

## Learning Styles in Higher Education: The use of Moodle platform

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### Abstract

A documentary review was carried out on the production and publication of research papers concerning the study of the variables Learning Styles in Higher Education in the use of Moodle platform. The purpose of the bibliometric analysis proposed in this document was to know the main characteristics of the volume of publications registered in the Scopus database during the period 2016-2021, achieving the identification of a total of 123 publications. The information provided by the said platform was organized through 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 Indonesia, with 12 publications, was the country with the highest scientific production registered in the name of authors affiliated with institutions of that country. The Knowledge Area that made the greatest contribution to the construction of bibliographic material referring to the study of Learning Styles in Higher Education in the use of the Moodle platform was Computer Science with 77 published documents, and the type of publication that was most used during the aforementioned period was the conference proceedings, representing 49% of the total scientific production.

**Keywords:** learning styles, moodle, virtual education.

## 1. Introduction

Virtual education is an educational model born from the digital transformation that society has experienced in recent decades, which leads educational systems to innovate by implementing information and communication technologies (ICT) in the teaching and learning processes to develop digital skills needed today in the profile of a good professional. For this reason, the use of virtual learning spaces such as Moodle, which is an educational platform that allows customizing educational environments according to the needs of students and teachers, allowing the integration of specific evaluation variables and the implementation of virtual learning objects that help students to understand the educational material, is increasingly seen. This new educational environment creates the need to identify the most frequent learning styles of students when using these platforms, since it is a different dynamic from the one known in the traditional classroom educational system, since in virtual education the teacher is not the main educational actor or the primary source of knowledge, but becomes a guide in the teaching and learning processes, motivating the construction of their knowledge from a critical analysis identifying the information with greater contribution to their professional training.

Learning styles are the ways of performing cognitive tasks, which vary depending on cultural differences and the tools that students put into practice in their pedagogical processes, so it is necessary to analyze which are the most used pedagogical styles in virtual education and the use of platforms such as Moodle since there is not a lot of research on this topic to identify how this affects the quality of higher education. One of the classifications of learning styles is the one elaborated by Kolb consisting of 5 categories or styles which are divergent (concrete and reflective), assimilative (abstract and reflective), convergent (abstract and active) and accommodative (concrete and active). In their study, Agudelo *et al.* (2010) found that in the

virtual education of a university the most used learning style was the divergent one which consists of the realization of concrete activities and reflective action, but that is not following the didactics implemented in the virtual environments by the teachers so it is necessary to integrate the educational actors identifying the activities that benefit all students to offer an educational quality and an integral formation. This helps to provide feedback to the universities regarding their educational practices and the design of curricular action plans and the use of methodologies where not only theoretical lectures are implemented, but also forums and debates that allow immediate feedback of the knowledge to be understood in a virtual course and the competences to be developed.

## 2. General objective

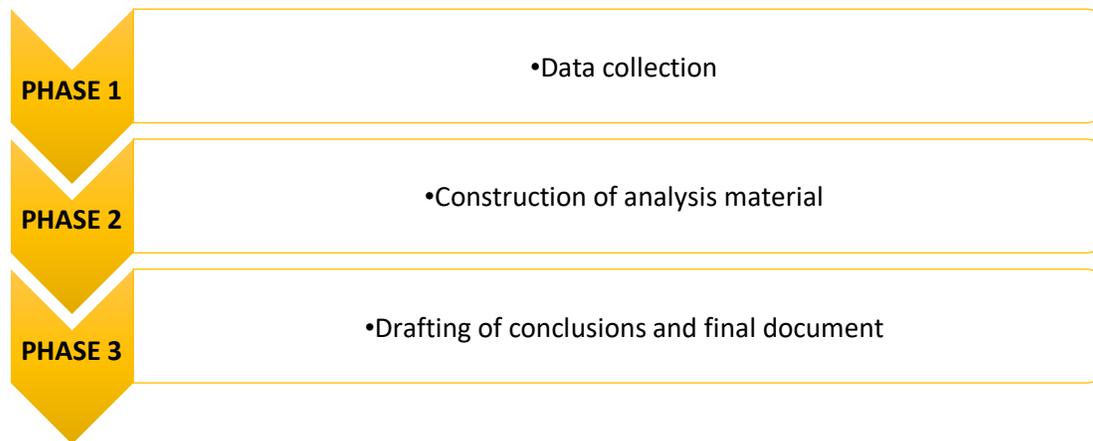
To analyze from a bibliometric and bibliographic perspective, the production of research papers on the variable Learning Styles in Higher Education in the use of Moodle platform during the 2016-2021 period.

