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Systematic Literature Review of Flipped Classroom Models in Geography Education: Trends, Challenges, And Future Directions

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ABSTRACT: This study is a systematic literature review on the application of the flipped classroom model in geography education, with the aim of identifying research trends, implementation challenges, and future development prospects. The review was conducted on scientific publications published between 2015 and 2025, using the Scopus and Mendeley databases, resulting in the selection of 35 articles that met the criteria for review. The analysis results show that research trends on the flipped classroom in geography education continue to increase, especially at the university and secondary school levels. Research topics are dominated by physical geography, human geography, and the development of spatial thinking skills. The flipped classroom has been proven to enhance student motivation, critical thinking skills, and digital literacy. The main challenges in its implementation include limitations in infrastructure, technology mastery, teacher readiness and creativity, as well as student awareness and discipline. Future development potential for the flipped classroom includes the integration of advanced technologies such as Virtual Reality, Artificial Intelligence, project-based learning, and strengthening Geographic Information Systems (GIS) learning. This review contributes strategically to the development of innovative flipped classroom-based learning models in geography education that are relevant to the needs of 21st-century learning.

KEYWORDS: Flipped Classroom, Geography Education, Systematic Literature Review, Technology-Based Learning, Trends and Challenges.

I. INTRODUCTION

The development of information and communication technology has brought significant changes to learning methods at various levels of education. One learning innovation that has received a lot of attention is the flipped classroom model. The flipped classroom is a learning method in which student activities that are traditionally carried out outside the classroom, such as discussions and problem solving, are moved to classroom activities, while the delivery of material, which is usually done in the classroom, is moved outside the classroom or done before the lesson begins [1]. In this approach, learning resources such as videos, reading texts, or preliminary assignments are prepared and studied by students before entering the classroom [2]. The concept of the flipped classroom was first discovered in 2007 by two chemistry teachers at Woodland Park High School, Colorado, United States, named Jonathan Bergmann and Aaron Sams. They were initially looking for ideas on how to repeat lessons for students who were absent from class. They made instructional videos and added notes to the learning materials, then uploaded them online for the absent students to study. However, it turned out that the uploaded material was not only studied by students who were absent from class, but also by other students to review and reinforce the material. Bergmann and Sams finally realized that the system of delivering material could be reversed, done at home before class, and then used in class to confirm the material that had been studied as material for discussion and problem solving [3].

Strong reasons for implementing the flipped classroom include technological developments that are becoming more accessible to students [4]. The flipped classroom became more popular during the COVID-19 pandemic [5]. The COVID-19 pandemic forced the transition of the learning process to online platforms, because this approach has been proven to attract students' attention through active learning techniques and combining synchronous and asynchronous elements. This model is the right choice for educators who are familiar with this teaching method during the pandemic [6]. The flipped classroom learning model offers the flexibility of learning that is needed in today's era The flipped classroom also facilitates a learning system where students are responsible for their own learning through the completion of pre-class learning tasks that cover lower cognitive levels, according to Bloom's taxonomy, so that higher-level cognitive learning (application, analysis, evaluation, and creation) can take place in class [8]. This approach also supports deep, student-centered learning with the help of technology that can increase student motivation [9].

Geography education is a science that requires an approach to integrate theoretical understanding with spatial understanding and analytical skills. The use of information technology in geography learning can improve the process of acquiring and transferring information in geographical and spatial understanding [10]. The use of technology in geography learning supports the application of the flipped classroom. Previous studies have shown that the flipped classroom is effective in helping students understand the basics of geography concepts, improving academic achievement and enthusiasm for learning [11]. The application of the flipped classroom in geography learning can also improve digital literacy and spatial problem-solving skills [12]. In general, many studies have been conducted on the flipped classroom, but systematic research specifically focusing on the flipped classroom model in geography education is still limited. This raises the need for a systematic literature review so that current trends, obstacles encountered, and potential directions for the development of the flipped classroom model in geography education can be clearly identified.

This article aims to present a systematic review of the flipped classroom model in geography education, focusing on identifying research trends, implementation challenges, and the potential for future development of this model. The main research questions raised in this review include: What are the main trends in the application of the flipped classroom in geography education? What are the challenges and obstacles often encountered in its implementation? And what is the direction of the development of the flipped classroom in the field of geography education in the future? This systematic review is expected to make a significant scientific contribution and serve as a strategic reference in the development of flipped classroom-based geography learning.

