International Journal of Learning, Teaching and Educational Research
Vol. 25, No. 4, pp. 293-309, April 2026
https://doi.org/10.26803/ijlter.25.4.14
Received Jan 17, 2026; Revised Mar 16, 2026; Accepted Mar 20, 2026

Sociocultural Factors Influencing Asian Science Teachers' Inquiry-Based Learning: A Systematic Review

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Abstract. Past research has shown that the low practice of inquiry-based learning (IBL) in Asian countries is not simply because of teachers' unwillingness, but because of other underlying factors, such as sociocultural, that influence it. However, past reviews only focus on the technology integration and students' outcome. This study systematically reviewed the sociocultural contexts influencing Asian science teachers' IBL practices. This study was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) which involves identifying, screening, and finding eligible studies. The sociocultural factors found in the Asian IBL practice were the social norms of authoritative and fast-paced learning, teachers' experiences (prior learning, environmental pressure, and professional development), cultural beliefs, East Asian culture, and the social norms of the education system. This study focused on reviewing 20 articles published in English from 2016 to 2026. Future studies should explore this further but focus on specific science subjects such as physics, chemistry, and biology. This study serves as a reference for teachers and provides support to policymakers in the development of science curricula and future professional development. These sociocultural factors should be addressed to enhance the impact of IBL on Asian students' learning.

Keywords: Sociocultural Factors; Asian Science Teachers; Inquiry-Based Learning; Systematic Literature Review

Citation:
Roslan, A. N., Phang, F. A., & Ahmad, M. F. (2026). Sociocultural Factors Influencing Asian Science Teachers' Inquiry-Based Learning: A Systematic Review. *International Journal of Learning, Teaching and Educational Research, 25*(4), 293–309. https://doi.org/10.26803/ijlter.25.4.14

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1. Introduction

In 21st century learning, science education prioritizes the mastery of inquiry skills, crucial in helping students become independent learners. The most effective learning approach for these goals is inquiry-based learning (IBL). Past studies have shown the positive effects of using IBL on students' motivation and conceptual understanding.

However, IBL is reportedly less practiced by teachers (Bako et al., 2022; Guerrero & Bautista, 2023) who continue to employ traditional approaches (Bako & Phang, 2020), which may be considered outdated and misaligned with contemporary global advancement (Teschers et al., 2024) in the context of science education. Past studies showed that IBL fosters students' argumentative skills (Kousloglou et al., 2023), but despite the importance of conversation in IBL, the teachers were reported to prefer using traditional learning. However, there is a relatively small body of literature concerning teachers' limitation in using IBL due to each country's sociocultural factors (Kapici, 2025).

IBL has been practiced worldwide according to each country's sociocultural context and needs with the science IBL practice developed based on Western models. However, based on the PISA assessment, the science teaching practices are different since the Western countries focus on the process of science and hands-on activities while East Asian countries still practice the traditional learning which emphasizes teachers as transmitters of knowledge (Chen & Tytler, 2016). This is related to the sociocultural context of each country, the cultural beliefs of the teachers, the social norms of the social setting, and the teachers' experiences. All these sociocultural factors influence teachers' roles in the classroom.

Lau et al. (2015) claimed that a combination of Western and East Asian framework is necessary to produce a meaningful science learning. Dyczek (2025) also claimed that there is a need to emphasize the culture-based framework according to each country's sociocultural factors. This applies to the Asian countries since they have a problem in applying IBL in science. Prior research raises questions about how culture impacts the IBL practices of science teachers. However, there is lack of review on the sociocultural factors that impact the use of IBL. Previous review studies on IBL in science learning were mainly on the use of technology in IBL, and the effects on students' engagements. These reviews did not explore the pros and cons of using IBL, and "why is it happening" based on the sociocultural factors. Hence, the current study will review the use of IBL in science and how these factors have been studied in Asian countries' classrooms to address this gap.

This study aims to address the following research questions:
What are the sociocultural factors that influence Asian science teachers' use of IBL?