## 3. Methodology

Quantitative analysis of the information provided by Scopus under a bibliometric approach on the scientific production related to the study of Learning Styles in Higher Education in the use of Moodle platform is performed. Also, from a qualitative perspective, examples of some research papers published in the area of the 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 parameters are established as shown in Figure 1.

### 3.1 Methodological design



**Figure 1.** Methodological design

**Source:** Own elaboration

### 3.1.1 Phase 1: Data collection

The data collection was carried out using the Scopus web page search tool, through which a total of 123 publications were identified. For this purpose, search filters were established consisting of:

- ✓ Published documents whose study variables are related to the study of Learning Styles in Higher Education in the use of Moodle platform.
- ✓ Without distinction of countries.
- ✓ Without distinction of the area of knowledge.
- ✓ Without distinction of the type of publication.

### 3.1.2 Phase 2: Construction of analysis material

The information identified in the previous phase is organized. The classification will be made employing graphs, figures and tables based on data provided by Scopus.

- ✓ Word Co-occurrence.
- ✓ Year of publication
- ✓ Country of origin of the publication.
- ✓ Area of knowledge.
- ✓ Type of publication.

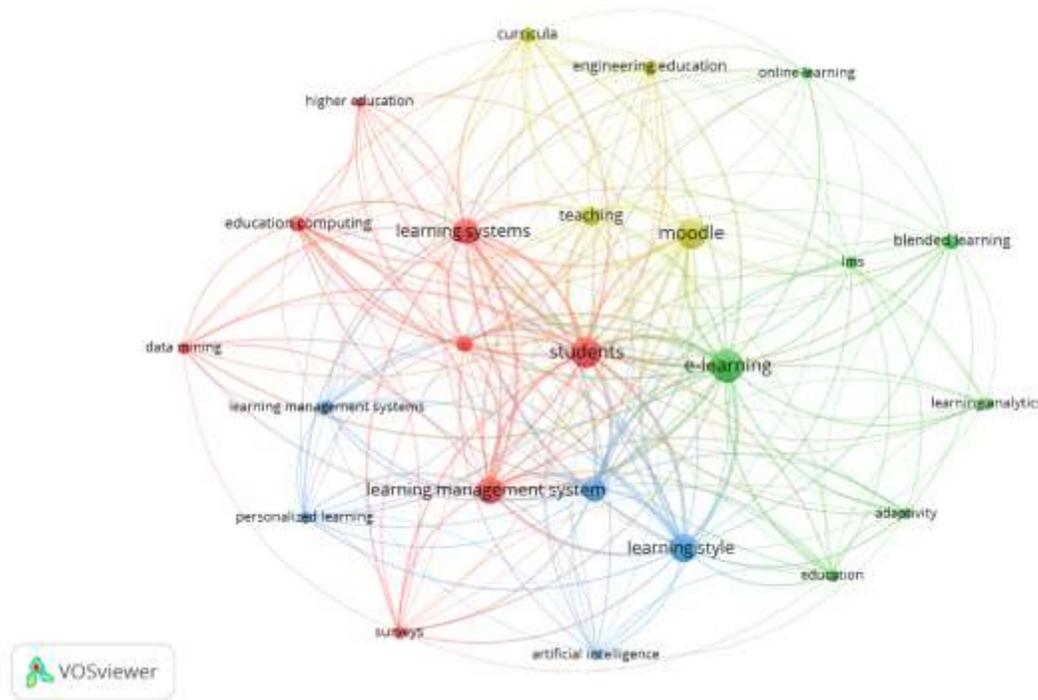
### 3.1.3 Phase 3: Drafting of conclusions and final document

After the analysis is carried out in the previous phase, the conclusions are drawn up and the final document is prepared.