II. METHOD

The method used in this study was a Systematic Literature Review (SLR). This approach is a technique for combining scientific evidence from various previous studies, with the aim of gradually supporting the development of scientific knowledge on similar themes [13]. The approach used in the following systematic literature review was the PRISMA approach. The PRISMA approach is a guideline for literature reviews, in which after the literature is collected, researchers must screen it based on predetermined eligibility criteria. This method is presented in the form of a flowchart that illustrates the amount of literature found before being evaluated according to predetermined criteria. The number of literature will decrease until it reaches the accepted number, through a process of reducing the excluded literature along with the accompanying reasons [14].

The literature search for this study was conducted in the Scopus and Mendeley databases using the keywords *"flipped classroom geography."* The criteria for articles that could be used for this study were articles published between 2015 and 2025, with topics related to geography education, not duplicated, and open access articles. The number of articles found with the keyword "flipped classroom geography" between 2015 and 2025 in Scopus was 27 articles and in Mendeley was 56 articles. This number is certainly very different from the number of articles found with the keyword "flipped classroom" in general, where the number of articles in Scopus reached 8,426 articles and in Mendeley was 17,736 articles. Of the 83 articles found using the keyword "flipped classroom geography" in Scopus and Mendeley, 26 articles were not open access, resulting in 57 open access articles that were then filtered according to the established criteria, and 35 articles were found to be ready for review. The article screening process can be seen in the following PRISMA diagram.

III. RESULT AND DISCUSSION

A. Research Trends in Flipped Classroom in Geography Education

Based on the results of bibliometric analysis, research trends in flipped classroom in geography education from 2015 to 2025 show a gradual increase in the number of studies with several significant fluctuations. In 2015 and 2016, the number of publications was still very low, after which there was a gradual increase until 2020. In 2021, there was a decline in publications, but 2022 became the highest point in the research trend on flipped classrooms in the field of geography education with 8 documents. This number declined in 2023 and 2024 but showed an increase again in 2025 (see Figure 1). Overall, this trend illustrates that research related to the flipped classroom in geography education has grown significantly in the last ten years, marked by significant peaks in research in 2020 and 2022 despite experiencing ups and downs. This condition is different from the general trend of flipped classroom research. Research on the flipped classroom in general increased from 2015 to 2021, approaching 1,000 publications. In the following years, these publications declined until 2025 (see Figure 2). This was due to the Covid-19 pandemic. The COVID-19 pandemic forced innovation in learning [15][16][17]. Flipped classroom research during the pandemic showed the effectiveness of flipped classroom learning. Flipped classrooms proved effective in increasing motivation and overcoming dissatisfaction with online learning during the pandemic[18][19].

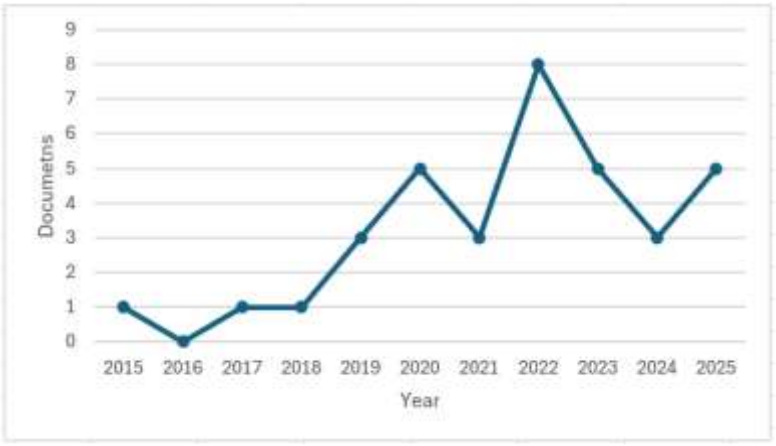

Figure 1. Number of Research Articles on Flipped Classrooms in Geography Education by Year

