



Systematic Literature Review (SLR): The Effectiveness of Learning Models in Improving Students' Scientific Argumentation Skills in Chemistry Learning

Juliana Zahwa, Najwa Fitri Desaspriya, Miterianifa^{3*}

Chemistry Education, Faculty of Teacher Training and Education, Universitas Islam Negeri Sultan Syarif Kasim Riau. Jl. H.R. Soebrantas No. 155 KM 15 Simpang Baru Panam, Pekanbaru, Riau 28293, Indonesia

*Corresponding-email: miterianifa@uin-suska.ac.id

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Abstract: : *Systematic Literature Review (SLR): The Effectiveness of Learning Models in Improving Students' Scientific Argumentation Skills in Chemistry Learning.* Scientific argumentation skills are a crucial component of chemistry education because they require evidence-based reasoning and scientific decision-making. Therefore, this study aims to analyze the effectiveness of a learning model in enhancing students' scientific argumentation skills through a Systematic Literature Review using the PRISMA framework. The identification conducted via Google Scholar yielded a total of 5,510 articles, and ultimately, 14 articles published between 2020 and 2025 were selected. The results indicate that the ADI model is more effective in enhancing students' scientific argumentation skills, particularly regarding acid-base concepts, buffer solutions, chemical equilibrium, and reaction rates. Furthermore, Cooperative ADI yielded more optimal results than conventional inquiry, while Inquiry and Guided Inquiry improved students' scientific literacy and attitudes. Therefore, this study concludes that inquiry-based and argumentation models make a significant contribution to students' argumentation skills.

Keywords: *Systematic Literature Review, Scientific Argumentation, Inquiry, and Chemistry Education*

Abstrak: *Systematic Literature Review (SLR): Efektivitas Berbagai Model Pembelajaran dalam Meningkatkan Keterampilan Argumentasi Ilmiah Siswa pada Pembelajaran Kimia.* Keterampilan berargumen ilmiah adalah komponen yang sangat penting dalam pembelajaran kimia karena memerlukan penalaran berdasarkan bukti dan keputusan ilmiah. Oleh karena itu, penelitian ini bertujuan untuk menganalisis efektivitas model pembelajaran dalam meningkatkan keterampilan berargumen ilmiah siswa melalui Tinjauan Pustaka Sistematis menggunakan kerangka kerja PRISMA. Identifikasi yang dilakukan melalui Google Scholar memiliki total 5.510 artikel, dan akhirnya, 14 artikel yang diterbitkan tahun 2020 dan 2025 dipilih. Hasil penelitian menunjukkan bahwa model ADI lebih efektif dalam meningkatkan keterampilan argumentasi ilmiah siswa, terutama pada materi asam-basa, larutan penyangga, keseimbangan kimia, dan laju reaksi. Selain itu, Cooperative ADI menunjukkan hasil yang lebih optimal dari pada inquiry konvensional, sementara Inquiry dan Guided Inquiry dapat meningkatkan literasi ilmiah dan sikap siswa. Oleh karena itu, studi ini dapat disimpulkan bahwa model based inquiry dan argumen memberikan kontribusi penting kepada keterampilan argumentasi siswa.

Kata kunci: *Systematic Literature Review, Argumentasi Ilmiah, Inkuiri, dan Pembelajaran Kimia.*

▪ INTRODUCTION

21st century education requires the ability to think critically and scientifically argumentative because both aspects are demanded by the rapid growth of science and global challenges. In chemistry, scientific argumentation refers to how well students can use evidence to make decisions, guess randomly, evaluate and interpret experimental data, and make decisions about experimental data.(Dulim & Madlazim, 2022). In an ever-evolving world, globalization, and scientific knowledge are important to emphasize mastery of scientific argumentation skills in order to educate a generation that adapts and innovates efficiently (Kuki et al., 2023).

Students are also expected to be literate in science, which includes chemistry literacy. This means they should be able to understand and use chemistry concepts in their daily lives and at school. (Laila et al., 2022). In other words, given the learning conditions of students, abstract materials still cause obstacles, most of which are not understood by students (Meiliza et al., 2025). Therefore, effective learning strategies are needed that not only improve conceptual understanding, but also scientific argument activities that support student development (Kartika et al., 2025). The Argument-Driven Inquiry paradigm, which focuses on the process of scientific inquiry and the creation, evaluation, and justification of evidence-based scientific arguments, is an effective method for improving students' scientific argumentation skills.. (Agustina et al., 2024).

