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Literature Review 2020–2025: Inquiry Approach in E-Worksheets to Improve Elementary Students' Critical Thinking Skills

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A B S T R A C T

In 21st-century learning, students are required to possess critical thinking, communication, collaboration, and creative thinking competencies. From observations in the classroom, students often experience difficulties in understanding learning materials due to the use of conventional student worksheets, which have a declining impact on learning outcomes. This study aims to analyze the research trends in inquiry approaches in electronic worksheets to enhance critical thinking skills from 2020 to 2025. The method used is a systematic literature review, incorporating the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The analysis was conducted using content analysis and bibliometrics, employing VOSviewer for network visualization, overlay, and density review. The results of the review indicate that the inquiry approach in electronic worksheets has a significant impact on enhancing the critical thinking skills of elementary school students. This research provides a theoretical foundation for digital learning media developers, practical guidance for teachers, and contributes to improving the quality of basic education in the digital era.

1. Introduction

In the 21st-century era, critical thinking skills are among the core competencies that elementary school students must possess (Fitriani et al., 2023). This ability enables students to analyze information, evaluate arguments, and make evidence-based decisions, thereby avoiding reliance on memorization (Lubis et al., 2024). Critical thinking skills are one of the primary competencies of 21st-century learning, encompassing critical thinking, creativity, collaboration, and communication (Ridwan Jusuf et al., 2024). In fostering these skills, the inquiry approach is

efficient because students are actively involved in asking, exploring, and finding answers independently (Andriani et al., 2024). In addition, the development of digital technology has opened up great opportunities for teachers to utilize technology-based learning media, such as e-worksheets, which can provide an interactive and collaborative learning experience, as well as direct feedback (Mega Puspitasari, 2025). The use of inquiry-based e-worksheets is believed to be more effective in increasing students' motivation, engagement, and critical thinking skills compared to conventional worksheets.

Inquiry is a learning approach based on the process of discovery and knowledge search that is carried out directly by yourself (W. I. Yanti & Suyanta, 2025). The inquiry approach is a learning model that is packaged to unlock students' knowledge during learning (Mahmudah et al., 2024). The inquiry approach and e-worksheets have had a significant impact on improving students' critical thinking skills (Andari et al., 2025), but implementation in the field still faces various challenges (Triyono et al., 2024). Several studies have been conducted that the quality of the e-worksheets used varies significantly in terms of instructional design, interactivity, and relevance of the material (Wulandahri et al., 2025). Some e-worksheets can improve learning outcomes and critical thinking (Suprapto et al., 2022), but others only enhance understanding of concepts without developing high-level thinking skills (Zahra & Wijanarko, 2025). Another challenge is the lack of teacher training in designing inquiry-based e-worksheets that are in accordance with the characteristics of elementary school students (Lestari & Fitriza, 2025). This imbalance suggests that inquiry-based e-worksheets have great potential, but their implementation still requires considerable effort to be truly optimized as a means of meaningful learning.

Some observations made during the learning of Natural and Social Sciences students suggest that they have difficulties understanding the learning material, as evidenced by the learning results, which show a decrease. In learning, students often rely solely on conventional worksheets purchased at school, even though the student worksheets used are still limited and not inquiry-based. For the learning process to run effectively, it is necessary to make a fundamental shift from a teacher-centered learning model to a student-centered one. In this case, teachers serve as facilitators who encourage students to participate actively in learning activities (Rusmiati et al., 2024). Additionally, there is a need to develop student worksheets that are packaged using an inquiry-based approach, enabling students to develop critical thinking skills. Aspects of e-worksheet design that are effective in improving critical thinking skills include the preparation of real problem scenarios, the use of inquiry approach steps (Illahi & Yurnetti, 2023), integration with technology, and the provision of structured questions that encourage analysis and evaluation (Oktaviani Silaen et al., 2025). Research indicates that e-worksheets that incorporate features such as interactive quizzes, learning videos, and open-ended questions are more likely to stimulate students' analytical thinking than traditional worksheets (Sudirman et al., 2024). Additionally, scaffolding or the provision of gradual guidance in the inquiry e-worksheets is crucial, ensuring that students do not experience confusion during the exploration process (Petersen, 2022). Teachers who use inquiry-based e-worksheets can also utilize real-time

student learning outcome data to provide targeted feedback (Maharani & Hamid, 2024).