## 4. Results

### 4.1 Co-occurrence of words

Figure 2 shows the co-occurrence of keywords within the publications identified in the Scopus database.



**Figure 2.** Co-occurrence of words.

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

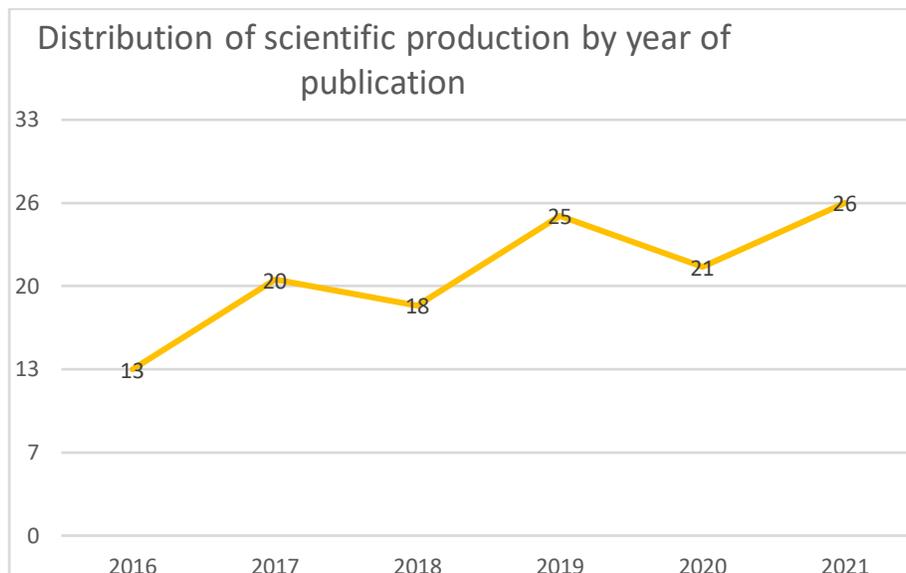
In the research related to the variables, there are keywords such as virtual learning, students and learning systems that refer to the educational strategies used by students to understand a subject. These strategies are due to the cultural characteristics of each student, and these learning styles have been studied in the traditional face-to-face educational model, but there is not much research oriented to the learning styles used in the virtual model since it is relatively new, but the needs that arise with virtual environments and the dynamics that are created in these spaces should be considered, favoring a quality education and the application of learning systems for all students.

On the other hand, keywords such as Moodle, teaching and curriculum are the most used by the authors to refer to virtual educational spaces such as Moodle, a platform that allows customizing the virtual space using varied didactics that allow assimilating the information with different activities due to the needs of each learning style. These activities differ from those implemented in

the traditional face-to-face educational model as the teacher is the main authority and source of information, while in virtual education the teacher takes a cooperative role in the way to obtain the necessary knowledge, being the students responsible for selecting the useful information for their professional training. For this reason, universities as transforming entities by nature are called to implement these technological innovations for training in digital skills, offering a comprehensive education that allows all students to have the same educational level understanding from the simplest to the most elaborate concepts using not only the lectures as tools but also activities that do not convert the pedagogical processes in vertical processes but use the classes as a space for confrontation that allows clearing doubts about a specific topic.

#### **4.2 Distribution of scientific production by year of publication.**

Figure 3 shows how the scientific production is distributed according to the year of publication, taking into account the period from 2017 to 2021.



