Contextual Natural Science Education Journal (CNSEJ)
https://jurnalpasca.unram.ac.id/index.php/cnsej
DOI: https://doi.org/10.29303/cnsej.v3i2.1077

e-ISSN: 3046-8094

# A Systematic Review of Research Trends in Cooperative Learning Models in Science Learning

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**Article Info**

***Article history:***

Received: June 12, 2025
Accepted: June 19, 2025
Published: June 30, 2025

***Keywords:***

Bibliometric analysis;
Cooperative learning;
Science learning;
VOSviewer.

**ABSTRACT**

This study aims to systematically review trends, patterns, and thematic developments in research related to cooperative learning models in science education. Utilizing a descriptive-analytical method, data were collected from documents indexed in Google Scholar, published between 2016 and 2025. The data were analyzed using bibliometric tools, including Publish or Perish, VOSviewer, and Dimensions.ai. The analysis highlights several key aspects, including publication trends, types of sources, top-cited articles, disciplinary research categories, and keyword mapping. Findings indicate a significant increase in research interest, particularly after 2021, with dominant focuses on improving students' motivation, learning outcomes, and scientific literacy. Cooperative learning models such as STAD, Jigsaw, TGT, TPS, and TSTS were the most frequently studied. The keyword analysis revealed six thematic clusters emphasizing cognitive, motivational, collaborative, and communicative dimensions of cooperative learning. This review underscores the growing significance of cooperative learning in 21st-century science education and identifies gaps for future research.



## INTRODUCTION

21st century education requires learners to not only master knowledge, but also critical thinking skills, communication, collaboration, and creativity (Alwanda et al., 2024). In this context, the role of the teacher as a learning facilitator is very important in creating an active and meaningful learning atmosphere (Prabawati et al., 2025). One of the learning models that is considered effective to achieve these goals is the application of cooperative learning models, which have been proven to improve student engagement, learning outcomes, and the ability to work together in the context of science learning (Abliani et al., 2024; Jurahmin, 2023; Widayati, 2023; Devi et al., 2023).

A learning model is a pattern designed as a reference in the learning process, both in the classroom and in tutorials. This model must be adjusted to the approach used, including learning objectives, learning environment, and class management (Hia et al., 2022). Through the learning process, teachers play a role in helping students obtain information, develop ideas, improve skills, shape ways of thinking, and express ideas (Susanti, 2022). In addition, the learning model also serves as a guide for learning designers in designing effective learning activities (Berliana, 2022).

Cooperative learning models have been widely recognized in education and have a long history. Teachers encourage learners to work together in completing group tasks, such as discussions, debates, or additional learning activities (Syahputra, et al., 2023). According to some experts, cooperative learning models are not only effective in helping learners understand difficult concepts, but also very useful in developing critical thinking skills (Hadi, 2025; Naga & Nirmala, 2024; Lathifa et al., 2024).

Cooperative learning model is a learning model that prioritizes the cooperation of students in learning activities. Learning activities are carried out in groups to work together to help each other instruct concepts, solve problems, or inquiry. Cooperative learning is a conceptual framework of a series of learning activities carried out by students in certain groups to achieve learning objectives that have been formulated. The groups work together to achieve the learning objectives. Cooperative learning is a learning strategy that involves learners working collaboratively to achieve a common goal (Amalia et al., 2023; Fakhriyah & Baalwi, 2025).

Empirical studies have shown that the application of cooperative learning models can improve learners' academic achievement, learning engagement, intrinsic motivation, and interpersonal skills (Adji et al., 2023; Kebede et al., 2025). The most commonly used types include Student Teams Achievement Division (STAD), Jigsaw, Group Investigation (GI), and Think-Pair-Share (TPS) (Irfan et al., 2023; Untari & Astuti, 2021). However, although these models have been widely applied, there are variations in their effectiveness and implementation based on the subject context, education level, and learner characteristics (Amanah, 2023).

As the number of studies examining cooperative learning models increases, there is a need to conduct a systematic review to obtain a more complete, comprehensive, and evidence-based picture of trends, key findings, and open research gaps. Therefore, this article aims to conduct a systematic review of the literature that discusses the application of cooperative learning models in various fields of study and levels of education, with a certain time span. This review is expected to contribute to formulating more effective educational policies and learning strategies in the future.