Research conducted by Jannah & Suciptaningsih (2023) Regarding the development of CTL-based e-LKPD using the ADDIE model R&D method, the results indicate that e-LKPD is suitable for use as teaching materials. In line with the research that has been carried out by Pristiwanti et al., (2024) Regarding the development of e-LKPD based on the local wisdom of the Batik motif in the city of Serang, which aims to enhance critical thinking abilities using the ADDIE model R&D method, the results obtained can serve as an alternative teaching and learning medium. Furthermore, the research that has been carried out by Putri & Raharjo (2024) Regarding the development of e-LKPD based on discovery learning using the ADDIE model R&D method, the results indicate that the product is suitable for use in the learning process. This is in line with research that has been conducted by Putra et al., (2023) Regarding the development of e-LKPD HOTS to enhance critical thinking through the R&D method using the ADDIE model, it was found that e-LKPD can improve students' critical thinking skills, making it a feasible option for use. This aligns with the research conducted by Suryani & Rini (2023) regarding the development of SET-based e-LKPD to enhance learning activities using the R&D method. The results showed that the SESET-based e-LKPD was valid, practical, and effective in improving student learning activities.

Based on the above explanation, this study aims to analyze the research trends of inquiry approaches in electronic worksheets to enhance the critical thinking skills of elementary school students from 2020 to 2025. The benefits of this research can provide a clear theoretical foundation for the development of digital learning media, serve as a reference for teachers in designing more effective inquiry-based electronic worksheets, and enrich the literature on the inquiry approach in electronic worksheets, as well as the critical thinking skills of elementary school students. Thus, this literature review plays a crucial role in enhancing the quality of basic education in the digital era. This research focuses on several main aspects, namely the number of scientific publications, the type of publication, and the method used. Additionally, this study presents a visualization of research trends on the inquiry approach in electronic worksheets, conducted through analysis using VOSviewer.

2. Methodology

This study employs a systematic review method using bibliometrics to identify research trends, ensuring that information from the research results is obtained completely and accurately, and serves as a basis for informed decision-making. The literature review research utilized two computer application tools: Publish or Perish to search for articles and VOSviewer to visualize the obtained data. The data source was obtained through the Publish or Perish search engine, which is powered by Crossref and Semantic Scholar, from October 2020 to 2025. The search used the keywords "inquiry approach", "electronic worksheet", "critical thinking skills", and "elementary school students". The total number of articles obtained is 1,038, comprising 1,000 articles from the Crossref database and 38 articles from the

Semantic Scholar database. Article analysis is conducted after all articles have been received and selected using the inclusion and exclusion criteria outlined in Table 1.

Table 1. Inclusion and Exclusion Criteria

Criteria Type	Inclusion	Exception
Types of publications	Journals and conferences	Books, thesis, repository
Year of publication	2020-2025	Less than 2020
Data source	Crossref and Semantic Scholar	In addition to Crossref and Semantic Scholar
Area	Inquiry approach, electronic worksheets, and critical thinking skills	Beyond inquiry approaches, electronic worksheets, and critical thinking skills
Research subjects	Elementary School Students	Junior high school, high school, college students, and teachers
Research methods	Research and Development, positions, theories, reviews, others	Other

The researcher employs a systematic review research stage, specifically the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), which comprises four stages: identification, screening, feasibility, and inclusion. The identification stage begins with searching for articles to be analyzed using the PoP search engine. The screening stage is conducted to identify and remove duplicated or inaccessible articles using Mendeley. The eligibility level is determined using inclusion and exclusion criteria outlined in Table 1. The inclusion stage is the final stage, which analyzes the selected articles. Bibliometric data analysis uses the VOSviewer application to visualize all the information from the research articles obtained. Furthermore, it was analyzed in three aspects: network visualization, overlay visualization, and density visualization. From the stages carried out, it can be visualized according to Figure 1.

