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# One Decade of Inquiry-Based Learning in Education: Trends and Hot Topics

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**Abstract**

The popularity of Inquiry-Based Learning (IBL) has continued to increase in the last decade, as reflected in the growing number of academic publications examining its implementation and impact across various disciplines. This study aims to analyze publication trends and hot topics related to IBL over the past decade using a bibliometric approach. A total of 236 Scopus-indexed documents were analyzed. The analysis showed a significant increase in the number of IBL publications and citations. Indonesia dominates the research contributions, indicating successful educational reforms that support the adoption of IBL. Physics and Astronomy were the disciplines that adopted this approach the most, followed by Social Sciences. Keyword analysis identified four main themes that were being discussed: attitude, character, cognitive style, and metacognition. The findings show the importance of a holistic approach to IBL learning, which includes both cognitive and non-cognitive dimensions. This study concludes that IBL is an effective pedagogical approach that continues to evolve. Further research is recommended to explore the integration of these key themes within a more inclusive IBL framework, as well as cross-cultural applications, to support more relevant and meaningful learning.

**Keywords:** Inquiry-Based Learning, Bibliometrics, Publication Trends, Scopus.

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## INTRODUCTION

IBL has become an increasingly popular approach in education. It focuses on the active involvement of learners in the learning process through exploration, questioning, and discovery, which directly supports the formation of critical thinking and problem-solving skills. As an approach rooted in constructivism theory, IBL provides opportunities for learners to construct their knowledge through interaction with stimulating learning environments. Pedaste et al. (2015) developed a conceptual framework that defines the inquiry cycle, which includes five main stages: orientation, conceptualization, investigation, conclusion, and discussion. This framework provides a systematic guide for the implementation of IBL in various learning contexts.

In a global context, IBL has been shown to be effective in improving student learning outcomes. For example, Lazonder and Harmsen's (2016) meta-analysis showed that IBL can significantly improve concept understanding compared to traditional learning methods, especially when accompanied by adequate guidance. Other studies also support the integration of IBL in cross-disciplinary approaches, such as STEM education (Deák et al., 2021; Fadillah et

al., 2024; Karamustafaoğlu & Pektaş, 2023; Ong et al., 2020) and project-based learning (Wale & Bishaw, 2020). In addition, the COVID-19 pandemic has accelerated the transformation of education, driving the implementation of IBL in online learning formats (Zhang et al., 2022).

IBL has also shown potential to improve students' metacognitive skills (Rodríguez et al., 2019) and critical thinking abilities (Costes-Onishi & Kwek, 2023; Sapriati et al., 2024; Wale & Bishaw, 2020). Research on the integration of IBL into various curricula shows that this approach can be adapted to local needs, including in resource-constrained environments (Karamustafaoğlu & Pektaş, 2023; Siantuba et al., 2023; Vilarta Rodriguez et al., 2020). On the other hand, Khalaf (2018) noted the importance of teacher support and curriculum coherence to ensure the successful implementation of IBL, highlighting that the success of this approach requires the support of a supportive and structured educational environment.

Although IBL has been widely studied, there needs to be more research regarding the adaptation of IBL structures for different levels of education and specific learning objectives. Pedaste et al. (2015) offer a comprehensive inquiry cycle framework. However, this research has yet to explore how the stages of the inquiry cycle can be adapted to the specific needs of each level of education or to achieve specific learning outcomes. Khalaf (2018) points out that while IBL improves students' knowledge and skills, there are limitations in meeting educational expectations for specific skill development. However, this study should have discussed in depth how the structure of the inquiry stages can be modified to meet these needs. Furthermore, Lazonder and Harmsen's (2016) meta-analysis shows that the success of IBL depends largely on the type of assistance provided to students but has yet to explore how each phase of inquiry can be customized based on age or educational level. Bogar (2019) discussed various models of IBL in science education but focused more on general descriptions rather than specific adaptations based on specific educational needs. Meanwhile, Strat et al. (2024), in their review of Inquiry-Based Science Education (IBSE) in pre-service teacher education, emphasized the importance of inquiry approaches in pre-service teacher training. However, this research is still limited to the context of teacher education and needs to offer specific guidelines for each level of education.