In order to assist students analyze data, assess evidence, and develop logical explanations when learning chemistry, scientific reasoning is crucial. (Sari et al., 2025). These skills help students to have an understanding of multiple perspectives, the ability to ask relevant questions, and the ability to craft arguments based on logic and evidence of critical thinking (Astuti et al., 2024). In addition, strong science literacy assists students in interpreting scientific information and making evidentiary decisions in scientific arguments (Sanjiartha et al., 2024).

Without argumentation skills, students then find it difficult to identify issues, gather information, and make valid generalizations, which is especially true for abstract chemical concepts (Aspari & Andromeda, 2025). Consequently, a comprehensive analysis of the literature is essential to assess the efficacy of various learning methods in enhancing students' scientific argumentation skills, especially in chemistry. (Laila et al., 2022; Purwanto et al., 2022). The study aims to determine the most effective learning models, analyze their application to a variety of chemistry-based topics, and explore the indicators used to measure scientific argumentation skills (Kartika et al., 2025).

Mastery of scientific argumentation is not only about understanding the material but also involves the ability to analyze data, evaluate evidence, and present conclusions supported by reasonable reasoning(Triani et al., 2023). Therefore, this study aims to identify the most effective learning models and investigate their application in various topics of chemistry discussion as well as analyze the indicators used to measure scientific argumentation skills (Yolanda et al., 2024). In addition, this study seeks to fill the research gap by providing a comprehensive mapping of learning models that specifically supports the development of scientific arguments, rather than focusing only on conceptual understanding.

This study aims to enhance chemistry education in both theoretical and practical dimensions. Theoretically, this study may enhance our comprehension of the impact of employed learning models on the development of scientific reasoning skills. From a practical standpoint, the findings of this study can provide educators with valuable guidance for choosing and applying appropriate learning models to enhance students' argumentative skills in chemistry classrooms.

▪ **METHOD**

Using the Systematic Literature Review (SLR) method, this study aims to systematically identify, evaluate, and synthesize all relevant literature regarding the effectiveness of several learning models in terms of students' scientific argumentation skills during chemistry instruction. The SLR was chosen as the research method because it provides systematic and detailed insights into existing studies and highlights trends or gaps in the research (Melta et al., 2024; Salsabila et al., 2025). These findings were identified and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, which ensures transparency, accuracy, and reproducibility in the article selection process (Suparwati, 2022). The PRISMA guidelines encompass four stages: identification, screening, eligibility assessment, and inclusion (Sukiastini, 2024).

Table 1. Inclusion and exclusion criteria

No	Inclusion Criteria	Exclusion Criteria
1.	Relevant to the topic of "Scientific Argumentation Skills" in chemistry education	Irrelevant to discuss Scientific Argumentation Skills
2.	Relevant to high school chemistry material	Does not discuss High School Chemistry Material
3.	Published between 2020 and 2025	Published outside the 2020–2025 time frame
4.	Articles that have passed the identification, screening, and eligibility process	There is duplication (title and content name) with another article

Then, data from studies that meet the criteria will be extracted and synthesized, enabling the creation of an effective learning model to help students improve their arguments (Melta et al., 2024).