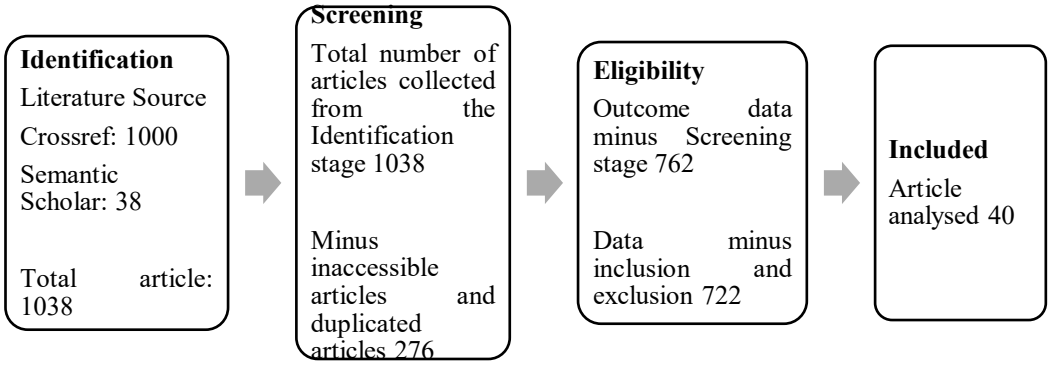

Figure 1. Stages of the PRISMA model

3. Results and Discussion

Results of a scientific publication analysis examining research trends and inquiry approaches in electronic worksheets to enhance critical thinking skills, based on the number of scientific publications, publication type, and research methods

employed. Analysis using VOSviewer focuses on three types of analysis: network visualization, overlay visualization, and density visualization. The number of articles published between 2020 and 2025 has fluctuated significantly. The number of articles published increased from 2020 to 2024, reaching a peak of 10 articles in 2024. In 2020-2021, there was an increase comparable to 2022-2023, which was 1 article. Meanwhile, in 2021-2022, there was an increase comparable to 2023-2024, which was two articles. However, there has been a decline from 2024 to 2025, with a difference of 4 articles, it can be visualized according to Figure 2.

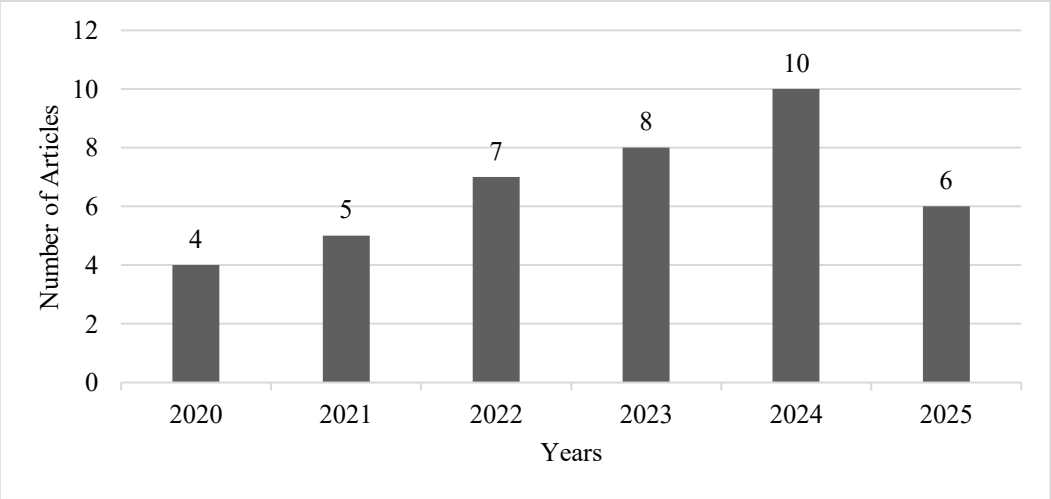

Figure 2. Number of publications on inquiry approaches in electronic worksheets from 2020 to 2025, October

Scientific publications on the inquiry approach in electronic worksheets, reviewed from the types of publications from 2020 to 2025, the number of scientific publications in the form of journals is more dominant than those in the form of proceedings. The type of publication, in the form of journal articles, consisted of 38 articles. Meanwhile, the kind of publication in the form of proceedings yielded two articles, it can be visualized according to Figure 3.