This study aims to answer two main questions: (1) What are the publication trends of IBL research over the past decade? Moreover, (2) What are the hot topics of focus in current IBL research? Through a bibliometric approach, we will map the evolution of IBL research, identify publication patterns, and explore key themes that dominate academic discourse. With this analysis, we seek to fill the research gap related to the adaptation of IBL structures at different levels of education and specific learning objectives while providing a more holistic picture of the development of IBL in the context of global education. The results of this study are expected to make a significant contribution to the development of IBL theory and practice in the future.

## RESEARCH METHOD

### Bibliometric Approach and Database Selection

This research uses a bibliometric approach, which is a quantitative analysis of scientific literature that aims to evaluate publication patterns, relationships between authors, and main topics in a field of research. This approach allows the identification of historical trends while providing an overview of future research focuses through the visualization of keyword networks or research themes (Mohamad et al., 2023). Scopus was chosen as the main database due to its extensive coverage of high-quality scientific literature, including journals, conference proceedings, and systematic reviews. Scopus has the advantage of providing data that can be used for citation analysis and visualization of bibliometric relationships using software such as VOSViewer (Festiyed et al., 2024).

### Search Strategy and Data Refinement

The search strategy was designed to cover literature relevant to inquiry-based learning (IBL). The keywords used were "inquiry learning model" and "inquiry-based learning model", applied to the title, abstract, and keywords of the documents (TITLE-ABS-KEY). The search was limited to documents published between 2014 and 2024 to reflect developments over the past decade. The initial search yielded 236 documents. Subsequently, a refinement process was conducted to filter out documents relevant to the research topic. Documents that should have discussed IBL in depth or mentioned the term without substantial contribution were excluded. All documents were considered relevant, consisting of 146 conference papers, 77 articles, 7 conference reviews, and 6 book chapters.

### Data Management and Analysis

The data obtained were exported in comma-separated values (CSV) format for further analysis. Descriptive analysis was conducted using Microsoft Excel to describe the distribution of the number of publications by year, document type, and author's country of origin. For visualization analysis, data were imported into VOSViewer. This software was used to map relationships between terms that frequently co-occurred in document titles and abstracts. The term co-occurrence analysis resulted in clusters depicting the main themes in the study. This visualization helped identify patterns of relationships between topics as well as map emerging topics.

## RESULTS AND DISCUSSION

### Trend Analysis of Article Publication on IBL

IBL is one of the pedagogical approaches that continue to grow in the world of education. This method emphasizes the active role of students in the learning process through exploration, investigation, and problem-solving. IBL has been proven effective in developing critical, analytical, and collaborative thinking skills, which are highly relevant in facing the challenges of the 21st century (Festiyed et al., 2022; Novitra et al., 2021; Pedaste et al., 2015). It is important to analyze publication trends in the last decade to understand the dynamics of

research development related to IBL, including the number of publications, geographical distribution, and subject areas involved.

***IBL Publication and Citation Trends (2014-2024)***

Publication trends show a significant increase in the number of documents addressing IBL over the period 2014 to 2024. Based on the data in Figure 1, the number of publications increased from 4 documents in 2014 to 52 documents in 2020, which was the highest peak in the ten years. After that, although there was a decline in the number of publications, with 12 documents in 2022, interest in IBL strengthened again, with 23 documents in 2023 and 14 documents in 2024. The number of citations also showed a significant spike. In 2014, there were only 3 citations, but this figure jumped to 45 citations in 2018 and reached 240 citations in 2024. This spike in citations shows that although the number of publications fluctuates, previously published articles have a great impact on strengthening the foundation of IBL research. It confirms the importance of IBL as a relevant topic in the global education discourse.

