4ta. ed). México: Mc Graw Hill.

Hu, X., Zhang, H., Song, Y. et al. (2019). Implementation of flipped classroom combined with problem-based learning: an approach to promote learning about hyperthyroidism in the endocrinology internship. *BMC Med Educ*, *19*(290), 1-8.

https://doi.org/10.1186/s12909-019-1714-8

Hughes, Y., Lyons, N. (2017). Does the flipped classroom improve exam performance in medical education? A systematic review. *MedEdPublish*. *6*(2). https://doi.org/10.15694/mep.2017.000100

King, A. M., Gottlieb M., Mitzman J., et al. (2019). Flipping the Classroom in Graduate Medical Education: A Systematic Review. *Journal of Graduate Medical Education. 11*(1), 18 29. https://doi.org/10.4300/JGME-D-18-00350.2

Martínez Serrano, B. (2019). Dale la vuelta a tu clase. *Revista Digital de Educación y Formación del Profesorado*. *16*. http://revistaeco.cepcordoba.es/wp-content/uploads/2019/04/Martinez_rese%C3%B1a.pdf

Roig-Vila, R. (2017). *Investigación en Docencia Universitaria. Diseñando el futuro a partir de la innovación educativa*. Octaedro. http://hdl.handle.net/10045/71081

Sablan, J. R., & Prudente M. (2022). Traditional and Flipped Learning: Which Enhances Students' Academic Performance Better? *International Journal of Information and Education Technology, 12*(1), 54-59. https://doi.org/10.18178/ijiet.2022.12.1.1586

Sanchez-Cruzado, C., Sánchez-Compaña, M., & Ruiz-Palmero, J. (2019).

Experiencias reales de Aula Invertida como estrategia Metodológica en la Educación Universitaria española. *Publicaciones de la Facultad de Educacion y Humanidades del Campus de Melilla*, *49*(2), 39-58. https://doi.org/10.30827/publicaciones.v49i2.8270

Sandrone, S. Berthaud, J. V., Carlson, C., et al. (2019). Strategic Considerations for Applying the Flipped Classroom to Neurology Education. *Annals of Neurology. 87*(1), 49. https://doi.org/10.1002/ana.25609

Tucker, B. (2012). *The flipped classroom*. Education Next.

https://www.educationnext.org/the-flipped-classroom/

Vidal, M., Rivera, N., Nolla, N., Morales, R., & Vialart, M. (2016). Aula Invertida, nueva estrategia didáctica. *Educación Médica Superior, 30*(3), 678-688. http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0864-21412016000300020

Viera, T. (2003). El aprendizaje verbal significativo de Ausubel. Algunas consideraciones desde el enfoque histórico cultural. *Universidades*, 37 - 43. https://www.redalyc.org/pdf/373/37302605.pdf

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The authors declare that they have no conflicts of interest.

Authors' contribution:

The authors have participated in the writing of the work and analysis of the documents.

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