## METHODS

This research uses a descriptive analytical method that aims to understand and describe the research trend regarding cooperative learning models. The data in this research is obtained from information sources that have been indexed in Google Scholar with the help of analysis tools such as Publish or Perish, VOSviewer, and Dimensions.ai. The article search process was conducted using the keywords “cooperative learning, science learning”. In addition, this study analyzed 1,000 documents indexed in Google Scholar through Publish or Perish, with a publication time span between 2016 and 2025. Google Scholar was chosen as the database because it has consistent selection standards in indexing scientific documents.

## RESULTS AND DISCUSSION

This article aims to systematically review the trends and patterns of research on the use of cooperative learning models in Science learning over the past ten years, from 2016 to 2025. The focus of this study includes the number and type of publications, top journal sources, articles with the highest citations, the most studied research categories, and visualization of keyword linkages based on the results of bibliometric analysis using VOSviewer software. This analysis is expected to provide a comprehensive picture of the development of research in the field, identify dominant topic trends, and reveal potential research gaps that can be used as a basis for further research in the future.

The trend of article publications from year to year shows how researchers' interest and attention to cooperative learning in the

context of science has changed and grown. The publication trend of articles discussing the application of cooperative learning models in science learning from 2016 to 2025 is shown in Figure 1.

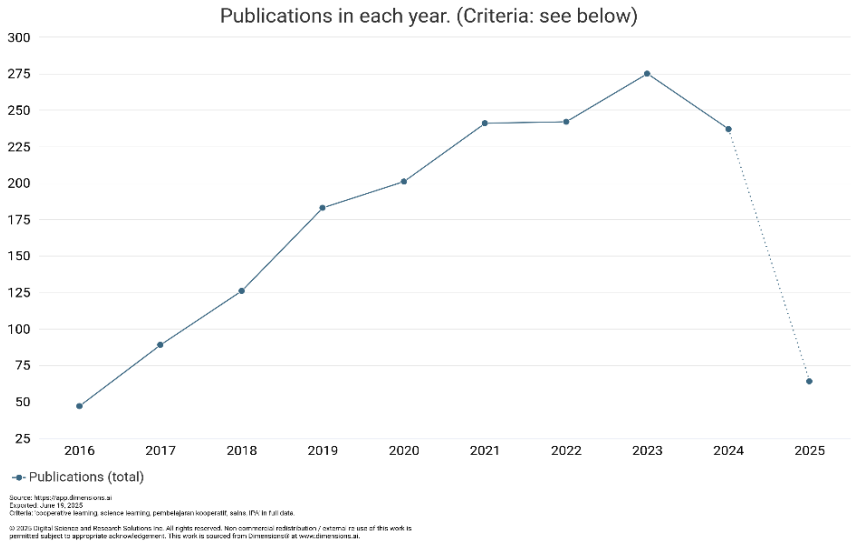


**Figure 1**. Article Publication Trends

In general, there is an increase in the number of publications from year to year, although some periods experience fluctuations. At the beginning of the period (2016-2020), the number of publications is relatively low and tends to be stable, indicating that researchers' interest in this topic is still limited.

However, from 2021 to 2023, there was a significant increase in the number of articles published. The peak occurred in 2023, which showed a sharp spike compared to previous years. This indicates that cooperative learning models are increasingly being researched and applied in science learning, in line with the demands of 21st century education which emphasizes the importance of collaboration, active participation, and the development of higher order thinking skills. This increasing trend can also be attributed to changes in education policy, especially after the COVID-19 pandemic, which encouraged innovation in learning, including the use of cooperative approaches to increase student engagement in science learning. In addition, this increase also suggests that models such as STAD, Jigsaw, TGT and other forms are considered relevant and effective for promoting students' collaborative skills and science literacy.

Overall, this trend reflects a shift in the learning paradigm from traditional approaches towards group-based learning that places learners as active subjects. The trend also opens up opportunities for further in-depth research, such as the effectiveness of cooperative models in the context of technology-based learning, differentiated learning, and strengthening social values in science learning.