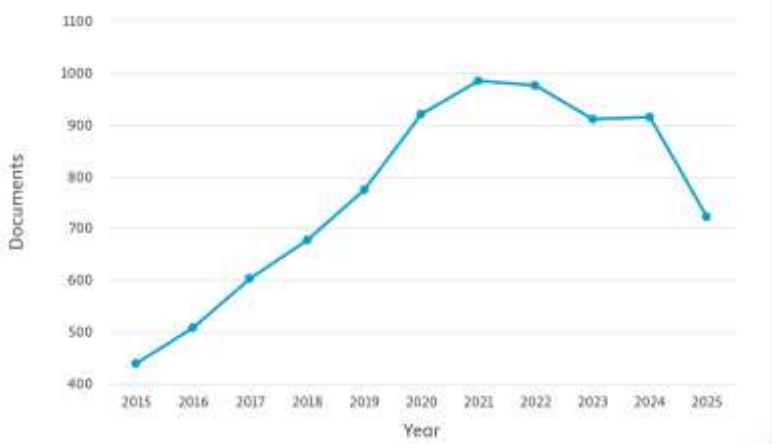

Figure 2. Number of Research Articles on Flipped Classrooms by Year

The trend of flipped classroom research in geography education is spread across various countries. The country with the highest number of publications on flipped classrooms in geography learning is Indonesia, followed by China, then the United States, Nigeria, and Spain. Other countries that have conducted research have only produced one publication on flipped classrooms in geography education (see Figure 3).

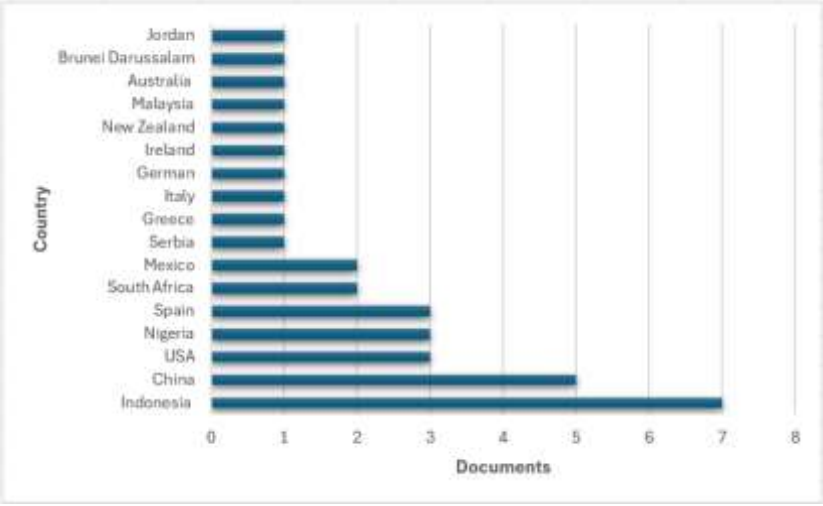

Figure 3. Number of Research Articles on Flipped Classrooms in Geography Education by Country

Research on the flipped classroom in geography education based on Figure 4 shows that the distribution of research focus varies greatly across different levels of education. Most research was conducted at the university level, accounting for 46%, indicating the main focus and greatest interest in the application of the flipped classroom model in higher education. Furthermore, research is also quite dominant at the senior high school level (SMA) with a share of 37%, showing that this

learning innovation is beginning to be significantly adapted at the secondary education level. At the elementary school level, research contributions reached 8%, while research at the junior high school level (SMP) covered 6%. Meanwhile, the pre-university level only accounts for 3%, indicating that the flipped classroom in geography education at this level is still relatively rarely researched.

The widespread implementation of the flipped classroom at the university level is supported by the fact that students take more responsibility for their learning than high school students [20]. Other studies also mention that the use of flipped classrooms at the university level demonstrates learning flexibility, enhances the learning culture among students, supports the transformation of the roles of lecturers and students in learning, and supports the utilization of technology that has been mastered by students [21][22]. At the secondary school level, both junior high and high schools, flipped classrooms support student-centered learning that trains responsibility and is able to improve higher-order thinking skills [23][24] Research shows that the effectiveness of implementing the flipped classroom at the secondary school level is highest because teachers still have tighter control to monitor and ensure that students do their pre-class preparation, for example, through homework assignments and supervision, as well as personal interaction because teachers are more often present in class [25]. At the elementary school level, the application of the flipped classroom is not yet popular, but research in Greece shows that the application of the flipped classroom has received a positive response from parents. They can accompany their children in their studies and monitor their learning process [26]. However, the results of this study may not necessarily be the same as the response of parents in other countries.