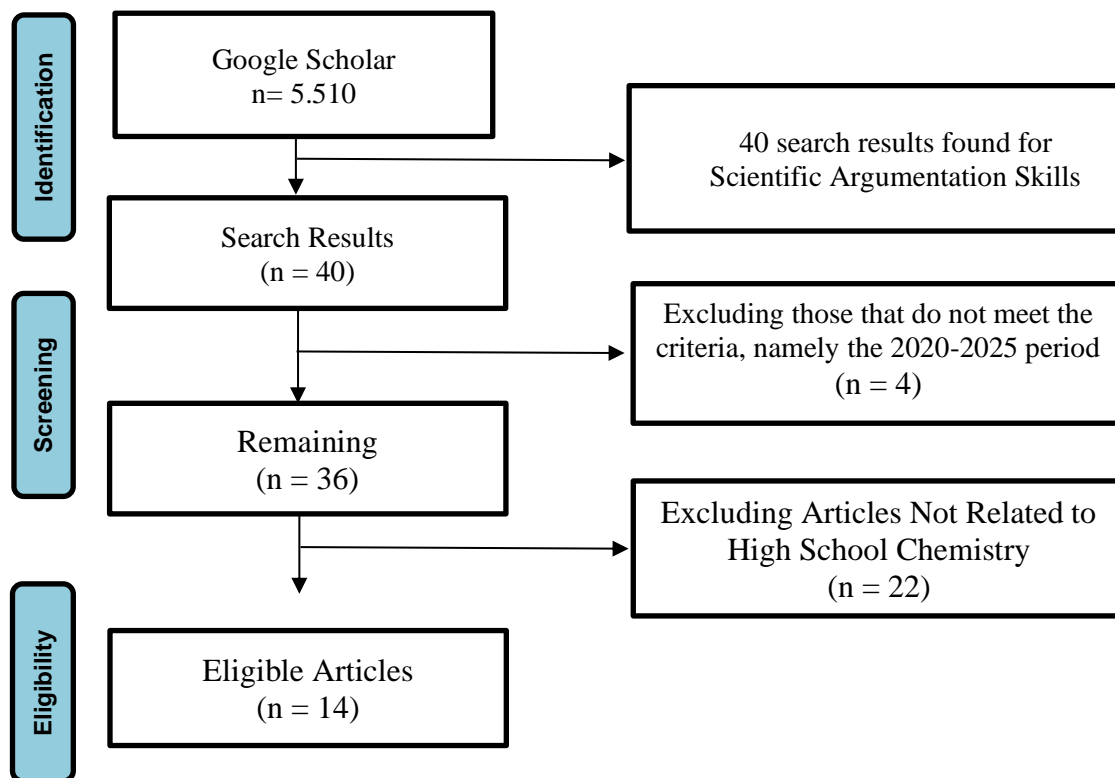




Figure 1. Article Screening Prism Diagram

Source: adapted from (Page et al., 2021)

Furthermore, during the screening stage, the article is reviewed and verified based on pre-established inclusion and exclusion criteria. Notably, the articles must be eligible based on the year of publication, from 2020 to 2025, and their relevance to high school chemistry material. Thus, 4 articles were excluded from the study because they were published outside the required time frame, while 22 articles were excluded because they did not fit the research context. 14 articles in accordance with the conditions given. During the eligibility stage, the remaining articles are reviewed again to verify their compatibility with the research objectives. All articles are eligible for entry and are taken into account in the final analysis. The inclusion and exclusion criteria used when selecting these studies are listed in Table 1. Next, data from the selected articles were extracted, and synthesized to identify patterns, compare effectiveness learning models, and select the ones that best contributed to students' scientific argumentation abilities. More specifically, the study highlights the focus of the learning model, the study design, the indicators measured, and the chemistry topics discussed. Furthermore, three key research questions were identified in the study:

Table 2. Research Questions

No	Research Question	Objective
1.	What learning models can improve students' scientific argumentation skills in chemistry learning?	To determine which learning models can improve students' scientific argumentation skills in chemistry learning
2.	How effective are these learning models in improving students' scientific argumentation skills in chemistry learning?	To determine the effectiveness of these learning models in improving students' scientific argumentation skills in chemistry learning
3.	What materials are widely used to train students' scientific argumentation skills in chemistry learning?	To determine which materials are widely used to train students' scientific argumentation skills in chemistry learning

However, this research has some limitations because it only uses one data source, namely Google Scholar. These limitations are expected to affect the coverage of internationally indexed publications and therefore create publication bias. Therefore, further research is recommended using a variety of data sources to obtain more comprehensive and representative results.

▪ RESULT AND DISCUSSION

Based on the search, in the initial stage, 5,510 articles were collected taken from Google Scholar. Then, in the first screening stage that focused on the topic of the approach, there were as many as 40 articles that were considered appropriate. The articles were then selected using predetermined inclusion criteria, namely publication in 2020-2025 and relevant to chemistry materials in high school. In the follow-up election, as many as one article was eliminated due to duplication with the same title and content.

Meanwhile, the other 22 articles were considered not to have passed the election with the consideration that they were not in accordance with the material. Therefore, only 14 articles that meet all these criteria can be analyzed for effectiveness in an effort to improve the learning ability of high school students.