2. Literature Review

2.1 Inquiry-Based Learning (IBL) in Science Education

IBL emphasizes students' exploration in seeking knowledge (Chen et al., 2025). It is an active learning approach in which students control their learning (Kunnath & Botes, 2025) and the process includes engaging, exploring, explaining, extending, and evaluating (Gillies, 2023). Teachers' roles have shifted from being dispensers of knowledge to facilitators, asking questions to develop students' curiosity and critical thinking (Radzali et al., 2018). Proper science learning using IBL creates an environment where students argue and think critically about natural phenomena, rather than just accepting teacher explanations (Jumadi & Dwandaru, 2023). IBL has been proven for its effectiveness for the students' lifelong learning, conceptual understanding, and higher order thinking skills compared to traditional learning (Morris, 2025). However, teachers struggle to develop questions that promote student thinking and scaffold science teaching effectively (Strat et al., 2024).

2.2 Sociocultural CHAT Theory

Vygotsky developed the Cultural-Historical Activity Theory (CHAT) based on his sociocultural theory. Engeström et al. (1999) expanded this theory, explaining the relationship between human action and the mind and its sociocultural mediation. This study focuses on Engeström's expanded theory, which addresses teachers' educational issues, particularly in preparing effective educators. CHAT explains teachers' actions as learners, influenced by external environments and sociocultural factors (Halim et al., 2023).

The theory includes subjects (teachers involved in science IBL), community (individuals in the sociocultural context), mediating artefacts (laboratory apparatus and technology), rules (set by policymakers), and division of labor (teachers' responsibilities). The community comprises individuals and groups that interact with teachers, while mediating artefacts are tools used in science IBL. Culture forms the basis of social interaction and the development of good questions for verbal interactions. Cultural values vary across sociocultural contexts, including social norms, beliefs, and teachers' experiences (Kapelari, 2015). As such, this study examined how cultural values shape Asian teachers' IBL practices.

2.3 Asian Science Teachers' IBL Practices

Prior research has shown that Asian teachers practice IBL based on their own understanding. However, Anuar et al. (2017) showed that the IBL model developed does not suit all teachers' practices. In East Asian learning culture, for example, teachers mostly use traditional methods (DiBiase & McDonald, 2015), with IBL implementation based on individual understanding. The issue that is overlooked by previous research is that science teachers find it difficult to implement IBL effectively. The lack of IBL usage has been linked to verbal interactions and questioning practices among science teachers. The teachers used closed-ended questions in chemistry classrooms (Li & Arshad, 2015).

Similarly, Fernandez (2017) found that physics teachers in Singapore used close-ended questioning due to achievement-focused social norms. Berg & Smith (2014) studied cultural differences affecting pre-service teachers' self-efficacy in Malaysia, England, and New Zealand, examining their sociocultural factors and prior experiences. Teachers' concerns vary based on policies, support and parents' expectations. Chen & Tytler (2016) noted the differences in IBL practices across countries, with Vietnam showing faster-paced practices than Germany and Australia. These differences emphasize the need to incorporate sociocultural context into Asian science teachers IBL framework (Halim et al., 2023).

Asian teachers are raised with cultural beliefs that equate academic performance with success. These values influence psychological processes and thinking. Cultural normalization, which emphasizes academic performance, affects teachers' beliefs and IBL practices (Lau et al., 2015). When teachers feel overwhelmed by classroom uncertainties, they resort to traditional teaching methods to cope. Asian cultural values, including teacher authority, influence IBL practices and prior experiences as learners affect teachers' IBL practices and questioning (Calderhead, 1996). This current study examined how sociocultural contexts shape teachers' IBL practices in Asian science education, aligning with social constructivist views on teachers' roles in learning (Kapelari, 2015).

East Asian countries favor traditional learning over science lifelong learning. Despite IBL being advocated in the national curriculum, parents and schools emphasize academic performance, leading teachers to adopt traditional practices. Social pressure thus impedes teachers' IBL implementation (Majid & Badrasawi, 2024). In East Asian countries, teachers and parents hold authority over their students (Fernandez, 2017), meaning that students hesitate to question teachers, which limits the development of higher-order thinking.