The types of publications in this bibliometric study show the diversity of knowledge dissemination channels used by researchers to convey findings related to cooperative learning in science learning. Based on Table 1, it can be seen that scientific articles (journal articles) dominate the number of publications with a total of 1,628 publications, which reflects the main preference of researchers to publish their studies in accredited and reputable scientific journals. This is reasonable considering that scientific articles have a wide distribution range and are often used as the main source in developing educational theory and practice.

**Table 1**. Publication Type

| Publication Type | Publication |
|---|---|
| Article | 1,628 |
| Edited Book | 67 |
| Proceeding | 33 |
| Chapter | 26 |
| Monograph | 6 |

In addition, there are 67 edited books, which show that cooperative learning topics are also discussed in edited books, usually in the form of a collection of writings from various authors in one volume. This type is important because it provides a broader and deeper perspective on one major theme. Meanwhile, proceedings from scientific conferences amounted to 33 publications. This indicates that cooperative learning is also an active topic of academic discussion in national and international scientific forums. This number is relatively smaller than journal articles, which may be due to the limited accessibility and citation of the proceedings.

Furthermore, 26 book chapters were found, indicating the contribution of researchers in writing part of a larger book. This type allows the topic of cooperative learning to be linked to a more specific context, such as its application in a particular field of science or in a particular pedagogical approach. As for the monographs, there are only 6 publications, indicating that there are still limited individual in-depth studies that only focus on one topic with a comprehensive description and written by one author. The low number of monographs can be an opportunity to develop scientific works in the form of books that focus on discussing cooperative learning in the context of science education as a whole and systematically. Overall, the dominance of scientific articles confirms that research related to cooperative learning in science learning continues to grow and become a serious concern in the academic community, especially in dissemination through internationally indexed journals.

An analysis of the top ten publication sources (Table 2) shows that studies on cooperative learning in science learning have been spread across various types of scientific journals, both national and international. Advances in Social Science, Education and Humanities Research is the journal with the highest number of publications, with 65 articles. However, the average citation per article is only 1.78, which indicates that the level of influence or visibility of articles in this journal is still relatively moderate.

**Table 2**. Top 10 Publication Sources

| Name | Publications | Citations | Citations mean |
|---|---|---|---|
| Advances in Social Science, Education and Humanities Research | 65 | 116 | 1.78 |
| Jurnal Penelitian Pendidikan IPA | 63 | 136 | 2.16 |
| Journal of Physics Conference Series | 33 | 194 | 5.88 |
| Jurnal Ilmiah Sekolah Dasar | 28 | 109 | 3.89 |
| Jurnal Pijar MIPA | 24 | 60 | 2.50 |
| Journal of Education Action Research | 24 | 91 | 3.79 |
| Prisma Sains Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram | 22 | 38 | 1.73 |
| Jurnal Basicedu | 20 | 184 | 9.20 |
| Jurnal Atrium Pendidikan Biologi | 20 | 10 | 0.50 |
| EDUKATIF JURNAL ILMU PENDIDIKAN | 18 | 44 | 2.44 |

The Journal of Science Education Research ranks second with 63 articles and 136 citations, resulting in an average of 2.16 citations per article. This figure shows that the journal is not only quantitatively productive, but also quite representative in

disseminating relevant research results in the field of science education, especially in Indonesia. Interestingly, Basicedu Journal shows the highest average citation value of 9.20, despite having fewer publications (20 articles). This indicates that the articles published in this journal have high academic appeal and quality, as well as strong relevance in the scientific community. Similarly, the Journal of Physics Conference Series obtained an average citation of 5.88 from 33 publications, indicating that the cooperative learning approach is also applied and in demand in the realm of physics education or multidisciplinary conferences involving science. Other journals that also contribute significantly to the dissemination of articles related to this topic include the Scientific Journal of Elementary Schools, Pijar MIPA Journal, Journal of Education Action Research, and EDUKATIF Journal of Education Science. Although the number of publications in these journals varies, the average citations achieved indicate that research results in this field have gained wide attention in the academic community.

In contrast, the Journal of Biology Education Atrium shows the lowest average citation, which is 0.50 out of a total of 20 publications. This indicates the need to improve the quality or range of articles published in the journal in order to attract more citations and the attention of other researchers in similar fields. In general, the distribution of publications in these various journals indicates that the topic of cooperative learning in science learning has become a fairly widespread concern.