Table 3. Article Analysis Results

NO.	Author	Findings	Index (Sinta)
1.	Siti Salsabila Utami, Ratna Sari Siti Aisyah, Isriyanti Affifah (2022)	The application of the Argument-Driven Inquiry (ADI) model improves students' scientific argumentation skills in Acid-Base material.	Sinta 2
2.	Tanzilia Anindhita, Suyono (2024)	There is a contribution from Supplementary Teaching Materials (BAS) used in conjunction with the ADI model in improving students' argumentation skills (Buffer Solution material).	Sinta 3
3.	Annisa Setiawan, Jumadi (2023)	The Argument Driven Inquiry (ADI) learning model is a model that is suitable for enabling students to convey their arguments correctly (Literature Study).	Sinta 3
4.	Intan Diah Purwandari, Sri Rahayu, I Wayan Dasna (2022)	The Inquiry Learning Model (Inquiry Learning) can improve students' ability to learn chemistry (Systematic Literature Review).	Sinta 4
5.	I Ketut Mardika (2020)	The inquiry learning model successfully improved students' scientific attitudes and chemistry learning outcomes (average scores and classical mastery increased).	Sinta 2
6.	Offy Resdiantari (2025)	The Argument Driven Inquiry (ADI) model has been proven to improve students' argumentation skills, critical thinking skills, and problem-solving skills (Literature Review).	Sinta 3
7.	Nurul Afidah, Elok Sudibyo (2025)	The application of the Guided Inquiry model improves students' science literacy skills in the subject of Global Warming.	Sinta 4

NO.	Author	Findings	Index (Sinta)
8.	Foniman Saragi, Nadhifa Rohdatul Aisyah, Bambang Supriatno, Yanti Hamdiyati (2025)	The application of the Guided Inquiry learning model combined with Nearpod media effectively improves students' science literacy (N-Gain score of 0.72, high category).	Sinta 4
9.	Stella Afrilita Limbong, I Wayan Dasna, Munzil (2024)	The CADI (Cooperative Argument Driven Inquiry) learning model significantly improves students' scientific argumentation and critical thinking skills in chemistry equilibrium material compared to the conventional Inquiry model.	Sinta 3
10.	Akili, AWR, Lukum, A., & Laliyo, LAR (2022)	The Argument-Driven Inquiry (ADI) model-based learning tool for electrolyte solutions that was developed is valid for training high school students' scientific argumentation skills.	Sinta 3
11.	Putri, PAW, Rahayu, S., & Fajaroh, F. (2020)	The Argument-Driven Inquiry (ADI) model is effective in improving students' scientific argumentation skills in reaction rate material, as demonstrated by the improvement in the quality of students' arguments.	Sinta 3
12.	Arbadilah, A., Juliyanto, E., & Dewantari, N. (2025)	Penerapan model inkuiri terbimbing berbantuan Powtoon efektif meningkatkan literasi sains siswa, dengan perbedaan signifikan antara kelompok eksperimen dan kontrol.	Sinta 3
13.	Siti Nur Fatimah Azzahroh, Kiki Septaria, Siska Ayu Wulandari (2024)	The application of the guided inquiry model assisted by Powtoon effectively improved students' science literacy, with significant differences between the experimental and control groups.	Sinta 4
14.	Rahmi Kurniawan, Andromeda (2025)	Student Worksheets (LKPD) based on Guided Inquiry Learning integrated with ethnoscience are effective in improving students' chemistry literacy skills (N-Gain score of 0.628, categorized as quite effective).	Sinta 4

A total of 14 selected articles were analyzed to examine the effectiveness of various learning models in improving students' scientific argumentation skills in chemistry learning. The findings suggest that different learning models contribute to students' argumentation skills in different ways, depending on the characteristics of the teaching and its supporting components. The Argument-Driven Inquiry (ADI) model emerged as the most consistently effective approach in improving students' scientific argumentation skills. In various studies, ADI has shown significant improvements in students' ability to formulate claims, support them with evidence, and provide logical reasoning. In some cases, students taught using ADI are able to achieve higher levels of argumentation, including the ability to generate rebuttals, which are rarely observed in other learning models. This effectiveness is closely related to the structured stages of ADI, which explicitly integrate the process of inquiry, argument construction, peer discussion, and evaluation.