**Figure 3.** Distribución de la producción científica por año de publicación.

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

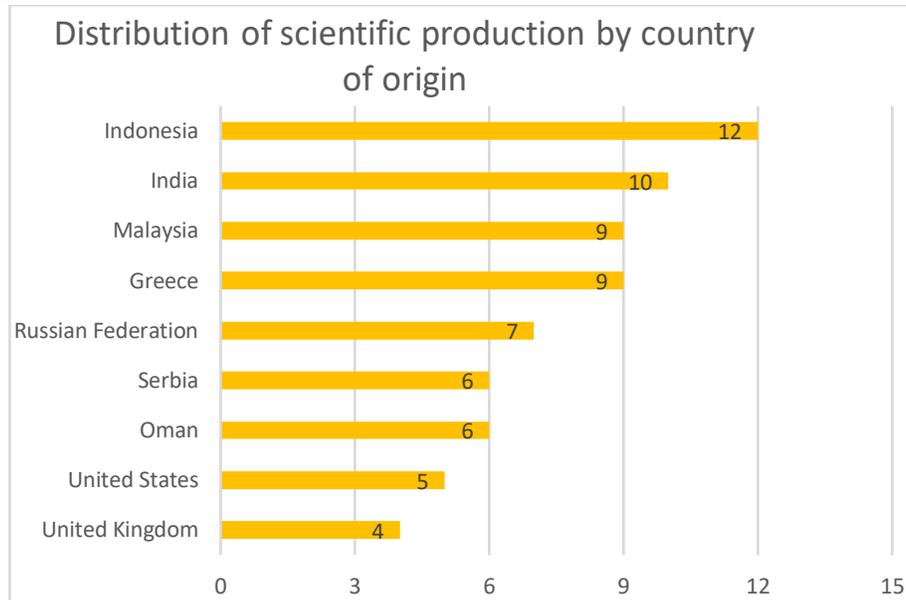
2021 is the year with the highest number of papers related to variables in studies registered in Scopus “An intelligent system to support the planning of interactive learning segments in online education” (Kuk *et al.*, 2021). This paper has as its main objective to propose, develop and explain the implementation of a personalized intelligent system that allows students to have interactive tools. Therefore, this project was conducted on the Moodle platform to determine which data analysis allows choosing the best option of didactic tools for students and how this helps in the personalization of the virtual educational environment depending on the learning behavior of each student. These results allow determining the data in the development of intelligent analysis systems that recommend these tools to students by patterns of behavior on these platforms allowing to adapt these environments to the learning style of each student from an intelligent service model giving autonomy to students when developing their virtual classroom.

In second place is 2019 with 25 publications, within which it is possible to identify the title

“Unique pedagogies of music learning through MOODLE through Russian and Indian approach” (Karkina *et al.*, 2019). In this paper, the possibilities of distance education based on MOODLE for music pedagogy in higher education are presented being this a platform that allows customizing the virtual space depending on the needs of each student. In this case, based on distinctive music pedagogies of Shulman's study comparing the use of this platform in Russia and India where it could be determined that although they are different musical models they have certain characteristics in common such as musical understanding. This platform allowed students to further develop their listening skills and was able to provide a wide range of musical materials, including different styles and genres helping the comprehensive training of musicians.

#### **4.3 Distribution of scientific production by country of origin.**

Figure 4 shows the distribution of scientific production according to the nationality of the authors.