Teachers in turn lack self-efficacy because of their expectations of infallibility and inexperience with IBL as learners. They use a prepared curriculum and find a disconnection between it and daily life. Lau et al. (2015) developed a science model based on the PISA assessment for East Asian Confucian-influenced countries: Hong Kong, Taipei, Japan, Korea, and Macau. The study revealed that these countries have fewer interactive classrooms compared to Western countries, negatively impacting students' skills and concept understanding. Based on suggestions made by prior research, this study examined the sociocultural factors influencing teachers' IBL practices in Asia.

3. Methodology

This section explains the methods and steps used to conduct a systematic review of previous studies related to IBL. The framework used for this SLR was the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. This is a standard framework for conducting an SLR (Page et al., 2021). The three main processes of developing an organized research framework are (i) identification, (ii) screening, and (iii) eligibility assessment.

3.1 Identification

First, the articles were identified using different keywords. Five keyword combinations were used to complete the search. The Boolean operators OR and AND were used to ensure systematic search. Table 1 lists the search strings used in this study. The search yielded 300 documents. The online databases used for the search were based on the following keywords:

- Emerald
- Web of Science
- ScienceDirect
- Scopus
- Springer
- Wiley
- Taylor and Francis
- IEEE Xplore
- Google Scholar

Table 1: The search strings

Keywords for titles
(access OR action OR adapt OR build OR collaborate OR design OR develop OR enhance OR examine OR experiment OR guide OR impact OR implement OR improve OR influence OR interactive OR intergrade OR measuring OR online OR practice OR promote OR relate OR socio OR track OR uncover OR use OR visualize) AND (Inquiry-Based Learning OR Inquiry-Based Teaching OR Inquiry-Based Science Learning OR Inquiry-Based Practice) AND (sociocultural factors OR sociocultural challenges OR sociocultural influence OR sociocultural context) AND (biology OR chemistry OR literacy OR mathematics OR physics OR reasoning skills OR science OR soft-skills OR technology OR thinking OR STEM) AND (activity OR class OR classroom OR college OR education OR high school OR higher-education OR lab OR polytechnic OR secondary school OR student OR teacher) AND (activity OR analysis OR argument OR attitude OR awareness OR case study OR challenges OR critical thinking OR diffusion OR exploration OR instruction OR problem-based OR review OR scientific issues OR skills OR taxonomy OR teaching OR teaching-material OR technologies OR understanding)
Source(s): Authors

3.2 Screening

In this process, the documents were included or excluded based on particular criteria. The first criterion was that the publications must be published in English and contain empirical data only. Next, the publication timeframes were limited to 11 years only (2016-2026). Studies published before 2016 were excluded. The papers were limited to Science subjects, (including chemistry, biology, and physics courses). This is due to the nature of science that requires students as explorers to investigate a phenomenon. Other subjects were excluded from this list. This ensures the recent trend, highlights the gap between research, and contributes to the credibility of the literature review. Figure 1 shows the tabulation of the publications included in this review. Most references used were from 2023, 2024, and 2025.