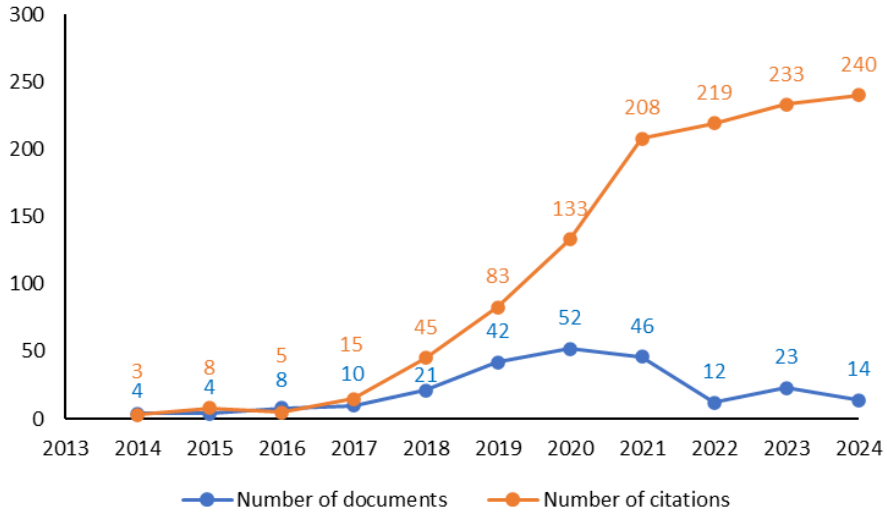


**Figure 1.** IBL Publication and Citation Trends

***Geographical Distribution of Publications***

The geographical distribution of publications shows Indonesia's dominance in IBL-related research. Based on Figure 2, Indonesia produced 182 documents, far exceeding other countries such as China and the United States, which contributed only 9 documents each. This shows that IBL is getting great attention in Indonesia, which can be attributed to the national education reform through the introduction of a curriculum that encourages inquiry-based learning. Other Asian countries such as Taiwan (7 documents), Thailand (6 documents), and Malaysia (5 documents) also contributed significantly to the development of IBL. In contrast, Western countries such as the United States, United Kingdom, and Australia recorded a smaller number of publications. However, despite the smaller number, research from Western countries often made important conceptual and theoretical contributions to the development of the IBL

framework. This wide distribution suggests that IBL has been adopted globally, with variations in implementation contexts reflecting local needs and priorities. The presence of 8 documents with no identified geographical origin also suggests the possibility of cross-country collaboration in IBL research.

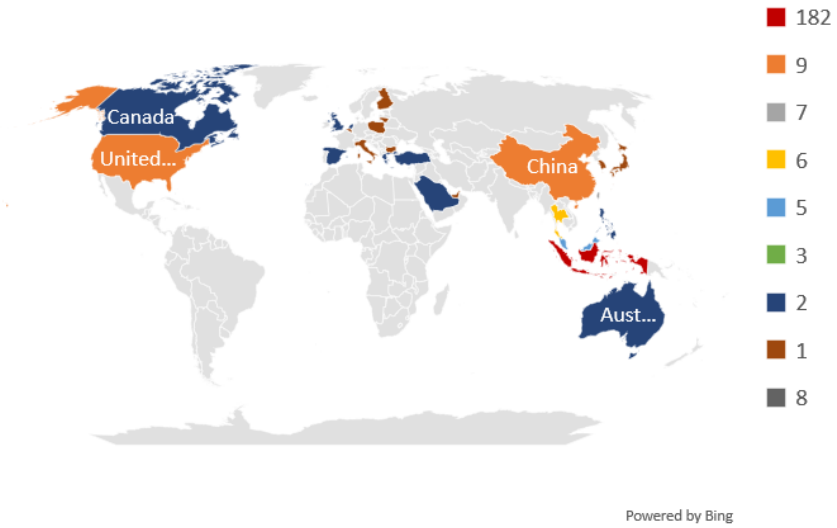


**Figure 2.** Geographic Distribution of IBL Publications

***Dominance of Inquiry-Based Learning Subject Areas***

IBL has been applied in a variety of disciplines, with a strong dominance in Physics and Astronomy, which recorded 139 documents (Figure 3). These fields are well suited for IBL methods due to their experimentation and investigation-based nature. In physics learning, for example, students can engage in laboratory experiments to observe phenomena and develop empirical data-based understanding (Fadillah & Sahyar, 2023; Liu et al., 2022). In addition, Social Sciences ranks second with 76 documents. In social sciences, IBL is often used to develop analytical and critical skills through case studies, field research, and community-based projects (Mohamed Yusof & Mohammed, 2024; Suharno et al., 2023). The dominance in these two fields shows that IBL is effective in supporting investigation-based learning in both the exact and social sciences.

Beyond that, the fields of Engineering (22 documents) and Computer Science (17 documents) also show significant adoption. In both fields, IBL is used to complete complex projects, such as system design or software development. The Business, Management, and Accounting field (9 documents) shows that IBL is also relevant for economic and managerial studies, helping students develop data-driven decision-making skills through simulations and case studies. Some other fields, such as Environmental Science, Medicine, and Mathematics, despite having fewer publications, still show great potential for applying IBL. This shows that this method is suitable not only for experiment-based learning but also in multidisciplinary contexts.