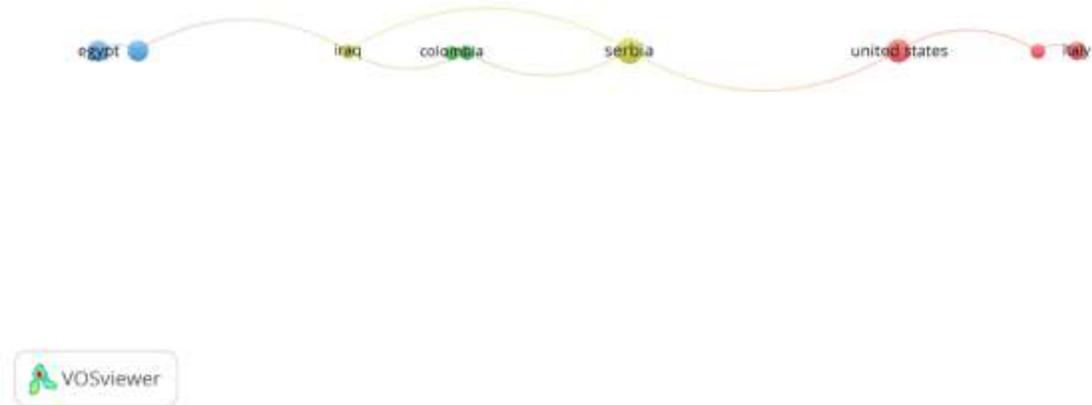
**Figure 4.** Distribution of scientific production by country of origin.

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

Indonesia is the country with the largest literature production related to Learning Styles in Higher Education in the use of Moodle platform, presenting 12 papers within which one can find the title “Development of Moodle-based adaptive hypermedia system to overcome the diversity of learning styles in vocational education in Indonesia” (Setiawan & Hasanah, 2018). This paper has the main objective to conduct the needs analysis of the products that will be developed based on the potentialities and problematics of adaptive hypermedia based on moodle from a review to literature and expert analysis so the results of this study allowed to determine the adaptive hypermedia benefiting the vocation of university students depending on learning styles and adapting the virtual classroom depending on

the needs of students allowing to cover all academic needs.

At this point, it is worth noting 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 different nationalities so that the production of an article with co-authorship of different authors from different countries of origin allows each of the countries to add up as a unit in the general publications. This is best explained in Figure 4, showing the flow of collaborative work from different countries.



**Figure 4.** Co-citations between countries.

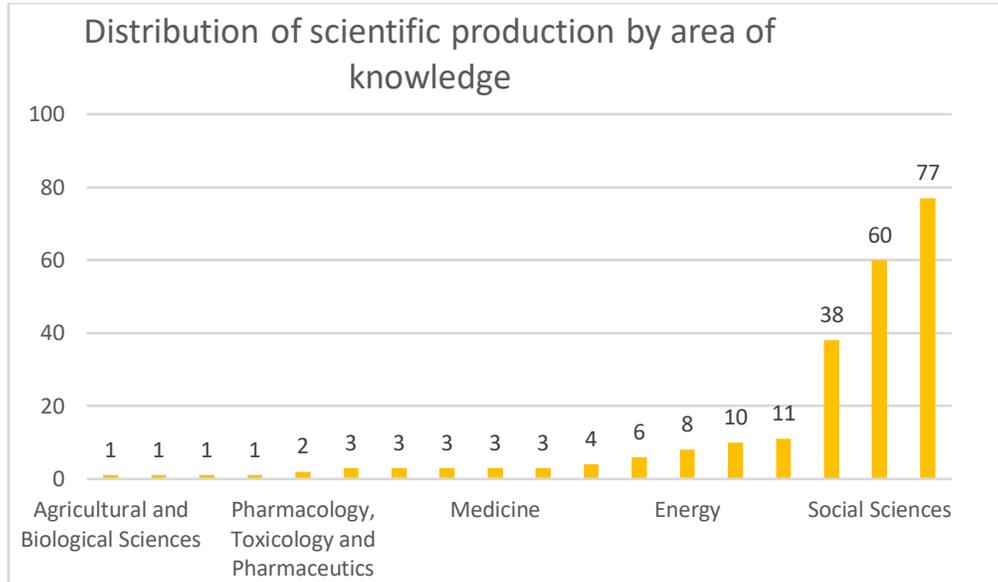
**Source:** Own elaboration (2022); based on data provided by Scopus.