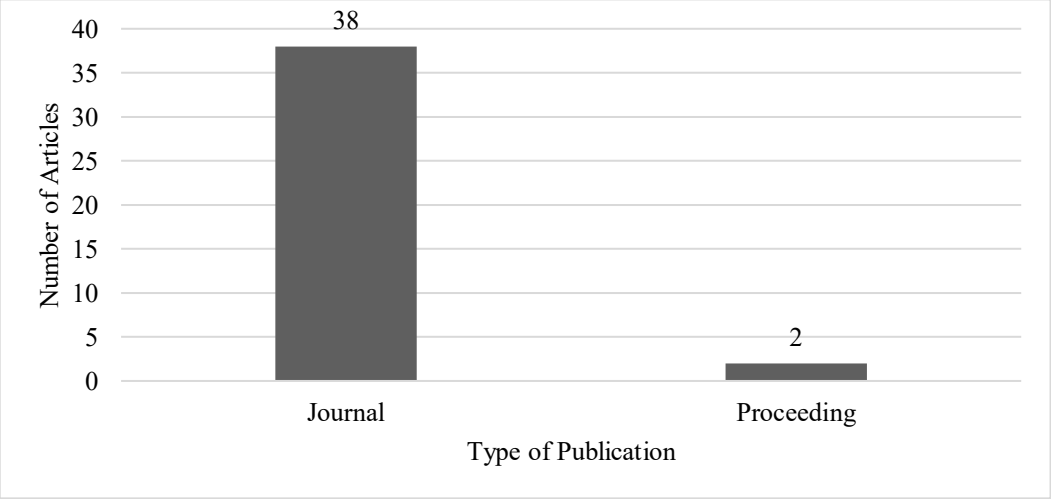

Figure 3. Types of publications on inquiry approaches in electronic worksheets from 2020 to 2025, October

The most often used research methods by researchers are Research and Development (R&D) research, with a percentage of 0.53. The experiment method got a rate of 0.23. The case study got a percentage of 0.08. Meanwhile, the research methods that are rarely used are quantitative and action research, with a percentage result of 0.05, it can be visualized according to Figure 4.

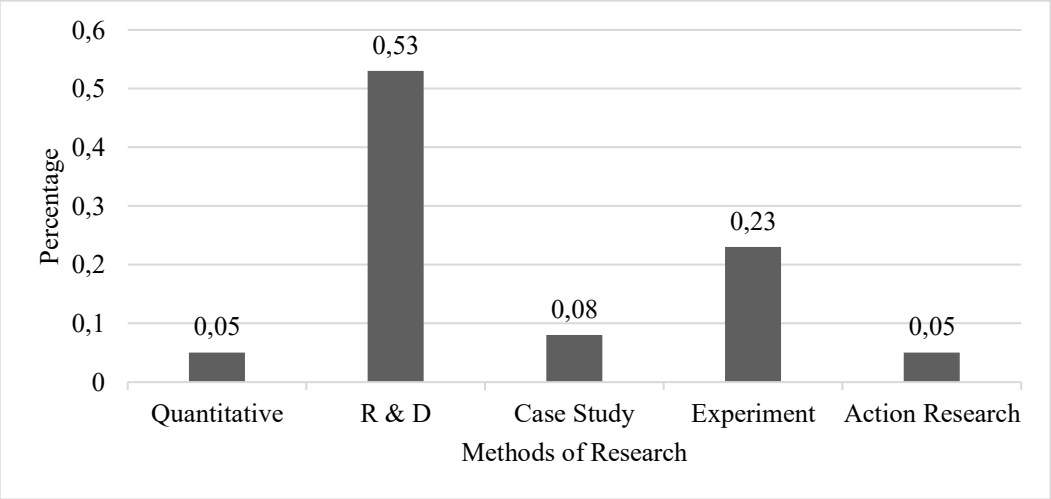

Figure 4. Research methods used in the inquiry approach in electronic worksheets from 2020 to 2025, October

The results of the network visualization-based analysis provide an overview of some of the topics that are widely cited and have a close relationship with other issues. In general, four main topic groups can be distinguished based on color, namely purple, green, red, and blue. The inquiry approach is the link between the green and blue color clusters. Therefore, it can be determined that the inquiry approach is related to electronic worksheets, and critical thinking skills are widely discussed in many research articles, it can be visualized according to Figure 5.