In comparison, the guided inquiry-based learning model and the general inquiry-based learning model also make a positive contribution to student learning outcomes, especially in improving conceptual understanding, science literacy, and scientific attitude. Guided inquiry-based learning provides structured guidance that supports students in conducting investigations and interpreting data systematically. However, these models tend to favor the development of scientific arguments more indirectly, as they do not explicitly emphasize the structure of arguments. As a result, the level of argument development achieved by students is generally lower compared to those engaged in ADI-based learning. Further analysis showed that variations in inquiry-based learning models affected the effectiveness of learning outcomes. For example, Cooperative Argument-Driven Inquiry (CADI) shows better performance than individual ADIs in improving students' argumentation and critical thinking skills, as collaborative interactions allow students to exchange ideas, evaluate alternative perspectives, and refine their arguments. Similarly, an inquiry model integrated with the Nature of Science (NOS) perspective provides deeper support for argumentation, as students develop an understanding of how scientific knowledge is constructed, validated, and applied.

In addition to the learning model itself, several supporting factors play an important role in increasing learning effectiveness. The use of learning media, such as Nearpod and Powtoon, increases student engagement and facilitates the visualization of abstract chemical concepts. Similarly, the use of structured learning materials, including student worksheets (LKPDs) and additional teaching resources, helps guide students through the process of inquiry and argumentation in a more systematic manner. Contextual approaches, such as ethnoscience, further enhance learning by connecting scientific concepts with students' real-life experiences and cultural contexts. However, the findings also show that the effectiveness of this learning model is influenced by contextual and individual factors. Elements such as teacher readiness, instructional design, classroom conditions, and students' cognitive characteristics contribute to variations in learning outcomes. For example, students with reflective cognitive styles tend to show higher levels of argumentation and critical thinking compared to students who are impulsive. In addition, while the integration of technology and supporting materials increases engagement and understanding, the impact often remains at a moderate level if not accompanied by optimal teaching strategies.

Overall, the results of this study show that argument-oriented learning models, particularly ADI and its variants, provide more direct and effective support in

developing students' scientific argumentation skills compared to general inquiry-based approaches. Meanwhile, the inquiry and guided inquiry model serves as a cornerstone to improve conceptual understanding and scientific literacy, which indirectly supports the development of argumentation skills. Therefore, the selection and application of learning models must consider not only the learning objectives, but also the supporting components and contextual factors in order to achieve optimal learning outcomes.

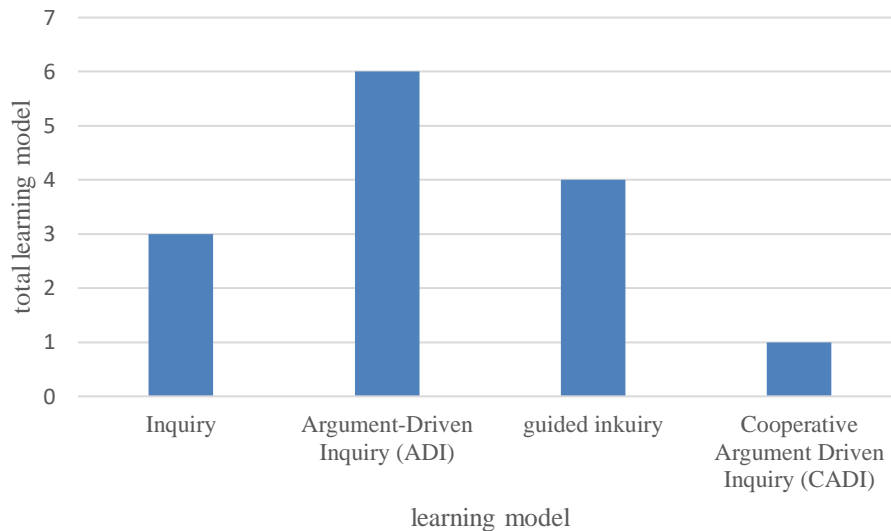


Figure 2. Learning Models Analyzed

Based on the distribution of the analyzed learning models, it can be seen that the Argument-Driven Inquiry (ADI) model is the most dominant approach used in research. This dominance shows a tendency that ADI is seen as the most relevant model in developing students' scientific argumentation skills. This can be explained because ADI explicitly integrates the process of inquiry with the construction of arguments, so that students not only understand concepts, but are also trained to structure claims, use evidence, and provide reasoning systematically. Compared to the general inquiry and guided inquiry models, ADI provides more direct support for the development of scientific argumentation because it has learning stages specifically designed for argumentation activities.

