

Development of the inverted classroom strategy and its impact on teachers

Cesar Augusto Hernández-Suarez¹, Audin Aloiso Gamboa-Suárez², William Rodrigo Castro-Avendaño³

¹Universidad Francisco de Paula Santander
<https://orcid.org/0000-0002-7974-5560>
cesaraugusto@ufps.edu.co

²Universidad Francisco de Paula Santander
<https://orcid.org/0000-0001-9755-6408>
audingamboa@ufps.edu.co

³Universidad Francisco de Paula Santander
<https://orcid.org/0000-0002-7510-8222>
williamavendano@ufps.edu.co

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Abstract

A bibliometric review was carried out on the production and publication of research papers concerning the study of the variable Development of the inverted classroom strategy in teachers in Latin America. The purpose of the analysis proposed in this paper is to know the main characteristics of the volume of publications registered in Scopus database during the period 2017-2021 in Latin American countries, achieving the identification of 45 publications. The information provided by said platform was organized by means of tables and figures categorizing the information by Year of Publication, Country of Origin, Area of Knowledge and Type of Publication. Once these characteristics were described, a qualitative analysis was used to refer to the position of different authors on the proposed topic. Among the main findings of this research, it is found that Colombia, with 26 publications is the Latin American country with the highest production. The area of knowledge that made the greatest contribution to the construction of bibliographic material referring to the study of the development of the inverted classroom strategy in teachers was Social Sciences with 25 published documents, and the type of publication that was most used during the above-mentioned period was the journal article, which represents 69% of the total scientific production.

Keywords: inverted classroom, teachers, Latin America

1. Introduction

The inverted classroom is a strategy used in recent years, which allows students in the construction of their knowledge. Strategies such as this help to improve the quality level of educational institutions in Latin America by improving educational methodologies, thus contributing to a more adequate pedagogical climate. This strategy is based on class discussion based on previously acquired knowledge, thus providing a space in which students can resolve doubts and assimilate concepts, with the student being the main actor

in these classes. The teachers with this strategy have a great change in their functions, since in traditional classes are used methodologies of lectures where the teacher is the main source of knowledge. Contrary to traditional classes, it seeks to give certain responsibilities to the student participant in the construction of concepts, allowing him to develop critical thinking about the information to which he has access. In this strategy, the teacher will be a guide who offers support to students in the doubts that arise on a specific topic, giving rise to a time to develop a meaningful and personalized learning, since the formation of

concepts depends on the experiences and what the student considers important for their academic training. This strategy helps to improve the level of quality of the education provided, since it obeys the particular needs of each student by identifying their own needs and strengthening their shortcomings.

The role of the teacher in the flipped classroom, since it is the one who determines the veracity of the knowledge that students have previously investigated, so education needs a trained teacher with knowledge and strategies that allow students to assimilate the knowledge that is intended to learn in class. The flipped classroom is not only about research at home, it is also group work and questionnaires that help students to exchange concepts and perceptions of the information found, thus having guided feedback in the classroom by the teacher in charge. Certainly, this strategy represents a challenge for teachers as they need to develop new skills that allow them to manage the classroom so that all students have the same level of understanding. Therefore, it is important to know, in terms of bibliographic resources, the current state of research on the development of the inverted classroom strategy and the perception of teachers on the application of this strategy in educational institutions in Latin America, Therefore, a bibliometric analysis of the scientific production registered in the Scopus database during the period 2017-2021 is proposed to answer the question: How has the production and publication of research papers related to the

study of the variable development of the flipped classroom strategy and the perception of teachers in Latin America during the period 2017-2021?

2. General Objective

To analyze from a bibliometric and bibliographic perspective, the production of high impact research papers on the variable Development of the inverted classroom strategy in teachers of Latin American institutions during the period 2017-2021.

3. Methodology

Quantitative analysis of the information provided by Scopus under a bibliometric approach on the scientific production concerning the development of the inverted classroom strategy in teachers is performed. Also, from a qualitative perspective, examples of some research papers published in the area of study mentioned above are analyzed from a bibliographic approach to describe the position of different authors on the proposed topic.