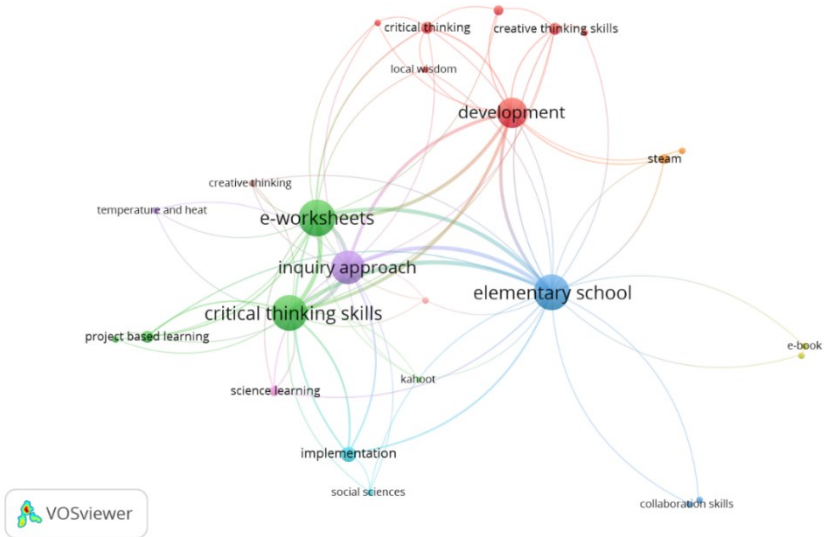

Figure 5. Network Visualization Research Inquiry Approach in Electronic Worksheets 2020-2025

The overlay visualization, show two main areas that are quite contrasting, namely yellow and green. The inquiry approach can be described as a research topic that has been heavily researched in recent years, characterized by a yellow or yellowish color. The difference between these two areas shows that brightly colored areas are a current topic. Meanwhile, dark-colored areas indicate research topics that researchers have extensively explored over time. The results of the analysis, based on Figure 6.

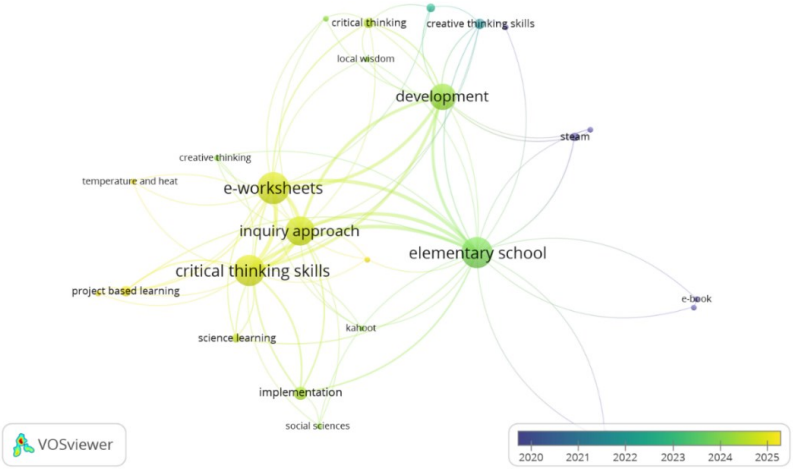

Figure 6. Overlay Visualization Research Inquiry Approach in Electronic Worksheets 2020-2025

The yellow area indicates that the term, as indicated by the color, has received considerable attention from researchers, while the blue area indicates areas that have received less attention. The researchers paid close attention to inquiry approaches, including development, electronic worksheets, and critical thinking skills, particularly in elementary school. These results provide information about research gaps that can be addressed in relation to current research trends. In general, the results of the analysis can be distinguished based on the color in Figure 7.