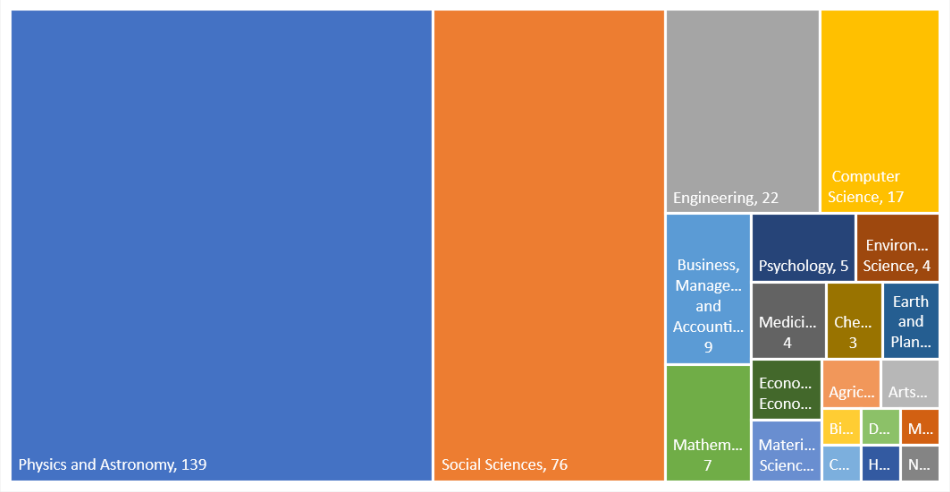


**Figure 3.** IBL Publication Subject Areas

## Analysis of Current IBL Hot Topics

The increasing interest in IBL in education triggers the growth of various relevant research topics. Keyword-based bibliometric analysis provides significant insights to identify hot topics in IBL. The keywords used in research documents are evaluated in-depth to uncover the most discussed and relevant themes in the current context. With the help of VOSviewer, this analysis provides a holistic view of trending topics based on their occurrence and impact in the literature. The analysis was conducted by selecting the "co-occurrence" type of analysis, using author keywords as the unit of analysis. This approach aims to identify the interrelationships between keywords and the dominant themes that are developing. Only keywords that appeared at least twice were included in the analysis, resulting in 38 keywords of primary focus. Furthermore, two types of overlay visualizations were used: first, based on average publication year to identify new and hot topics, and second, based on average citations to determine topics that have high academic impact.

### *Hot Topics Based on Research Novelty*

One way to identify hot topics in IBL is to look at recent publication trends. Figure 4 shows an overlay visualization based on the average publication year, where red represents new hot topics, while blue indicates topics that have long been discussed in the literature. In this context, two keywords that stand out as hot topics are "attitude" and "character". The keyword "attitude" has become one of the more popular topics in recent years. Research related to student attitudes towards inquiry-based learning has shown that positive attitudes towards this method contribute to higher student engagement. Students' attitudes cover a wide range of aspects, from motivation to learn and interest in the subject matter to confidence in solving problems. Recent research highlights the importance of building these positive attitudes as a prerequisite for maximizing the effectiveness of IBL. In addition, the keyword "character" reflects the increased attention on character development through IBL. In recent years, the focus of education has shifted not only to cognitive learning outcomes but also to student character

building. Through the inquiry process, students are encouraged to develop values such as responsibility, honesty, cooperation, and perseverance. This topic is aligned with global initiatives that emphasize the importance of character education as an integral part of the curriculum.