The search is performed through the tool provided by Scopus and the parameters referenced in Table 1 are established.

3.1 Methodological design

	PHASE	DESCRIPTION	CLASSIFICATION
PHASE 1	DATA COLLECTION	Data was collected using the Scopus web page search tool, through which a total of 45 publications were identified.	Published papers whose study variables are related to the Development of the inverted classroom strategy in teachers Research papers published during the Period 2017-2021. Limited to Latin American countries. Without distinction of area of knowledge. Without distinction of type of publication.

<p>PHASE 2</p>	<p>CONSTRUCTION OF ANALYSIS MATERIAL</p>	<p>The information identified in the previous phase is organized. The classification will be made by means of graphs, figures and tables based on data provided by Scopus.</p>	<p>Word Co-occurrence. Year of publication Country of origin of the publication. Area of knowledge. Type of publication</p>
<p>PHASE 3</p>	<p>DRAFTING OF CONCLUSIONS AND FINAL DOCUMENT</p>	<p>After the analysis carried out in the previous phase, The study proceeded to the drafting of the conclusions and the preparation of the final document.</p>	

Table 1. Methodological design.

Source: Own elaboration (2022)

4.1 Co-occurrence of words

Figure 1 shows the co-occurrence of keywords within the publications identified in the Scopus database.

4. Results

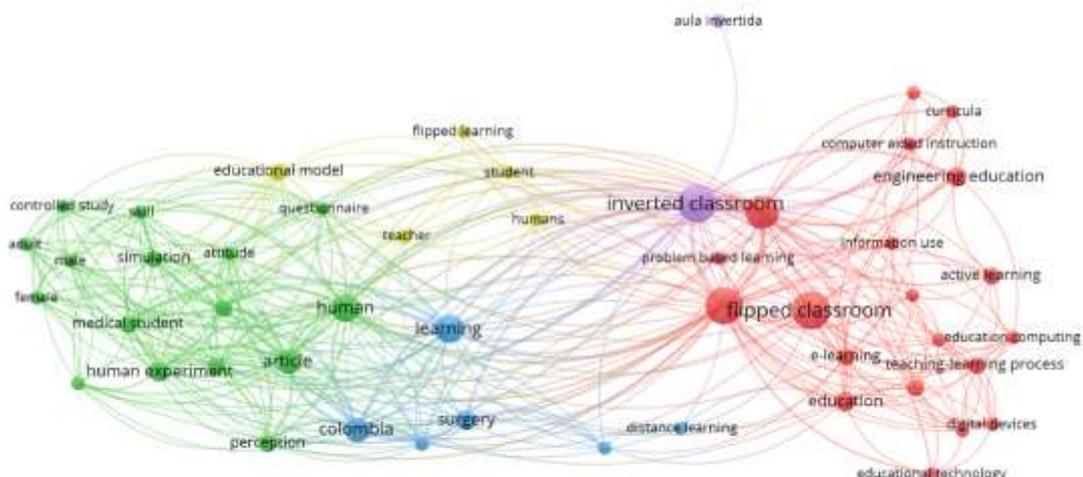


Figure 1. Co-occurrence of words

Source: Own elaboration (2022); based on data provided by Scopus.

As shown in Figure 1, the most used keyword is *inverted* which is one of the variables under study and refers to the pedagogical strategy last years in Latin America, in order to improve educational quality; this aims to give certain responsibilities to students in the acquisition of knowledge being them in charge of research and selection of concepts according to their criteria, and then in the classroom as the most successful concept. This strategy makes the student the main actor of the pedagogical process, having an active role in the construction of their own knowledge.

There are keywords such as *technological education*, *virtual learning* and *active learning* which shed light on the ways in which this strategy was implemented being very studied at

the beginning of 2020 when because of COVID-19 the classes were remotely so the inverted classroom, was presented as the ideal strategy that would help the educational actors and maintain quality levels by being able to teach from the particularities of the students. Finally, there are keywords such as problem-based learning, use of information and curriculum, which refer to the information to which students have access and how they use them to solve conflicts present in their social context, thus generating practical knowledge that they can implement in society.