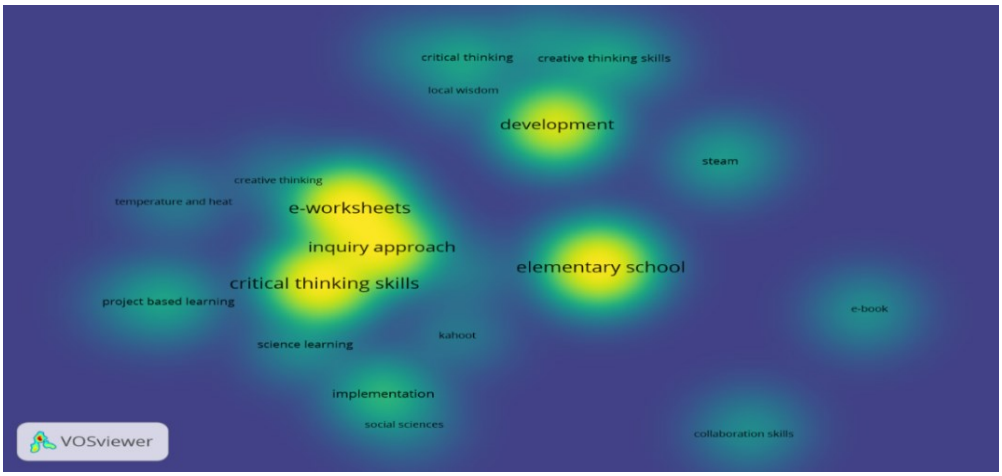

Figure 7. Density Visualization Research Inquiry Approach in Electronic Worksheets 2020-2025

This study aims to analyze research trends of inquiry approaches in electronic worksheets to improve critical thinking skills. These research trends will provide an overview of the research interests, approaches, and shared knowledge of researchers (Istichomah et al., 2024). Based on the data obtained, the research trend of inquiry approaches in electronic worksheets is gaining attention in the field of basic education, especially in the context of improving students' critical thinking skills. This is in line with Muhardini et al., (2021) This emphasizes that critical thinking skills are a key competency in 21st-century learning. The increase in the number of publications from 2020 to 2024 reflects the growing academic awareness of the importance of integrating digital technology to support inquiry-based learning models. Although the number of publications is expected to decrease by 4% in 2025 compared to the previous year, this is not a problem, as the data collection was carried out in October at the time.

Based on Figure 3, it is evident that from 2020 to 2025, the type of publication in the form of journals yielded 38 articles, while proceedings accounted for two articles. This indicates that publication in the form of journal articles is more dominant than the form of proceedings. The topic of inquiry approaches in electronic worksheets has been the focus of researchers. According to Liu et al., (2025), publication articles in the form of scientific journals display research results through various rigorous processes, so that they have a higher scientific weight than publication in the form of proceedings (Asmaryadi et al., 2022). This can reinforce the validity of the trend that the application of inquiry approaches in electronic worksheets is not only a methodological innovation but also a teaching strategy that has proven effective in improving learning quality (Riyadi et al., 2021).

The research method most often used by researchers, as shown in Figure 4, is Research and Development (R&D), with a percentage result of 0.53. Research and Development is a research method used to create new products or improve existing ones (Rahma & Novita, 2024). Popular R&D models used include the Borg and Gall models, as well as the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model and 4D models (Define, Design, Development, Dissemination) (Ramadhani et al., 2025). The results of the literature review analysis indicate that researchers frequently employ the ADDIE model, suggesting that the focus of research is primarily on developing and validating digital-based learning products (Handayani et al., 2025). Research on inquiry approaches in electronic worksheets is excellent, utilizing the Research and Development method, as researchers can develop electronic worksheets that incorporate an inquiry approach to enhance students' critical thinking skills (Setiawan et al., 2024).