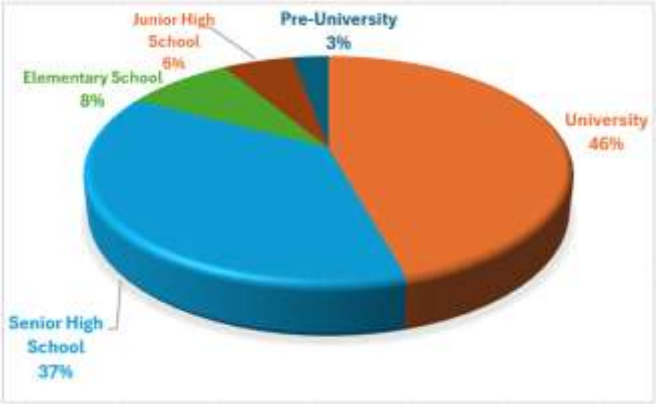

Figure 4. Distribution of Flipped Classroom Research in Geography Education Based on Education Level

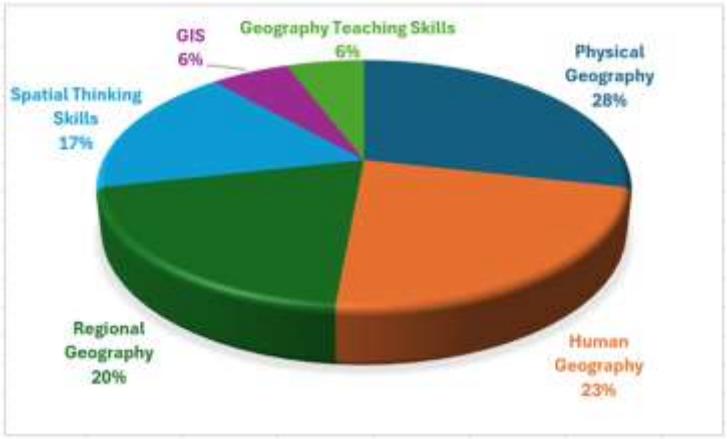

Figure 5. Distribution of Flipped Classroom Research Topics in Geography Education

The geography material applied in flipped classroom research varies. The most widely used geography material in flipped classroom research is physical geography, with a proportion of 28%. These physical geography themes include geology, geomorphology, the solar system, disaster geography, and environmental geography. This shows that the physical aspects of geography are the main focus in geography learning. Physical geography material requires a lot of time for field studies, but sometimes time constraints prevent field studies from being carried out, opening up opportunities for the flipped classroom to be applied so that students are able to understand physical phenomena [27]. Human geography topics ranked second with 23%, indicating a great interest in social and cultural phenomena and human interaction with the environment. Regional geography accounted for 20%, indicating the importance of studying regions and spatial differences in geography education. Research related

to Spatial Thinking Skills accounted for 17%, highlighting the importance of developing critical geographical thinking skills in geography learning for students. The results showed that the application of the flipped classroom was able to improve spatial thinking skills [28]. Meanwhile, the themes of Geographic Information Systems and Geography Teaching Skills each contributed 6%, indicating that more specific research on these topics still needs to be developed.

B. Challenges in Implementing the Flipped Classroom in Geography Education

Some of the challenges in implementing the flipped classroom in geography education include the following::