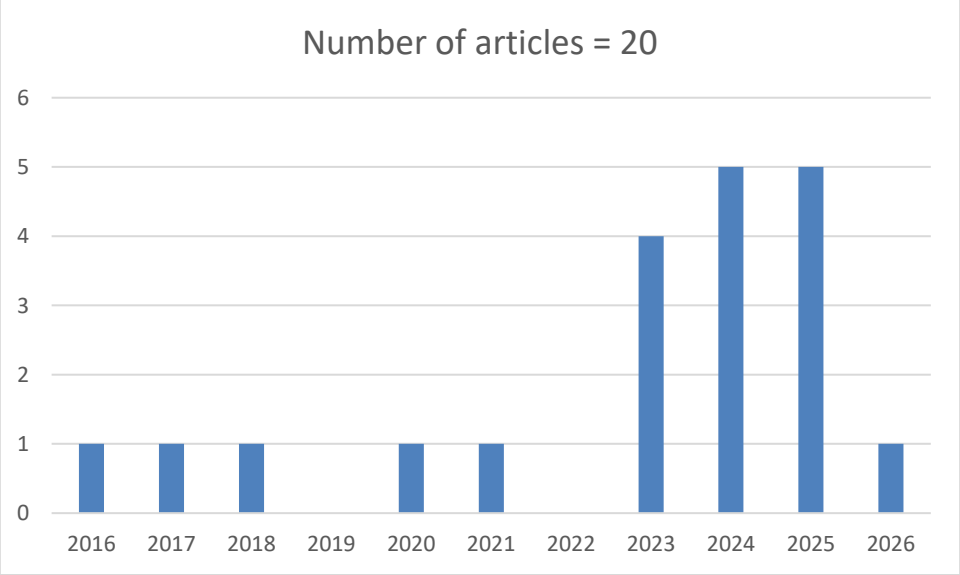

Figure 1: Number of reviewed articles

3.3 Eligibility

In this process, the authors manually reviewed each article's title, abstract, and methodology to ensure the relevance of the articles gathered for this study and the research question. This ensured that the selected articles were eligible as references to answer the research question. Articles that were restricted and full-text documents that could not be downloaded were also excluded. The final number of articles was 20 (Figure 1) meanwhile the process of the systematic search strategy is explained in the PRISMA flowchart (Figure 2).

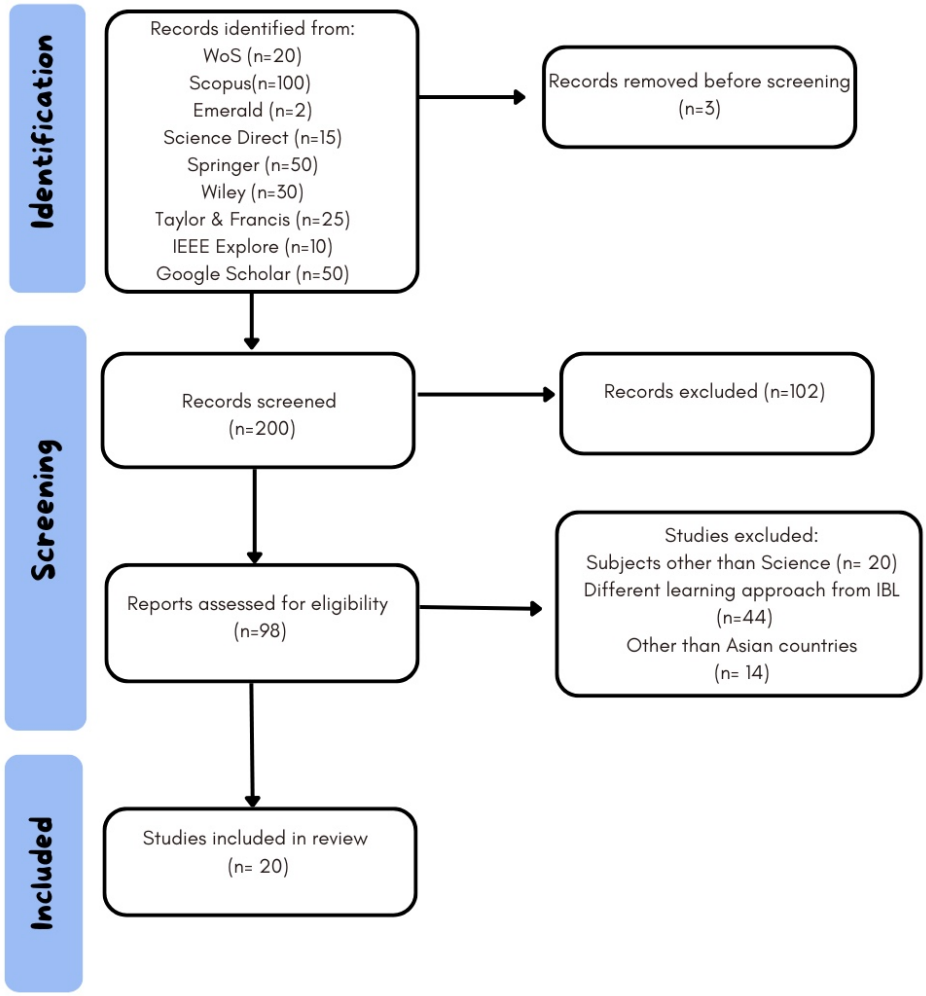

Figure 2: The PRISMA Flowchart

4. Findings

Table 2 presents the reviewed studies on the sociocultural factors influencing science teachers' questioning in using IBL, while Table 3 presents a summary of the findings for selected SLR studies. These studies are discussed in the following sections.