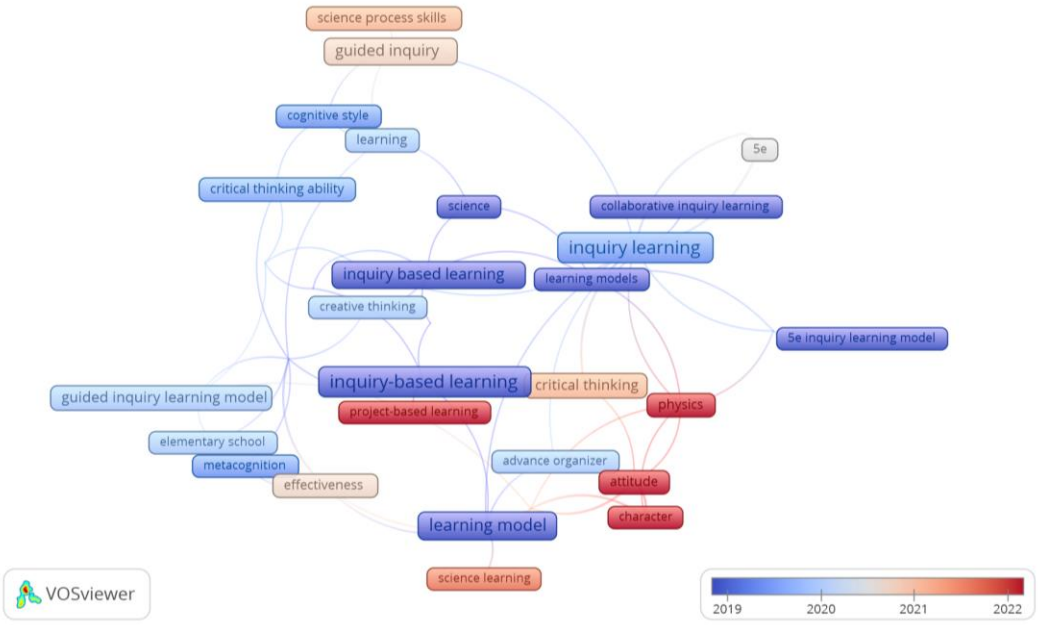


**Figure 4.** Visualization of IBL Overlay Based on Average Publication Year

***Hot Topics Based on Citation Impact***

Another dimension that provides important insights is the influence of certain topics in the academic literature, as measured by the number of citations. Figure 5 shows an overlay visualization based on average citations, where red indicates topics that are frequently cited, while blue indicates topics that rarely receive attention. Two keywords that stand out in this analysis are "cognitive style" and "metacognition". The keyword "cognitive style" refers to an individual's preference for processing information, thinking, and problem-solving. In the context of IBL, research shows that cognitive style plays an important role in determining how students engage with the inquiry process. Some students may be more inclined to use an analytical approach, while others are more intuitive. Studies that address cognitive styles highlight the importance of tailoring IBL approaches to the individual needs of students to improve learning effectiveness. The high number of citations on this topic indicates that this issue receives widespread attention from the academic community.

The topic of "metacognition" also shows significant influence in the IBL literature. Metacognition refers to students' ability to realize, monitor, and regulate their thinking processes. In inquiry-based learning, students are often faced with complex tasks that require planning, monitoring, and reflection. Research shows that students with good metacognitive skills are better able to identify questions, design experiments, and analyze results more effectively. Therefore, metacognition is considered one of the key skills developed through

IBL, and the high citations on this topic indicate that the scientific community recognizes the importance of this aspect in supporting deeper and more meaningful learning.