Meanwhile, the Guided Inquiry and Inquiry models still show significant contributions, but play a greater role in building conceptual understanding and science literacy. This suggests that while all inquiry-based models have the potential to improve learning outcomes, models that explicitly integrate argumentation, such as ADI and CADI, tend to be more effective in developing students' scientific argumentation skills

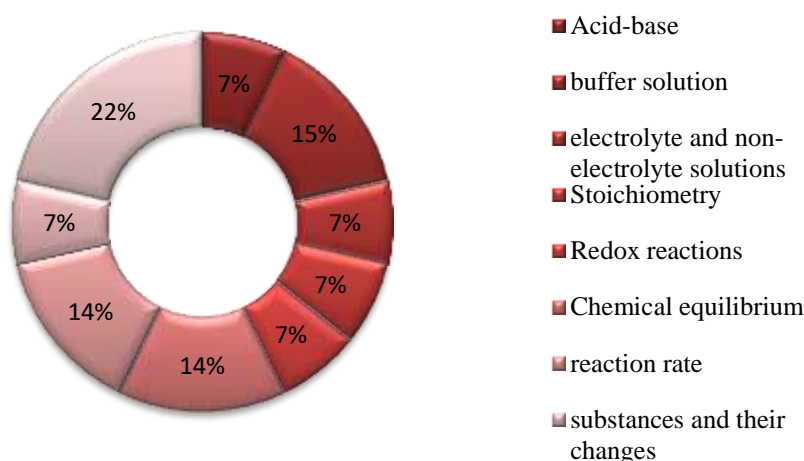


Figure 3. Materials Used

Based on the distribution of chemistry learning topics analyzed, it can be seen that some materials such as environmental chemistry and buffer solutions are more predominantly used in the research than other topics. This suggests that the selection of materials in research tends to consider contextual relevance as well as the level of complexity of the concept. Contextual material, such as environmental chemistry, provides greater opportunities for students to relate concepts to everyday life phenomena, thus supporting the development of evidence-based scientific arguments. Meanwhile, materials such as buffer solutions, equilibrium, and reaction rates were chosen because they have a high level of abstraction, so they require a learning approach that is able to help students understand concepts while developing scientific reasoning.

These findings suggest that the effectiveness of learning models is not only influenced by the type of model used, but also by the characteristics of the chemical material. Therefore, the selection of the right learning model needs to be adjusted to the nature of the material, both contextual and abstract, in order to optimally support the development of students' scientific argumentation skills.

In line with these findings, various studies show that inquiry-based learning models make a significant contribution to improving scientific argumentation skills, science literacy, and students' critical thinking skills in chemistry learning. The application of guided inquiry has specifically shown effectiveness in improving students' science competence, which is demonstrated through the significant difference between statistical test results and high N-gain values (Afidah & Sudibyo, 2025). In addition, the inquiry approach encourages students' active involvement in the investigative process, such as formulating problems, constructing hypotheses, analyzing data, and drawing evidence-based conclusions, thereby contributing to improved learning outcomes and critical thinking skills (Humolungo et al., 2025; Sipayung et al., 2025). The integration of interactive media and contextual approaches such as ethnoscience also strengthens the effectiveness of inquiry in improving science literacy and understanding of abstract chemical concepts (Afiyah & Zulkarnaen, 2025; Dewi & Iswendi, 2025). In general, these findings show that inquiry models, both guided and pure, have consistency in improving various aspects of learning, including science process skills, scientific attitudes, science literacy, and students' chemistry learning outcomes (Rahmawati, 2025). On the other hand, the Argument-Driven Inquiry (ADI)

model also shows strong effectiveness in developing students' scientific argumentation skills through a learning process that emphasizes the construction of evidence-based arguments (Ahmad et al., 2023; Dulim & Madlazim, 2022).

Overall, the results of the analysis of the fourteen reviewed articles indicate that inquiry-based scientific argumentation learning models—which encompass various types of Argument-Driven Inquiry and their variations—significantly improve students' scientific argumentation skills. In addition, a new chemistry model has been shown to improve students' critical thinking skills, chemistry literacy, understanding of the nature of science, and problem-solving abilities on several topics in high school chemistry. Thus, these findings suggest that high school chemistry instructional design strategies utilizing active learning, evidence-based inquiry, and argumentative discourse can enhance the quality of student learning outcomes.