Based on Table 3, which contains the ten articles with the highest number of citations per year related to cooperative learning models in science learning, it is found that this strategy has gained wide attention in the academic community. An analysis of the top ten publications based on the number of citations per year indicates that cooperative learning models in the context of science learning received wide attention from the academic community. The average citation per year indicates the level of relevance and scientific contribution of each article in the development of cooperative learning theory and practice.

**Table 3**. Top 10 Citations

| Citations/year | Year | Author | Title |
|---|---|---|---|
| 41.00 | 2024 | NN Latihifa, K Anisa, S Handayani, G Gusmaneli | Strategi pembelajaran Kooperatif dalam Meningkatkan Motivasi Belajar Siswa |
| 33.00 | 2021 | DK Adiputra, Y Heryadi | Meningkatkan Hasil Belajar Siswa Melalui Model Pembelajaran Kooperatif Tipe TGT (Teams Games Tournament) Pada Mata pembelajaran IPA di Sekolah Dasar |
| 27.00 | 2024 | YP Astuti, J Jamilah | Penerapan Model Cooperative Learning dengan Teknik Two Stay Two Stray dalam Pembelajaran IPAS di Sekolah Dasar |
| 14.50 | 2019 | I Israil | Implementasi Model Pembelajaran Cooperative Learning Tipe STAD untuk Meningkatkan Motivasi Belajar Siswa dalam Pembelajaran IPA di SMP Negeri 1 Kayangan |
| 14.00 | 2023 | M Musdalifah | Implementasi Pembelajaran Kooperatif dalam Meningkatkan Motivasi Belajar Siswa di Madrasah |
| 7.33 | 2019 | A Amiruddin | Pembelajaran Kooperatif dan Kolaboratif |
| 6.50 | 2021 | P Utami, K Kadir, Y Herlanti | Meta-analisis Pembelajaran Kooperatif di Indonesia |
| 5.00 | 2020 | HE Haryono | The Influence of Cooperative Learning Model Type Group Investigation toward Results of Learning Science Materials of Students |

| | | | |
|---|---|---|---|
| 5.00 | 2021 | FP Soedimardjono, P Pratiwi | Cooperative Learning Model with Jigsaw Type Improves Student's Sciences Process Skills and Learning Outcomes |
| 5.00 | 2023 | P Artawan | Effectiveness of Group Investigation Cooperative Learning Model on Students' Science Learning Achievement |

The article that received the highest citations/year was by Latihifa, Anisa, Handayani, and Gusmaneli (2024) with 41.00 citations per year. This article explicitly discusses cooperative learning strategies in increasing students' learning motivation. This finding indicates that affective aspects, especially motivation, are the main focus appreciated by educational researchers and practitioners. This shows that cooperative learning is not only seen from a cognitive perspective, but also as a strategy that can shape students' positive disposition towards science learning. Meanwhile, Adiputra and Heryadi (2021) with 33.00 citations/year explored the implementation of the Teams Games Tournament (TGT) model in elementary school science learning. TGT, which integrates elements of competition and collaboration, proved effective in significantly improving student learning outcomes. The high number of citations indicates that the collaborative game-based approach is an interesting innovative alternative to be applied in the context of science learning which is often perceived as difficult and abstract.

Astuti and Jamilah (2024) obtained 27.00 citations/year through the application of the Two Stay Two Stray (TSTS) model in elementary science learning. TSTS provides space for students to exchange information across groups, thus encouraging the expansion of knowledge and increasing conceptual understanding more deeply. The relevance of this model is evident in the context of science learning that demands elaboration, discussion, and validation among students. Other articles, such as Israil (2019) work examining the Student Teams Achievement Division (STAD) type and gaining 14.50 citations/year, and Musdalifah's (2023) focus on madrasah gaining 14.00 citations/year, also show that cooperative models can be adapted contextually in various levels and types of educational institutions, with consistent results leading to increased motivation and learning participation.

The last two articles on the list with identical citations/year (5.00) are by Soedimardjono & Pratiwi (2021) who examine the Jigsaw model, and Artawan (2023) who explores the Group Investigation (GI) approach. Both emphasize collaborative aspects and scientific thinking in science learning. Although the number of citations/year is lower than other articles, the topics raised have urgency in developing 21st century skills, especially in the context of science process skills and scientific literacy.