4.2 Distribution of scientific production by year of publication.

Figure 2 shows how the scientific production is distributed according to the year of publication, taking into account the period from 2017 to 2021.

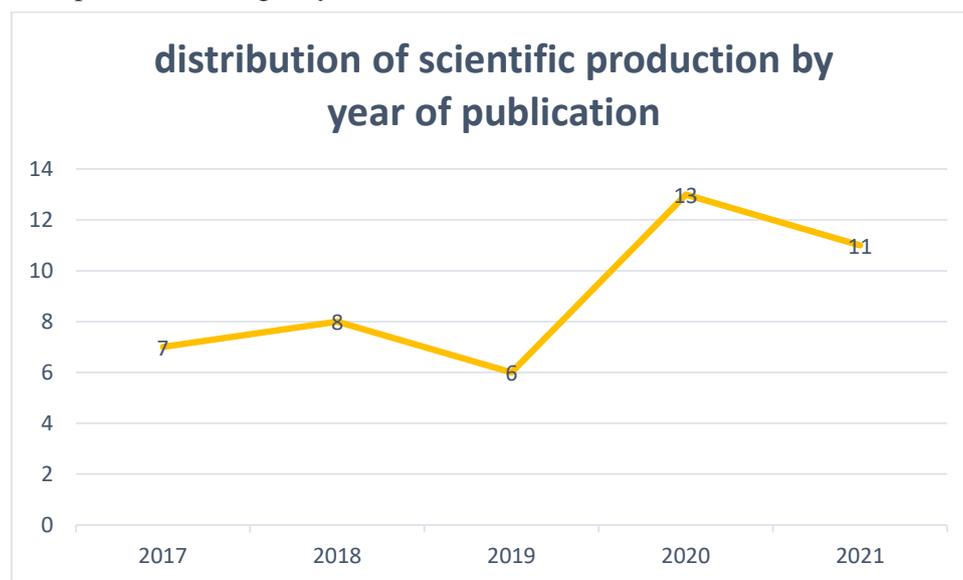


Figure 2. Distribution of scientific production by year of publication.

Source: Own elaboration (2022); based on data provided by Scopus.

2020 is the year with the greatest contribution to research related to the variables under study presenting 13 papers in total, among which we can find “*Effects of concept mapping on the synthesis of information in an interactive learning environment: A pre-experimental study*” (Dominguez & Vega, 2020). This paper raises a problem presented by the inverted classroom strategy, which is the large amount

of information to which students are exposed which can cause confusion and erroneous assimilation of concept. Therefore, this document proposes concept maps as a strategy to synthesize information, whereby teachers take the primary perceptions and information gathered by students and after the debate of the inverted classroom. Another concept map is made containing effective and true information in order to give clarity to the student. More studies are needed to evaluate, functionally and experimentally, the neurocognitive efficacy of

concept maps, as well as their effects on long-term learning.

2021 is the second year with the second highest number of publications registered in Scopus presenting 11 publications among which is “*Inverted distance classroom vs. Conventional inverted classroom: a comparative study*” (Domínguez-Torres et al., 2021). In this paper, the authors compared the effects of the Conventional Inverted Classroom (virtual component for independent study + face-to-face component for interactive discussion of clinical cases) and the Remote Inverted Classroom (FRFC) (virtual component for

independent study + “online” component for interactive discussion of clinical cases). With this, it was concluded that the two strategies have the same results in students facilitating the application of this strategy in times of COVID 19 and the adoption of the emergency remote modality.

4.3 Distribution of scientific production by country of origin.

Figure 3 shows the distribution of scientific production according to the nationality of the authors.