▪ CONCLUSION

The systematic literature review shows that the argument-based inquiry learning model is a good way to help students improve their scientific reasoning skills in chemistry. The argument-driven inquiry (ADI) approach can systematically improve students' critical thinking, problem-solving, and the quality of scientific arguments in various courses. In contrast to conventional research models, ADI and its variants, such as cooperative ADI, produce significant results regarding the volume and caliber of arguments. In addition, inquiry and guided inquiry models are relevant for abstract chemistry materials because both learning models can have an effect on chemical literacy, the nature of science, and scientific attitudes. Overall, the study highlights that the selection of learning models that can improve the process of evidence-based investigation and verification is key to driving the quality of scientific arguments among chemistry students. The results of this research are also a reference for the development of more innovative chemistry learning strategies that are oriented towards scientific arguments for curriculum and policy developers.

▪ REFERENCES

- Afidah, N., & Sudibyoy, E. (2025). Penerapan Model Inkuiri Terbimbing Untuk Meningkatkan Kemampuan Literasi Sains Siswa Di Smp Negeri 51 Surabaya. *Science : Jurnal Inovasi Pendidikan Matematika Dan Ipa*, 4(4), 648–658.
- Ahmad, Z., Ammar, M., Sellami, A., & Al-Thani, N. J. (2023). Effective Pedagogical Approaches Used In High School Chemistry Education: A Systematic Review And Meta-Analysis. *Journal Of Chemical Education*, 100(5), 1796–1810.
- Anggi Nur Afiyah, & Zulkarnaen. (2025). Penerapan Inkuiri Terbimbing Untuk Meningkatkan Keterampilan Berpikir Kritis Dan Kolaborasi Siswa Pada Pembelajaran Ips Sd. *Jurnal Inovasi Pendidikan Ips*, 5(2), 306–316.
- Angki Yustito Dulim, & Madlazim. (2022). Penerapan Model Argument-Driven Inquiry (Adi) Dengan Bantuan Phet Simulation Untuk Melatih Argumentasi Ilmiah Peserta Didik Kelas Xi Sma Pada Topik Gas Ideal. *Ipf: Inovasi Pendidikan Fisika*, 11(1), 20–28.
- Dian Larasati Kartika, Diah Kartika Sari, & Revy Martusyilia. (2025). Implementasi Model Pbl Dan Diferensiasi Untuk Meningkatkan Hasil Belajar Kelas X.I Sman 1 Palembang. *Science : Jurnal Inovasi Pendidikan Matematika Dan Ipa*, 5(3), 1097–1105.