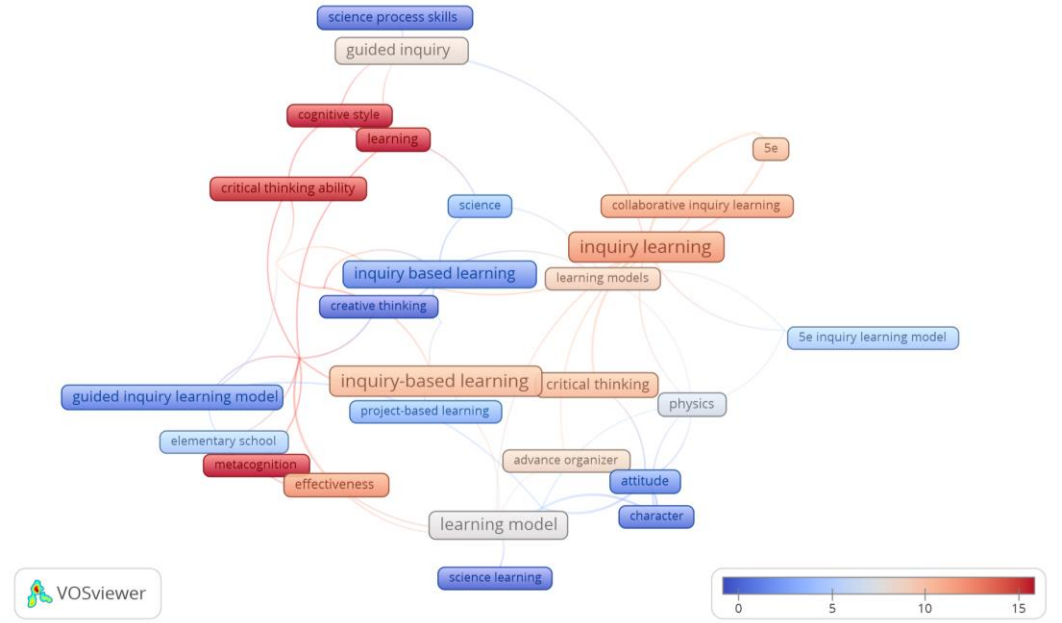


**Figure 5.** Visualization of IBL Overlays Based on Average Citations

## Discussion

This publication trend analysis shows that IBL has become a relevant and influential learning approach in the past decade. The increase in the number of publications and citations indicates that the topic is increasingly attracting the attention of educational researchers and practitioners around the world. Indonesia's dominance in the number of publications demonstrates the success of educational reforms that support the adoption of IBL. At the same time, contributions from various other countries show the global spread and adoption of this method.

The dominance of subject areas such as Physics and Astronomy, and Social Sciences suggests that IBL is most widely used in the context of experimentation and investigation-based learning. However, applications in fields such as technology, business, and health underscore the flexibility of IBL as a method that can be adapted to the needs of different disciplines. It is important to continue exploring the application of IBL in broader contexts, including online and hybrid learning (Novitra et al., 2021). Further research is also needed to explore how IBL can improve engagement and learning outcomes at different educational levels. Thus, IBL can continue to evolve as an innovative, relevant, and effective pedagogical approach in various global educational contexts.

In addition, the hot topics identified, such as attitude, character, cognitive style, and metacognition, reflect the holistic approach that is increasingly dominating IBL research. Attitude and character are closely related to the non-cognitive dimensions of learning, emphasizing the importance of forming

individuals who are not only intellectually intelligent but also have strong moral and social values. Meanwhile, cognitive style and metacognition focus more on the cognitive dimension, helping students develop adaptive and reflective thinking strategies. This convergence between cognitive and non-cognitive dimensions reflects a paradigm shift in modern education, where student success is not only measured through academic outcomes but also through their ability to adapt, think critically, and cooperate in a complex and dynamic environment (Ahmad et al., 2024; Usmeldi et al., 2017). Research that integrates these four aspects has the potential to make a significant contribution to developing a more inclusive and effective IBL approach.

The identification of hot topics in IBL provides some important implications for the development of educational research and practice. First, the findings suggest the need for further research on how factors such as attitude and character can be influenced and enhanced through IBL. Second, the attention to cognitive style and metacognition emphasizes the importance of designing more personalized and adaptive learning experiences. Future research could explore how these four topics can be integrated into the IBL framework to support more holistic learning. Moreover, cross-cultural exploration of the application of IBL could also provide additional insights into how local contexts influence the effectiveness and relevance of these topics. Thus, IBL can continue to evolve as a pedagogical approach that is not only relevant but also capable of preparing students to face global challenges.

## CONCLUSION

This research reveals that IBL has become a significant and relevant pedagogical approach in the past decade. Publication trends show a significant increase in the number of IBL-related documents and citations, with a predominance of research from Indonesia reflecting the success of educational reforms in the country. The dominance of subject areas such as Physics, Astronomy, and Social Sciences demonstrates the effectiveness of IBL in experimentation and investigation-based learning. At the same time, contributions from a range of other disciplines highlight the method's versatility. The hot topic analysis identified four main themes on which the research focused: attitude, character, cognitive style, and metacognition. Students' positive attitudes and character development through IBL proved important in improving learning engagement and effectiveness. Cognitive style and metacognitive skills are key factors in supporting deep and meaningful investigation-based learning. The convergence of cognitive and non-cognitive dimensions reflects a holistic approach in IBL research, emphasizing the importance of learning that focuses not only on academic outcomes but also on character building and student adaptation to a dynamic environment. Further research is needed to explore the integration of these themes within a more inclusive IBL framework and evaluate its effectiveness in a cross-cultural context. This approach is expected to prepare students for global challenges through innovative, relevant, and effective learning.

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