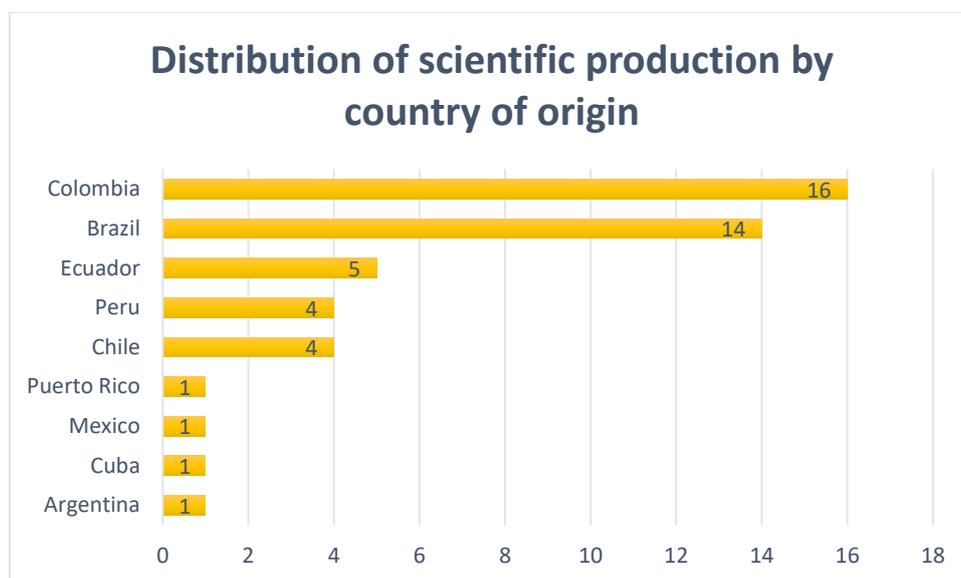


Figure 3. Distribution of scientific production by country of origin.

Source: Own elaboration (2022); based on data provided by Scopus.

Colombia is the Latin American country with the greatest contribution to research related to the development of the inverted classroom strategy with a total of 16 documents, among which is “*Learning climate and preparation for self-directed learning in surgery: does the teaching approach influence?*” (Dominguez et al., 2020). This paper has as main objective to compare the learning climate between 2 teaching approaches in surgery. This was done through questionnaires with formats that evaluated the inverted classroom and master classes and the role of the teacher in each of these. It was concluded that the inverted classroom favors a superior learning climate, with respect to the lecture, which is positively

related to self-directed learning in surgery students, even so similar results are found in the development of autonomous knowledge skills, so it is necessary to analyze in depth the factors that determine the learning of these competencies, since the inverted classroom is considered fallacious, since this strategy is designed with the purpose of developing autonomy in learning.

At this point, it should be noted that the production of scientific publications, when classified by country of origin, presents a special characteristic and that is the collaboration between authors with different affiliations to both public and private institutions, and these institutions can be from the same country or from different nationalities, so that the production of an article co-authored by different authors from different countries of origin allows each of the countries to add up as

a unit in the overall publications. This is best explained in Figure 4, which shows the flow of

collaborative work from different countries.



Figure 4. Co-citations between countries.

Source: Own elaboration (2022); based on data provided by Scopus }

As shown in Figure 4, Colombia is the Latin American country with the highest number of publications co-authored with other countries, having publications mainly with Spain and France, which demonstrates the interest of countries outside Latin America in how the flipped classroom is developed in this region. Brazil is in second place presenting 14 publications within which is “*Inverted Classroom Applied to Software Architecture Teaching*” (Goncalves et al., 2020). This document has as main objective to present results on the adoption of FC applied to software architecture teaching. Therefore, surveys were conducted for both inverted

classroom and traditional methods, which showed that the inverted classroom has an approach with potential to reinforce the learning of software architecture, since it facilitates the assimilation of knowledge, applied content and fundamental concepts, which make the teacher become a guide and not the main source of knowledge of students, providing them with autonomy and developing critical thinking.

4.4 Distribution of scientific production by area of knowledge

Figure 5 shows how the production of scientific publications is distributed according to the area of knowledge through which the different research methodologies are executed.