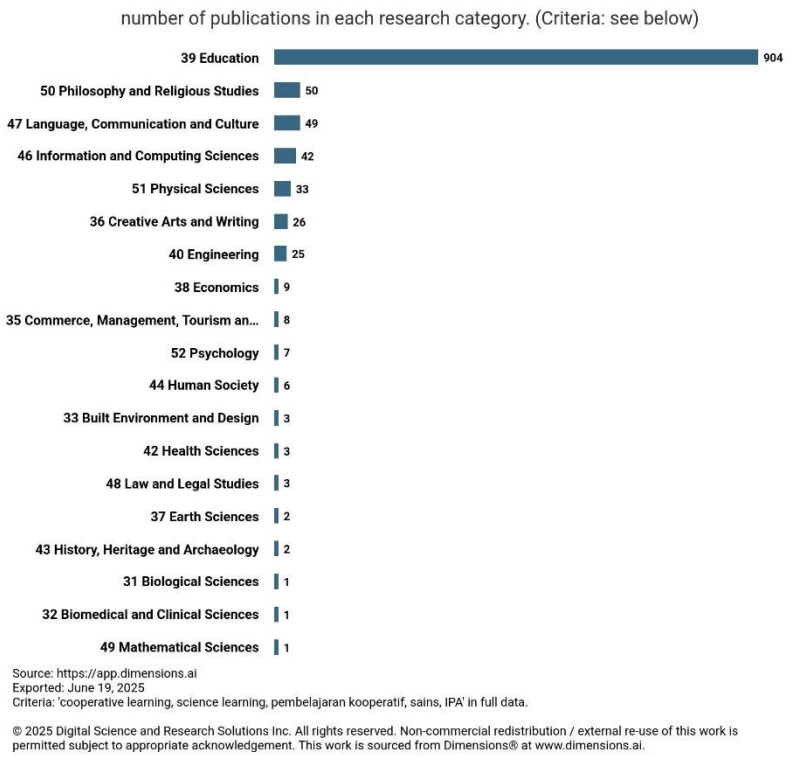


**Figure 2**. Research Categories

Based on Figure 2, which displays the number of publications in various categories of disciplines related to the topics of cooperative learning, science learning, cooperative learning, science, and science, it is found that the education category dominates the number of publications significantly with a total of 904 publications. This number far exceeds other categories, indicating that the issue of cooperative learning in the context of science learning is still very strongly rooted and developed in the realm of education. The next largest category is Philosophy and Religious Studies (50 publications), followed by Language, Communication and Culture (49 publications), and Information and Computing Sciences (42 publications). Meanwhile, the field of Physical Sciences recorded 33 publications, which shows that the application of cooperative learning models is also adopted in pure science education, albeit with a relatively small number compared to the field of education in general.

Other categories show much lower numbers, such as Engineering (25), Creative Arts and Writing (26), and Economics (9). Meanwhile, some disciplines such as Biological Sciences, Biomedical and Clinical Sciences, and Mathematical Sciences only have 1 publication, indicating a lack of exploration of the application of cooperative learning in these disciplines. Overall, the distribution of publications shows that although the concept of cooperative learning is cross-disciplinary, its application and intensive study are still very much centered in the realm of formal education, especially in the context of science learning.

This finding indicates that the study of cooperative learning in the context of science is predominantly in the scientific area of education, both theoretically and practically. This is very reasonable considering that cooperative learning is basically a pedagogical approach designed to be implemented in the teaching and learning process, so its central role is in the educational domain. The high number of publications in the Education category (904 publications) reflects two things: first, the urgency in reforming participatory and collaborative-based learning approaches in science classrooms; and second, the increasing interest of researchers in developing models, strategies, and evaluation instruments relevant to cooperative learning.

The emergence of categories such as Philosophy and Religious Studies, Language, Communication and Culture, and Information and Computing Sciences with a high number of publications indicates a multidisciplinary approach to the study of cooperative learning. The presence of publications in Physical Sciences and Engineering indicates that cooperative learning is starting to be applied in project-based learning, experiments, and problem solving in the STEM context. However, the low number of publications in categories such as Biological Sciences, Mathematics, and Health Sciences suggests that the potential of applying this model is still not widely explored in specific science content-based learning.