Table 2: Reviewed studies on the sociocultural factors influencing Asian science teachers' use of IBL

No	Author(s) and year	Country	Study design	Sample size
1	Selpianti et al. (2025)	Indonesia	Quantitative	28 students
2	Nugroho & Masykuri (2025)	Indonesia	Quantitative	119 students
3	Chen et al. (2025)	China	Quantitative	290 students
4	Nahar & Machado (2025)	Bangladesh	Mixed method	109 students & 20 teachers
5	Long et al. (2024)	China	Qualitative	19 teachers
6	Huang & Pei (2024)	China	Quantitative	106 students
7	Nurhairani et al. (2026)	Indonesia	Mixed methods	74 teachers
8	Saman et al. (2018)	Indonesia	Mixed methods	64 students
9	Majid & Badrasawi (2024)	Malaysia	Quantitative	50 teachers
10	Bogador et al. (2024)	Philippines	Qualitative	12 students
11	Guerrero & Bautista (2023)	Philippines	Quantitative	79 teachers
12	Alqawasmi et al. (2024)	UAE	Quantitative	71 students
13	Qamariyah et al. (2021)	Indonesia	Quantitative	96 students
14	Roslan et al. (2023)	Malaysia	Qualitative	3 teachers
15	Halim et al. (2023)	Malaysia	Qualitative	223 teachers
16	Premthaisong & Chaipidech (2023)	Thailand	Quantitative	25 students
17	Areepattamannil et al. (2020)	UAE	Qualitative	Data: surveys from PISA 2015
18	Baroudi & Rodjan Helder (2021)	UAE	Qualitative	50 teachers
19	Fernandez (2017)	Singapore	Quantitative	3 intact classes
20	Chen & Tytler (2016)	Taiwan	Qualitative	3 teachers

Table 3: Summary of findings for selected SLR studies

No	Summary/Aim of the Study	Sociocultural Factors
1	Students' learning outcome in science using IBL	Social norms
2	Effect of Socioscientific Real World Inquiry (SSRI) to improve the students' problem-solving skills	Social norms
3	Explored on the predict-observe-explain diagnose approach on students	Social norms
4	Effects of inquiry-based professional development (PD) on educators' classroom practice	Teachers' experience, teachers' cultural belief and social norms
5	Impact of integrating KI in IBL among pre-service teachers	Teachers' experiences
6	Effects of web-based inquiry on improving the elementary school students' science identity	Social norms
7	Address the teachers' knowledge and implementation of IBL in Indonesia	Teachers' experiences & cultural belief
8	Explore the students' scientific reasoning in a course after given e- scaffolding	Teachers' experiences & social norms
9	Science teachers' beliefs and practices in using IBL	Teachers' experiences & social norms
10	Grade 12 STEM students' challenges and benefits in using IBL	Teachers' experiences
11	Implementation of IBL secondary teachers	Teachers' experiences & cultural beliefs
12	Effects of using IBL toward the students' achievements	Social norms
13	Effects of IBL embedded with socioscientific issues on students	Teachers' experiences & cultural beliefs
14	Challenges faced by the Physics teachers in implementing IBL in Physics classroom	Teachers' experiences, cultural beliefs & social norm
15	Cultural values that guide the IBL practice among Malaysian Science teachers	Cultural beliefs & social norms
16	Use of IBL in STEM education which integrated ICT among the fourth-grade students	Social norms
17	Explored on the relationship between traditional and IBL to students' science inclination	Social norms
18	Teachers' perspectives on factors influencing IBL	Social norms
19	Effectiveness of IBL on students' critical thinking, interest and self-efficacy	Social norms
20	Multi-case studies from teachers (three countries) using IBL	Cultural belief, social norms & teachers' experiences

5. Discussions

5.1 Social Norm of Authority and Fast-Paced Style of Learning

Chen & Tytler (2016) explored IBL practices in Taiwan, Germany, and Australia. They found that the Taiwanese teacher used an authoritative style, the German

teacher emphasized student reasoning, and the Australian teacher focused on student engagement. Similar claims found in Baroudi & Rodjan Helder (2021) and Selpianti et al. (2025) mentioned that Indonesian, Lebanese and science teachers in the UAE struggle to adapt in IBL due to previous practices of traditional learning. This finding is supported by Fernandez (2017) who found that East Asian teachers' authoritative approach is due to achievement-focused curricula, which affects teachers' questioning methods.