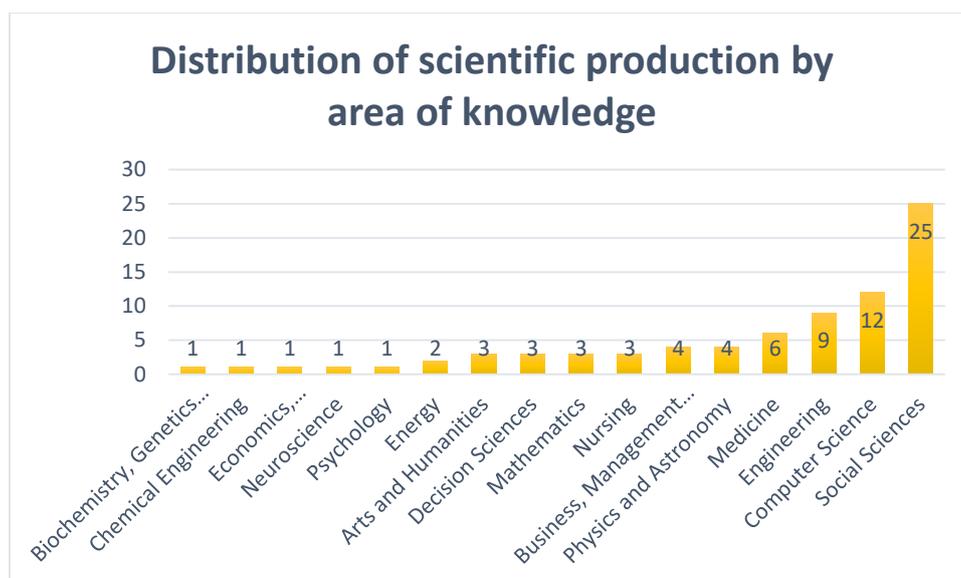


Figure 5. Distribution of scientific production by area of knowledge.

Source: Own elaboration (2022); based on data provided by Scopus.

Social sciences is the area of knowledge with the largest number of contribution through the theories that are framed in it, in the search for new knowledge on the development of the Inverted Classroom strategy and its impact on the work of teachers presenting 25 papers, among which is the article entitled “*Impact and recommendations of inverted classroom in the teaching-learning process of geometry*” (Albornoz-Acosta, Maldonado-Cid, Vidal-Silva, & Madariaga, 2020). This paper studies the implementation of the inverted classroom strategy in undergraduate, more specifically in the study of geometry; so, it conducts a survey to 176 first year mining engineering students and metallurgical engineering students who were taking a geometry class evaluating how they perceive the implementation of these strategies and the role of the teacher in these methodologies. It is concluded that the applicability of the inverted class for the education of working students is feasible as it helps them to develop independent knowledge skills.

Computer Science is in second place, presenting 12 papers registered in Scopus during the period 2017-2021. One of the papers is “*Bibliographic review of the inverted classroom model in the baccalaureate: A look from technological tools*” (Urbano et al., 2020). This document has as its main objective to offer a clearer vision of the impact of technological tools in the implementation of the inverted classroom model, so it performs a bibliometric review with 61 articles found in SCOPUS and WOS, processed with a scientometric tool, which shows that these strategies seek to help new researchers to make a conscious decision on the type of tool to implement to support the flipped classroom model and shows the importance of developing technological tools that are not limited by the use of the Internet so that they can reach a wider audience.

4.5 Type of publication

Figure 6 shows how the bibliographic production is distributed according to the type of publication chosen by the authors.