Thus, these results suggest that although cooperative learning has a strong position in science education studies in general, there are great research opportunities to develop this model in cross-disciplinary contexts, especially for integration with the fields of pure science, technology and health. Collaboration between disciplines, for example through interdisciplinary or transdisciplinary approaches, has the potential to expand the impact of cooperative learning in addressing 21st century learning challenges.

The results of bibliometric analysis based on keywords using VOSviewer software on a collection of publications on cooperative learning in the context of science learning resulted in three forms of visualization, namely network visualization, overlay visualization, and density visualization. In the network visualization (Figure 3), 42 keywords were identified that were divided into 6 clusters, each of which illustrates a different but interconnected thematic focus.

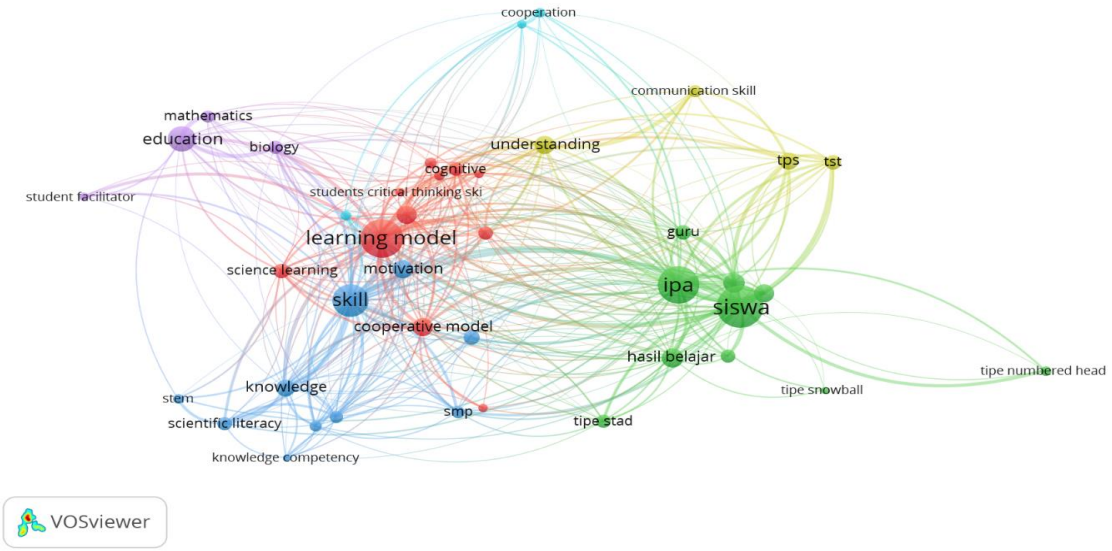


**Figure 3**. Network Visualization

The first cluster (in red) centers on the terms learning model, motivation, cognitive, and science learning. This cluster shows that most of the research is focused on the effectiveness of cooperative learning models in improving students' motivation and cognitive ability in science learning. This cluster reinforces the position of cooperative learning models as a promising pedagogical approach in shaping meaningful learning experiences and impacting student learning outcomes. Furthermore, the second cluster (in green) contains dominant keywords such as science, students, teachers, learning outcomes, as well as several model variations such as STAD type, numbered head type, and snowball type. This cluster shows a more practical orientation, which is on the direct implementation of cooperative learning in science classrooms, with the main focus on the active role of students and the learning outcomes achieved.

The third cluster (in blue) is dominated by keywords such as skills, scientific literacy, STEM, knowledge, and cooperative model. This indicates that some of the research leads to the dimension of strengthening 21st century skills, especially scientific literacy and conceptual knowledge within a cooperative-based learning framework. Research in this cluster tends to explore the integration between learning models and the achievement of more complex scientific competencies. Meanwhile, the fourth cluster (yellow) focuses more on aspects of interaction and communication in groups, with keywords such as understanding, cooperation, communication skills, and types of models such as TPS (Think-Pair-Share) and TSTS (Two Stay Two Stray). This indicates that cooperative learning is not only oriented towards learning outcomes, but is also closely related to strengthening social skills and teamwork among students.