These findings in Asian countries are in contrast to the findings by Amos & Levinson (2019) who found that the pre-service teachers trained in the IBL (embedded with sociocultural) project in London had a positive influence on teachers and student's practices. IBL practice must align with each country's sociocultural context (Heinz et al., 2017), as no single framework suits all countries. Some countries apply Western IBL frameworks, but differences in beliefs and norms affect its effectiveness (Wilson et al., 2025). Understanding how sociocultural contexts shape teachers IBL practices is crucial (Edwards, 2017).

5.2 The Teachers' Experiences (Prior Learning, Environment Pressure and Professional Development)

Science teachers reported to have low self-efficacy when using IBL in science. This finding is similar to those of Baroudi & Rodjan Helder (2021) who claimed that the lack of professional development and financial and moral support influences their IBL practices. Due to this, teachers prefer using familiar approaches they believe are most effective.

Other than that, Woo et al. (2018) found that STEM teachers' learning instructions correlate with their self-efficacy. A Malaysian study showed a low but significant correlation between teachers' self-efficacy and learning approach selection. Yesilyurt et al. (2021) confirmed that a lack of self-efficacy influences teachers' approach choices while Mohammed & Amponsah (2021) attributed low IBL practice to teachers' lack of experience as learners. Berg & Smith (2014) highlighted the cultural differences affecting pre-service teacher's self-efficacy in Malaysia, England, and New Zealand, considering sociocultural factors such as prior learning and experiences.

Chen & Tytler (2016) noted variations in IBL practice across countries, emphasizing the need to incorporate sociocultural context into Malaysian physics teachers' IBL framework (Halim et al., 2023). Nurhairani et al. (2026) also found that Indonesian teachers have misconceptions in IBL knowledge, which leads to confusion due to the lack of guidance to the science teachers. This is supported by DiBiase & McDonald (2015) who claimed that teachers' IBL implementation varies according to their understanding. Some teachers believe that they practice IBL when they do not.

The findings based on the Asian countries contradicts with findings in a study by Wilson et al. (2025) who explored professional development (PD) for STEM teachers through interviews with six K-12 teachers. The program addressed challenges such as time constraints and IBL implementation. The results showed that PD improved teachers' confidence and students' engagement. They found

that IBL effectiveness depends on addressing these challenges in PD programs; the problem-focused PD improved IBL practice (van Aalderen-Smeets et al., 2017). Amos & Levinson (2019) also added that a survey to explore and address the challenges faced by the teachers is needed before designing a good model in IBL. Jha et al. (2024) emphasized the need to improve both PD and curricular development for better education in Asian countries.

5.3 Cultural Belief; East Asian Culture

In Asia, there is a culture of conforming to traditions, ethnicity, and religious norms. Parents and teachers prioritize on standardized examination excellence with students prioritizing good scores over exploration, reflecting the emphasis on achievement in East Asian culture. This approach of "education for earning, not learning" hinders lifelong learning (Halim et al., 2023). Regular practice to produce good results contradicts with the use of IBL, culture shapes beliefs through environment.

Teachers' formal and informal learning and at-home experiences influence their teaching perceptions and practices. Their prior experiences shape their views on the importance of learning, educational goals, and IBL teaching styles and teachers in performance-focused environments tend to engage in traditional teaching: culture shapes cognitive and affective development (Lau et al., 2015). According to Vygotsky (1978), mind development occurs through mediation, which refers to using questioning to develop students' physics problem-solving skills (Edwards, 2017).