1. Availability of Infrastructure
   Infrastructure greatly affects the success of flipped classroom learning. Infrastructure includes the availability of software or LMS, computers or gadgets owned by teachers and students, and internet access. A lack of infrastructure will hinder flipped classroom learning [29].
2. Mastery of technology
   The mastery of technology by both students and teachers greatly influences flipped classroom learning. Teachers who lack mastery of technology will choose not to use the flipped classroom. Students who lack mastery of technology will also experience difficulties in applying this learning method [30].
3. Student awareness and discipline
   Student awareness and discipline in learning, especially in the pre-class stage and in the main class activities, affect the success of flipped classroom learning. Many students do not watch videos or study learning materials in pre-class activities, so they become passive in the main class. They are distracted by other applications such as social media and games [10]. The lack of student discipline in online learning is not only caused by distraction from other applications but also by a lack of awareness among students or their tendency to forget to participate in online learning activities [31].
4. Time and Workload
   The implementation of the flipped classroom requires more time. Students spend more time studying the learning material [32],[33]. In addition to the students, teachers also need more time to design the learning activities [31] [34]. The relationship between the longer time required and the increased workload for both students and teachers [29], [30].
5. Teacher Readiness and Creativity
   Teachers play an important role in designing learning activities for the flipped classroom. Teachers must be prepared to shift from traditional learning. Many teachers do not yet understand the flipped classroom model and are not familiar with this learning model [35]. Teachers must also be creative in developing learning designs that are interesting for students in order to increase their interest in learning [36]. In geography education, teachers must prepare teaching materials that are appropriate for the characteristics of the material to be delivered. For example, in physical geography learning, teachers must provide videos or learning materials that are relevant to the case studies being discussed. In GIS learning, teachers must also prepare tutorial videos on how to create maps using the specified application.
6. Institutional Support
   Institutions play an important role in the implementation of the flipped classroom. Schools and universities that provide hardware and software facilities such as LMS and MOOC facilitate teachers and students in conducting flipped classrooms [34]. Institutions that pay attention to flipped classroom learning will facilitate collaborative spaces such as the use of Moodle, Google Classroom, institutional LMS, Edmodo, and so on [37]

C. The Direction of Flipped Classroom Development in Geography Education in the Future

1. The Application of VR and AI in Flipped Classroom Learning
   The application of Virtual Reality in geography learning provides a more in-depth impression of the actual conditions of a phenomenon despite the limitations that exist. VR has greater potential for use in geography education because there are many aspects or phenomena that cannot be seen directly due to our limitations, such as geological materials, geomorphology, the solar system, and so on [38].
2. Application of Flipped Classroom in GIS Learning
   GIS learning with the flipped classroom allows students to learn basic GIS concepts through video tutorials and digital simulations that can be accessed at any time before class, so that face-to-face time can be used more effectively for practice and discussion. Flipped classroom learning in GIS can also integrate case-based learning that requires spatial problem solving, such as land use, disaster mitigation, and environmental change analysis, which can improve analytical critical thinking skills.
3. Application of Project-Based and Inquiry-Based Learning
   Project-based learning with a flipped classroom can be referred to as the project-based flipped classroom (PjBFC) model. The PjBFC model combines the strengths of the flipped classroom and project-based learning, so that students can first learn geographical concepts through pre-class videos and digital resources, then apply them in real projects such as conducting field research, analyzing geographical phenomena, or creating thematic maps. This approach fosters critical

and creative thinking skills, as well as collaboration and communication skills in the context of geography [39]. Inquiry-based learning encourages students to ask questions, conduct investigations, and build understanding through exploration and analysis of geographic data. With the flipped classroom, students have more time to explore theory independently and then focus in class on practical and challenging inquiry-based exploration activities with direct guidance from the teacher.

IV. CONCLUSION

The flipped classroom model in geography education shows an increasingly positive development trend with an increase in the number of studies and applications at various levels of education, particularly in higher education and secondary schools. The flipped classroom is applied to various geography subjects, such as Physical Geography, Human Geography, Regional Geography, as well as mapping skills and Geographic Information Systems (GIS). The flipped classroom can increase student motivation, critical thinking skills, and spatial skills through a student-centered learning approach and the use of digital technology. Despite challenges such as limited facilities and infrastructure, mastery of technology, and the readiness of teachers and students, the potential for developing the flipped classroom in geography education is enormous, especially with the integration of cutting-edge technologies such as Virtual Reality, Artificial Intelligence, project-based learning, inquiry, and Geographic Information Systems. This learning model can enrich contextual, interactive, and applicable geographical learning experiences, thereby producing students who are able to understand spatial and environmental phenomena in a deep and critical manner. Therefore, the development of the flipped classroom needs to be supported by educational institutions, the provision of adequate technology, teacher training, and ongoing research to optimize its application in geography education in the future.

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