The fifth cluster (purple) reflects the expansion of the context of cooperative learning application to other subjects such as mathematics, biology, and also pedagogical dimensions such as student facilitator. Although not the main focus, this finding shows that cooperative approaches are starting to touch cross-disciplines in the STEM education domain more broadly. The sixth cluster (light blue or cyan) includes terms such as students' critical thinking skills and cooperation, which highlights the importance of cooperation in building students' critical thinking skills. This cluster, although smaller in size, makes an important contribution in bridging constructivistic learning theory with collaborative classroom practice.

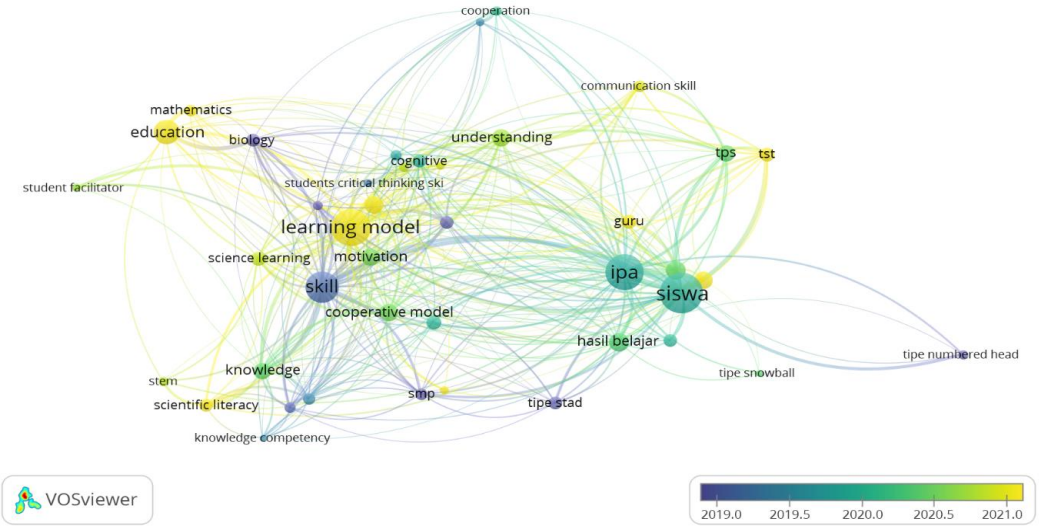


**Figure 4**. Overlay Visualization

Figure 4 shows an overlay visualization that provides a temporal dimension to the identified keywords, with publication years ranging from 2019 to 2021. The blue color represents keywords that are more dominant in early publications (around 2019), while the yellow color marks the appearance of keywords in more recent publications (2021). These results show the dynamic development of research focus in cooperative learning in science learning over the last three years. Keywords such as learning model, scientific literacy, skills, and cooperative model tend to appear earlier in the 2019-2020 timeframe, as illustrated by the blue-green color gradation. This early appearance indicates that researchers' initial attention is focused on the basic exploration of cooperative learning models and their contribution to learners' scientific literacy and basic skills. This is consistent with the early trend of implementing 21st century learning that emphasizes critical thinking, collaboration and conceptual knowledge as key learning outcomes in science subjects.

Meanwhile, keywords such as education, communication skills, TPS, TST, and student facilitator appear in yellowish color, indicating that these keywords are emerging topics that began to be researched in 2021. The appearance of these keywords in recent years indicates a shift in research focus away from the effectiveness of learning models towards more specific aspects such as the role of the teacher as facilitator, student communication skills, and the effectiveness of certain types of cooperative models such as Think-Pair-Share (TPS) and Two Stay Two Stray (TSTS). This shift reflects an increased awareness of the importance of aspects of social interaction, interpersonal communication, and small group dynamics in supporting the successful implementation of cooperative learning. Thus, the overlay visualization not only shows how the research focus has changed thematically, but also reflects the dynamics of time that accompany the development of new issues in cooperative learning-based science education. This change is an indicator that research in this field is progressive and adaptive to the evolving needs of learning.