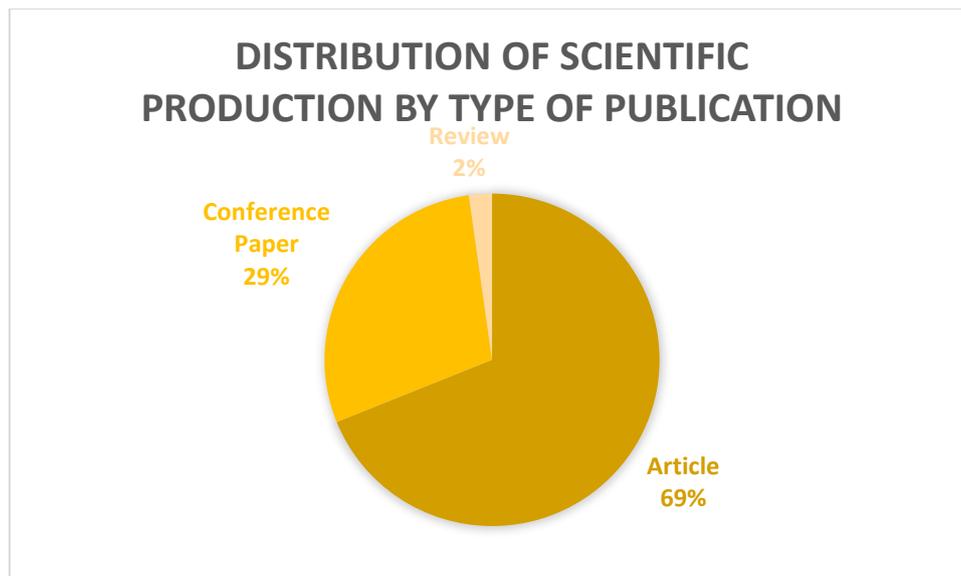


Figure 6. Type of publication

Source: Own elaboration (2022); based on data provided by Scopus.

As shown in Figure 6, within the different types of publications, 69% of the total number of documents identified through Phase 1 of the Methodological Design, correspond to Journal Articles, within which is the one entitled “*Inverted classroom teaching in the first-year design workshop, a case study*” (Elisa Navarro & Londoño, 2019). This document raises the way of acting in traditional education which is the direct transmission of knowledge from teacher to apprentice, as well as in the skills that students acquire with the repeated practice of the craft. Therefore, the advantages of using the inverted classroom strategy more and more are studied, since the inclusion of new technologies in teaching provides the opportunity to update study methodologies. This paper was conducted with educational actors belonging to the first year of Architecture at the Universidad de Los Andes in Bogota, Colombia. It is concluded that this strategy is a process that must be contextualized within local teaching practices, contributes to student autonomy, promotes individual and collaborative work and transforms the entire methodological scheme of the classroom.

In second place are the conference proceedings which represent % of the total documents identified in this study, within which is

“*Course of economic analysis of engineering: from the inverted classroom to distance learning*” (Méndez-Piñero, 2020). This document raises as a fundamental element of the transformation of strategies The professor's experience in teaching the economic analysis of engineering for more than ten (10) years, since it was what motivated a significant change in the way of teaching the course. This process began with the inverted classroom concept for approximately 70% of the course. As a result, the teaching strategy is working adequately and the students are taking additional knowledge with them.

5. Conclusions

Thanks to the bibliometric analysis proposed in this research, it can be determined that Colombia is the Latin American country with the highest number of bibliographic records in Scopus database during the period between 2017 and 2022 with a total of 16 documents. The scientific production related to the study of the development of the inverted classroom strategy has presented an important growth during the period previously indicated, from 7 publications in 2017 to 11 publication in 2021 with the highest number of publications in 2020 with 13 documents, that is to say, it was possible to increase the creation of bibliographic records in a period of 4 years and more creation of scientific literature related to this topic is considered necessary. This

indicates the importance of reforming methodologies according to what society demands, taking into account the changes in the role of the teacher in a class, going from a lecture where he is the protagonist, to a participatory class where the teacher takes on the role of guide in the search for knowledge.

Inverted is a pedagogical strategy that has changed the role of the teacher in the classroom from being the leader to being a guide for the search of knowledge of the students, since being better trained in this specific knowledge of each subject can help to clear doubts that may arise in the students. With this strategy, there is more time for the socialization of concepts and the discussion of these concepts, since the students have previously investigated the topic, which means that in the classroom with the shortcomings they have on the topic identified, this space is conducive to the resolution of doubts and thus be able to reach a complete concept on the subject to be addressed. All of the above allows this article to highlight the importance of analyzing the new educational strategies implemented in order to achieve better efficiency in the pedagogical processes and therefore better results and how society is changing the role of the teacher in the educational model. That is why it highlights the need for studies such as the one presented in this paper, which make a tour of those texts that address the aforementioned topic, in order to give the reader a broad view of the current status of the literature on the development of the flipped classroom strategy and the perception of teachers in Latin America.

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