As mentioned above, Indonesia is the country with the highest number of publications related to the variables under study, most of these being presented by authors with affiliation to Indonesian institutions, with few papers co-authored with other countries. In second place is India with 10 papers and in third place are Greece and Malaysia with 9 papers each. In fourth place is the Russian Federation with 7 papers and in fifth place are Serbia and Oman with 6 publications each, within the publications belonging to Serbia is “Analysis of adaptive e-learning systems with adjustment of the Felder-Silverman model in a Moodle DLS” (Zlatkovic *et al.*, 2020). This paper seeks to determine the effectiveness of E-learning and all that it implies. Therefore, this paper considers the characteristics of the students and their learning styles where it was possible to carry out a process

that adapts the work of the DLS based on the knowledge of the students to improve the design and usefulness of the course from the understanding of the needs of each student depending on the learning styles, providing a comprehensive and quality education providing virtual educational environments related to the objectives of higher education and the development of skills needed today.

#### **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.

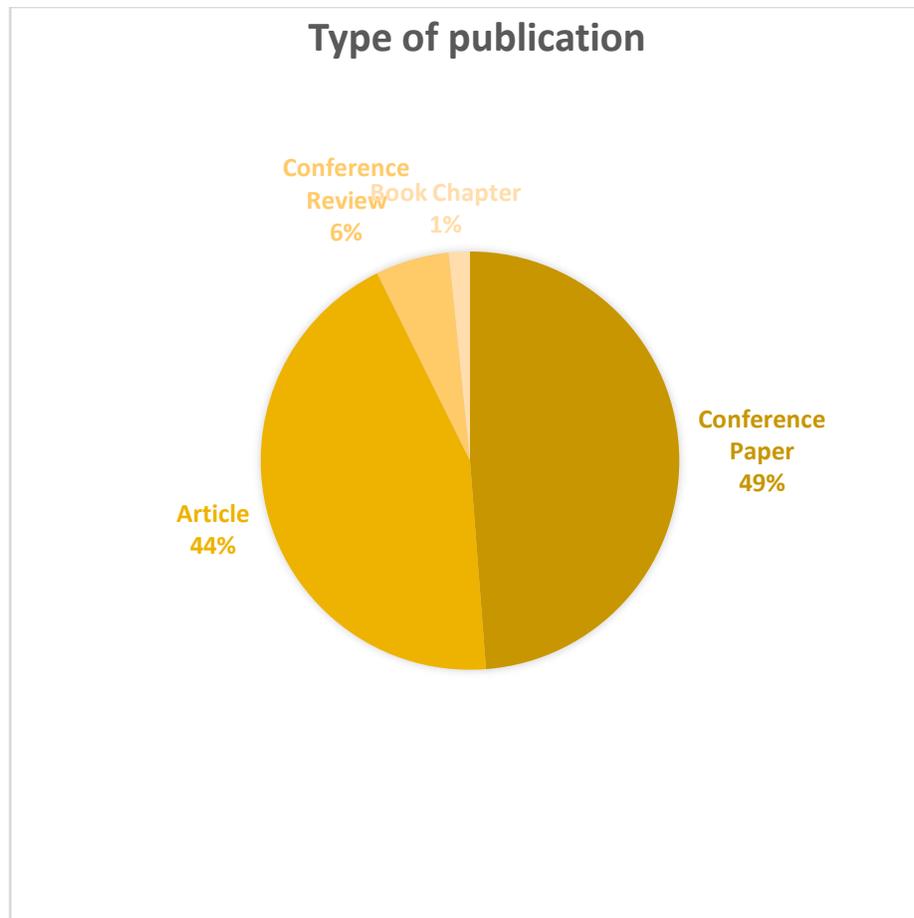
Computer Science is the area of knowledge with the largest number of contributions through the theories that are framed in it, in the search for new knowledge about Learning Styles in Higher Education and the Moodle platform with 77 papers, within which is the title “Analysis of student behavior to detect learning styles in the Moodle learning management system” (Ikawati *et al.*, 2020). This paper presents an approach to automatically predict learning styles based on Felder and Silverman's learning style model (FSLSM) that uses the decision tree algorithm and the Gradient Boosted Tree ensemble method since it is difficult to monitor student behavior when using virtual learning media.