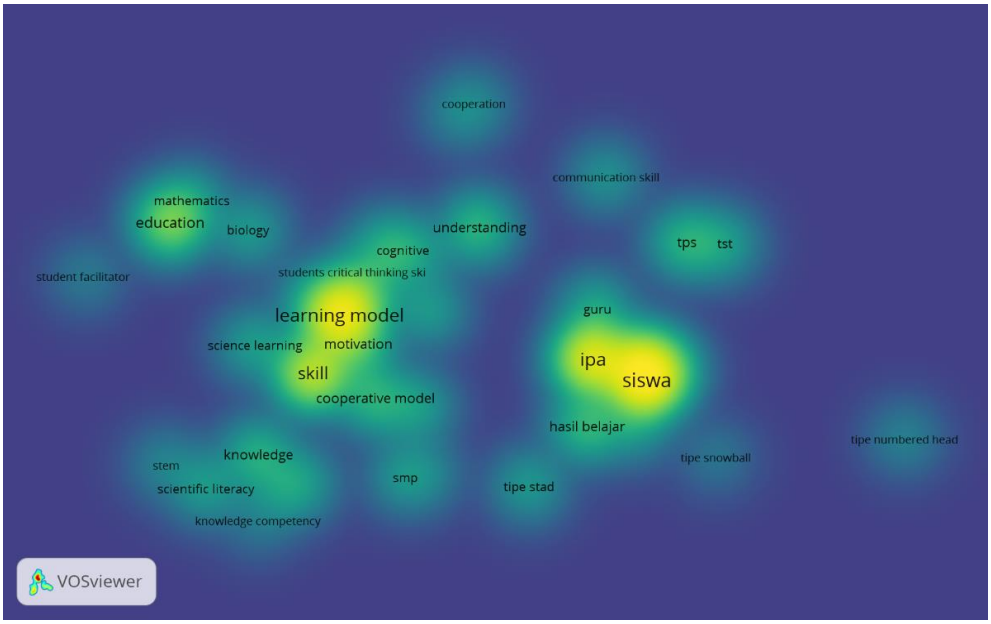


**Figure 5**. Density Visualization

Meanwhile, the density visualization results show that the highest research density is centered on keywords such as learning model, skill, science, and students, as seen from the bright yellow color that dominates the area. This indicates that these four terms are the center of gravity in the discourse of cooperative learning research in science. Terms such as motivation, science learning, and cooperative model also appear in a fairly high intensity, indicating their close relationship with the main focus of the research. On the other hand, terms such as communication skills, student facilitator, and numbered head type appear in green or blue, indicating that although relevant, these topics are still relatively rarely explored and offer great opportunities for further research. Overall, the results of this visualization show that research on cooperative learning in science learning is multidimensional-from learning models and cognitive outcomes to science literacy, social collaboration, and strengthening soft skills. The interconnectedness of the keywords shows that the development of cooperative learning theory and practice is simultaneous and complementary. The findings also reinforce the urgency of strengthening collaborative, literative and communicative aspects in science learning design amidst the demands of 21st century educational transformation.

## CONCLUSION AND SUGGESTION

This systematic review concludes that the application of cooperative learning models in science learning has shown a significant upward trend over the last decade. The increasing number of publications, particularly from 2021 onward, reflects growing interest from researchers and educators in adopting collaborative learning approaches that emphasize active student participation, critical thinking, and scientific literacy. Among the most frequently studied models are STAD, Jigsaw, TPS, TSTS, and Group Investigation, each contributing positively to students' motivation, academic performance, and social skills. The bibliometric analysis reveals not only the dominance of education as a research category but also the emergence of cooperative learning studies across interdisciplinary fields.

However, several research gaps remain. Disciplines such as biology and mathematics are still underrepresented in cooperative learning studies, highlighting the need for broader implementation and contextual adaptation. Furthermore, despite the growing

attention to motivation and cognitive outcomes, future research should delve deeper into how cooperative learning enhances scientific reasoning, collaboration in digital learning environments, and character education in science classrooms. It is suggested that researchers integrate cooperative learning with inquiry-based, project-based, or STEM-oriented approaches to respond to the demands of 21st-century science education. Expanding this model into interdisciplinary and transdisciplinary contexts can also foster more holistic and impactful educational outcomes.

## ACKNOWLEDGMENTS

The researchers would like to express their gratitude to Prof. Dr. Joni Rokhmat, M.Si., the lecturer of the Science Learning Model Design course, for his support and valuable advice in completing this research in the form of journal publications.

## AUTHOR CONTRIBUTIONS

All authors have read and approved the published version of the manuscript.

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