While IBL research is extensive, Mansour (2013) emphasized the importance of including the sociocultural context to understand teachers' classroom practice. Wei et al. (2024) supported this through their findings that an environment which is open to any innovative teaching method tends to produce a good practice in IBL. This is due to the practice of good questions developing students' thinking and reasoning. Teachers often use closed-ended questions to save time in IBL settings and studies have shown that teachers expect predetermined answers, leading to low thinking skills (Gillies, 2023).

5.4 Social Norms of Education System and National Curriculum

Most Asian countries such as Malaysia, China and Singapore follow a top-down educational system with a national curriculum. This causes teacher's difficulty in connecting science with daily life. Science teachers, trained in rote learning, feel disconnected from real-life applications (Akuma & Callaghan, 2019). Corbett (2016) discussed science as culture, noting that it stems from knowledge, thinking, and attitudes while Gurgel et al. (2016) emphasized the sociocultural aspects of science learning, including religious views, ethnic backgrounds, and student values. Teachers must incorporate these aspects (Hairon, 2017), including students, schools, and national values, into the curriculum.

The statement "this student cannot understand this topic" should be reframed as "why can this student not understand this topic?" leading to the question, "how can this student understand this topic?". This affects students' perceptions of physics. Omitting sociocultural aspects causes cultural incompatibility, Halim et al. (2023) and Gurgel et al. (2016) found that students are disconnected from

science learning, leading to reduced interest in science and low program enrolment (Akuma & Callaghan, 2019). Lee et al. (2020) found a similar result. They compared IBL beliefs between Hong Kong and US pre-service teachers in a study that involved 54 US and 75 Hong Kong third-year pre-service teachers.

Hong Kong PSETS practiced traditional IBL, viewing it as time-consuming and focusing on conceptual learning. This contrasts with the constructivist approach of US PSETS, which emphasizes reasoning and student experience. These differences reflect cultural values, with Hong Kong students performing poorly in scientific IBL compared to US students due to the emphasis on rote learning. Exam-based pressure exists in these Asian countries (Fernandez, 2017). Long et al. (2024) supported integrating sociocultural context in IBL training for improved teacher engagement.

6. Conclusion

Sociocultural context influences IBL use significantly. Teachers' guidance is essential in scaffolding students' learning. In social constructivism theory, teachers play a crucial role in restructuring and building students' knowledge. Teachers must help students explore beyond their capabilities in the zone of proximal development. The first sociocultural context is the social norm of authoritative and fast-paced learning. Teachers are used to control learning and prefer closed-ended questions with "yes or no" responses. Teachers' experiences, including prior learning, environmental pressure, and professional development, also affect IBL.

While science is known to be difficult to understand, teachers' self-efficacy differs across countries due to different challenges. Malaysian teachers face challenges such as parents' expectations, policy, and lack of support. In East Asian culture, there is emphasis on students' achievement and teachers need time to promote students' exploration. However, parents' and organizational pressure make teachers use close-ended questions or practice traditional learning. The majority of the Asian education system follows a top-down approach, and the general curriculum makes teachers accustomed to traditional learning feel disconnected from the curriculum and daily life, in turn making students feel disconnected from learning science using IBL.

7. Limitations and Recommendations

This review has limitations, as it only includes articles from the past 11 years (2016–2026). Second, only articles published in English were included, hence some relevant studies that were not published in English might have been excluded. Previous research has shown limited studies on the use of IBL, specifically focusing on questioning and sociocultural factors. It would be interesting to explore this study, focusing on each country's sociocultural factors which influence science teachers' IBL, since each country has own unique sociocultural values. Future studies should also explore this, focusing on specific science subjects such as physics, chemistry, and biology. This study will serve as a reference for future studies. First, this review promotes awareness of the cultural influence on the use of IBL, especially questioning strategies. This also serves as

proof that there is a need to embed sociocultural sensitivity in IBL professional development (PD). This is supported by Twahirwa et al. (2022) and Wilson et al. (2025) who mentioned that targeted problem PD will have a good impact on IBL. Third, this study will serve as a reference for policymakers. They should address the exam-oriented culture barrier before making any curriculum or PD, and they should also encourage discourse-rich classrooms.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The research is funded by Universiti Teknologi Malaysia under the grant no. R.J130000.7334.1R113.

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