The results of network visualization using VOSviewer are presented in Figure 5, which illustrates the relationships between inquiry approach, critical thinking skills, and electronic worksheets. This interconnectedness indicates that recent research has sought to integrate inquiry approaches with digital media (Valentza et al., 2025). According to Harmony & Handayani (2025)The integration of inquiry-based approaches and digital media can create a more collaborative and reflective learning environment. Students are not only recipients of learning information, but also sources of knowledge through the process of exploration and discovery

(Nurhidayah et al., 2025). This aligns with the current curriculum development of teachers as facilitators in the learning process. Students are allowed to search for information through digital media (Aulia & Alberida, 2025).

Visualization of the yellow 6-area image overlay reveals that the inquiry approach in electronic worksheets remains a topic that warrants further study. The colors in the map indicate the time period of the study (Sudirman et al., 2024). Green wana indicates research that has been carried out for a long time, while yellow and yellowish colors indicate new topics and have become research trends in recent years (Suri et al., 2025). The relationship between the inquiry approach and e-worksheets indicates that the inquiry approach is widely integrated in the development of electronic worksheets. According to Salsabila Devira et al., (2025) The inquiry approach is effective in instilling high-level thinking skills because it encourages students to think analytically and evaluatively. This aligns with 21st-century learning, which emphasizes student activity, exploration, and discovery. This integration aims not only to increase student participation in the learning process but also to train the ability to analyze, evaluate, and solve problems independently (Fathoni et al., 2025). The latest research trends in the field of teaching material development in elementary schools tend to focus on integrating inquiry-based approaches and e-worksheets to enhance students' critical thinking skills. These findings reinforce the importance of developing inquiry-based electronic worksheets as a relevant and sustainable innovation in 21st-century learning.

Meanwhile, the results of density visualization showed that the keywords "inquiry approach", "critical thinking skills", and "elementary school" formed a good central focus for the research (M. Yanti et al., 2025). This suggests that these keywords are the primary focus of recent research on the development of inquiry-based learning tools, as well as the enhancement of critical thinking skills in primary schools (Aras et al., 2024). The dominance of bright yellow indicates the novelty of the latest research topic, while the green color indicates research that has been carried out for a long time (Suri et al., 2025). Figure 7 provides information on the existence of research gaps that can be developed related to the latest research trends. This illustrates that the focus of the research does not lie in the technological aspect, but rather in efforts to strengthen students' cognitive abilities through the integration of meaningful learning approaches (Yi-Ming Kao et al., 2025). Several studies have demonstrated that inquiry-based e-worksheets are effective in enhancing learning outcomes, student engagement, and learning motivation (Sudirman et al., 2024).

The inquiry approach in electronic worksheets based on the results of analysis using VOSviewer is closely related to several other research topics. Inquiry-based research in electronic worksheets has garnered considerable attention from researchers, particularly in recent years, and has become a key demand of 21st-century learning. Research on inquiry approaches in electronic worksheets will be an exciting research topic in the future, particularly in primary schools, due to its connection with critical thinking skills (Subekti & Prahmana, 2021). Based on this information, researchers will gain insight into developing a research inquiry approach for electronic worksheets.

4. Conclusion

Based on the results of the data obtained, it can be concluded that research on the inquiry approach in electronic worksheets between 2020 and 2025 can provide valuable insights into the application of the inquiry approach in electronic worksheets to enhance the critical thinking skills of elementary school students. Research on inquiry approaches in electronic worksheets has increased steadily from year to year. Most scientific publications are in the form of journals as opposed to proceedings. The most widely used research method is Research and Development (R&D), specifically the ADDIE model, which focuses the researcher's attention on the development and validation of digital learning products. Network visualization and overlays from the VOSviewer analysis show that the topics of "inquiry approach", "critical thinking skills", and "electronic worksheets" are the main clusters that are closely related and are the focus of the latest research. The results of the density visualization indicate that research on the inquiry approach in e-worksheets still has vast development opportunities, especially in the context of implementation in elementary schools. This research is expected to provide a theoretical basis for learning media developers, a practical guide for teachers, and a reference for researchers to develop inquiry-based e-worksheet models that are more adaptive, interactive, and contextual, tailored to the needs of elementary school students

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