In the second place, social sciences are one of the areas of knowledge with the largest number of documents related to the criteria of this area, presenting 60 documents, among which there is the title “Distance learning for the teaching of simple colloids with the help of moodle” (A. a, *et*

*al.*, 2021). This document has as its main objective to improve the teaching procedure for both students and teachers. For this reason, they use Moodle to improve pedagogical processes, so a study was conducted with a group of students of the module “Simple Colloids” where the effectiveness of this platform in improving teaching-learning tools was demonstrated taking into account all learning styles having access to a comprehensive education for all students. This is to innovate in distance education and present models of curricular plans that allow adapting higher education to the needs of the distance education model and the tools used in its application.

#### 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, 49% of the total number of documents identified through Phase 1 of the Methodological Design correspond to conference proceedings, among which is the one entitled “Adaptive learning and testing in moodle” (Kika *et al.*, 2021). This document has as its main objective to present the adaptations made to the Moodle platform to provide the tools to adapt the functions depending on the needs of the educational actors depending on the learning styles, so a questionnaire was conducted and a survey was used to evaluate the effectiveness of learning and satisfaction with the learning of 50 students who took the test, determining their level of performance and their ability to adapt to online education and its tools.

In second place are the journal articles that represent 44% of the total number of documents registered in this study. Within these documents, it is possible to identify the one entitled “Teaching and learning styles in moodle: An analysis of the effectiveness of the use of stem and non-stem ratings from a gender perspective” (Sáiz-Manzanares *et al.*, 2021 ). The main objective of this document is to check if significant differences can be found with the use of learning objects in Moodle, depending on the experience of the teacher, showing differences in the courses where there were experienced teachers and teachers with a low level of experience, so it is necessary to increase technological training for both teachers and students.

## 5. Conclusions

Thanks to the bibliometric analysis carried out in this article, it is possible to determine that among the main characteristics in the volume of scientific production related to the study of Higher Education in the use of Moodle platform, the low participation of the humanities in the publication of this type of topics as a subject of research prevails, even so, it is established that Indonesia was the country with the highest number of reports through its institutions to Scopus with a total of 12 documents registered during the period 2016-2021. Due to the nature of the study, which seeks to determine how learning styles are used in online education and the use of the Moodle platform in higher education, it is established that Computer Science was the area of knowledge with the greatest influence on the research identified, since 77 of the 123 publications related to this analysis, actively participate with theories framed in this area of knowledge.

Similarly, and following the nature of the study and the technological component, Social Sciences also played a fundamental role in the execution of 60 publications. It should be noted that within the analysis presented regarding the position of different authors concerning the study of the topic proposed in this research, it can be concluded that learning styles are the ways that students have to assimilate the information that is given to students through different tools. For this reason, the Moodle platform is key because it allows customizing with tools that support learning styles in distance education. Similarly, the Moodle platform helps to maintain educational quality in higher education as it helps students to develop their skills from the personalization of virtual educational environments.

Thus, this study concludes by highlighting the importance of taking into account the learning styles in the virtual curriculum plan by determining the virtual learning objects that help students to develop competencies under the learning systems, however, it is expected that from bibliographic and bibliometric reviews such as the one proposed in this document, the current situation of the literature on the subject will be taken into account and the educational actors will devote even more efforts in the search for the

generation of new knowledge on the subject to have newer and better tools to determine the role of Learning Styles in higher education with the use of the Moodle platform.

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