- Dwi Retno Sari, Sulistyono Saputro, & Sajidan. (2025). Educational Studies And Research Journal A Systematic Review On Integrating Ssi Into Science Education: Its Impact On 21 St Century Skills (2014-2024). *Educational Studies And Research Journal*, 2(1), 1–14.
- E. Triani, Darmaji, & Astalini. (2023). Identifikasi Keterampilan Proses Sains Dan Kemampuan Berargumentasi Siswa. *Jurnal Pendidikan Dan Pembelajaran Ipa Indonesia*, 13(1), 9–16.
- Elisa Dewi, & Iswendi. (2025). Pengembangan Modul Bermuatan Etnosains Berbasis Gdl Pada Materi Laju Reaksi Fase F Kelas Xi Sma/Ma. *Science : Jurnal Inovasi Pendidikan Matematika Dan Ipa*, 5(4), 1968–1979.
- Humolungo, E., Abdullah, G., Rifda Mardian Arif, & Irvin Novita Arifin. (2025). Pengaruh Model Pembelajaran Inquiry Berbantuan Media Wordwall Terhadap Hasil Belajar Siswa Materi Wujud Zat Dan Perubahannya Di Kelas Iv Sd. *Science : Jurnal Inovasi Pendidikan Matematika Dan Ipa*, 5(2), 453–460.
- I Gusti Ayu Ngurah Kade Sukiastini. (2024). Literature Review: Integrasi Model Pembelajaran Ipa Dengan Digitalisasi Dan Kearifan Lokal Untuk Menghadapi Tantangan Di Masa Depan. *Science : Jurnal Inovasi Pendidikan Matematika Dan Ipa*, 4(4), 318–327.
- Kuki, A. D., Agustini, R., & Azizah, U. (2023). Analysis Of Effectiveness Argument-Driven Inquiry To Improve Students' Argumentation Skill And Conceptual Understanding. *Ijorer : International Journal Of Recent Educational Research*, 4(3), 329–342.
- Laila, E., Sudarmin, S., Prasetya, A. T., & Sumarni, W. (2022). Studi Literatur: Penggunaan Jenis Media Pembelajaran Untuk Meningkatkan Kemampuan Literasi Kimia Siswa. *Edukatif : Jurnal Ilmu Pendidikan*, 4(3), 4982–4993.
- Cici Meiliza A, Diah Kartika Sari, & Revy Martusyilia. (2025). Penerapan Model Problem-Based Learning Untuk Meningkatkan Hasil Belajar Materi Kelarutan Dan Hasil Kali Kelarutan Pada Peserta Didik Kelas Xi.4 Sman 1 Palembang. *Science : Jurnal Inovasi Pendidikan Matematika Dan Ipa*, 5(3), 1079–1087.
- Melta, D., Azhar, M., Arsih, F., & Razak, A. (2024). Argument-Driven Inquiry Learning Model To Improve Students' Argumentation Skills In Science Learning: Systematic Literature Review. *Edu Sains Jurnal Pendidikan Sains & Matematika*, 12(1), 55–63.
- Nabila Tricia Aspari, & Andromeda. (2025). Uji Validitas Dan Praktikalitas E-Chemagz Berbasis Chemoentrepreneurship Pada Materi Ikatan Kimia Untuk Meningkatkan Literasi Kimia Peserta Didik. *Science : Jurnal Inovasi Pendidikan Matematika Dan Ipa*, 5(3), 1235–1247.
- Nanik Nia Puji Astuti, Muh Zubair, Bagdawansyah Alqadri, & Mohammad Mustari. (2024). Internalisasi Nilai-Nilai Dalam Membentuk Profil Pelajar Pancasila Di Ma Manhalul Ma'arif Darek. *Social: Jurnal Inovasi Pendidikan Ips*, 4(3), 155–165.
- Ni Made Ary Suparwati. (2022). Analisis Reduksi Miskonsepsi Kimia Dengan Pendekatan Multi Level Representasi: Systematic Literature Review. *Jurnal Pendidikan Mipa*, 12(2), 341–348.
- Ni Putu Rahma Agustina, Nurhasanah, & Gamilla Nuri Utami. (2024). The Implementation Of Modified Free Inquiry Method In The Biomolecular Structure And Function Course To Enhance Students' Critical Thinking And Learning Outcomes. *Jurnal Pendidikan Dan Pembelajaran Kimia*, 14(1), 197–206.

- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... Moher, D. (2021). The Prisma 2020 Statement: An Updated Guideline For Reporting Systematic Reviews. *Bmj*, 372.
- Purwanto, A., Rahmawati, Y., Rahmayanti, N., Mardiah, A., & Amalia, R. (2022). Socio-Critical And Problem-Oriented Approach In Environmental Issues For Students' Critical Thinking Skills Development In Chemistry Learning. *Journal Of Technology And Science Education*, 12(1), 50–67.
- Rahmawati, A. (2025). Implementasi Inkuiri Terbimbing Berbantuan Live Worksheet Untuk Meningkatkan Keterampilan Proses Sains Siswa Smp Pada Materi Getaran Dan Gelombang. *Science : Jurnal Inovasi Pendidikan Matematika Dan Ipa*, 5(2), 837–845.
- Salsabila, C. T., Muttaqin, & Putri, R. (2025). The Effect Of The Argument Driven Inquiry (Adi) Model On Students' Argumentation Skills In Science Learning. *Indonesian Science Education Research (Iser)*, 7(1), 15–21.
- Sanjiartha, I. G. D., Suwindia, I. G., & Winangun, I. M. A. (2024). Peran Literasi Sains Dalam Membentuk Generasi Berfikir Kritis Dan Inovatif: Kajian Literature Review. *Education And Social Sciences Review*, 5(2), 120–128.
- Sipayung, P. A., Ginting, M. E., & Hutasuhut, A. Z. (2025). The Effect Of Guided Inquiry Learning Model To Improving Student's Interest And Learning Outcomes On Chemical Bonding Material. *Jurnal Pendidikan Dan Pembelajaran Kimia*, 14(2), 62–74.
- Uci Apriliya Yolanda, Meirita Sari, & Salamah. (2024). Analysis Of The Process Oriented Guide-Inquiry Learning Model On Students' Scientific Literacy Abilities Analisis Model Pembelajaran Process Oriented Guide-Inquiry Learning Terhadap Kemampuan Literasi Sains Siswa. *Jkip : Jurnal Kajian Ilmu Pendidikan*, 4(2), 310–317.