



PSYCHOLOGICAL SAFETY AND CHILD PROTECTION IN PRIMARY SCIENCE LEARNING ENVIRONMENTS: IMPLICATIONS FOR STUDENT PARTICIPATION AND INQUIRY

Bramianto Setiawan^{1,*}, Eko Handoyo², Edi Waluyo³

¹ Department of Elementary Teacher Education, Universitas Pelita Bangsa, Indonesia

² Department of Pancasila and civic education, Universitas Negeri Semarang, Indonesia

³ Department of Early childhood education, Universitas Negeri Semarang, Indonesia

*Corresponding author E-mail: sbramianto@pelitabangsa.ac.id

Abstrak

Kata Kunci:

Psychological Safety, Perlindungan Anak, Pembelajaran Berbasis Inkuiri, Pembelajaran IPA SD, Partisipasi Siswa

Penelitian ini bertujuan menganalisis peran psychological safety dan interaksi kelas ramah anak terhadap partisipasi siswa dalam pembelajaran IPA berbasis inkuiri di sekolah dasar. Penelitian menggunakan pendekatan mixed methods dengan desain convergent parallel yang melibatkan 60 siswa kelas V, lima siswa wawancara, dan satu guru IPA di sekolah dasar negeri. Data kuantitatif dikumpulkan melalui Psychological Safety Scale dan Student Participation Scale, sedangkan data kualitatif diperoleh melalui observasi kelas dan wawancara semi-terstruktur. Hasil penelitian menunjukkan adanya hubungan positif yang signifikan antara psychological safety dan partisipasi siswa dalam pembelajaran IPA berbasis inkuiri ($r = 0,68$, $p < 0,001$). Siswa yang merasakan lingkungan belajar yang aman secara emosional dan suportif menunjukkan partisipasi yang lebih aktif dalam bertanya, menyampaikan ide, serta terlibat dalam diskusi dan eksperimen ilmiah. Temuan kualitatif juga menunjukkan bahwa interaksi guru yang suportif dan pedagogi ramah anak memperkuat kepercayaan diri serta keterlibatan siswa dalam proses inkuiri sains. Penelitian ini menegaskan bahwa psychological safety merupakan fondasi pedagogis penting dalam menciptakan pembelajaran IPA SD yang partisipatif dan bermakna.

Abstract:

Keyword:

Psychological Safety, Child Protection, Inquiry-Based Learning, Primary Science Education, Student Participation

This study investigates the role of psychological safety and child-friendly classroom interaction in shaping student participation within inquiry-based primary science learning. Using a mixed methods approach with a convergent parallel design, the study involved 60 fifth-grade students, five interviewed students, and one science teacher from a public primary school. Quantitative data were collected through the Psychological Safety Scale and Student Participation Scale, while qualitative data were obtained through classroom observations and semi-structured interviews. The findings revealed a significant positive relationship between psychological safety and student participation in inquiry-based science learning ($r = 0.68$, $p < .001$). Students who perceived emotionally supportive and non-threatening classroom environments demonstrated greater willingness to ask questions, communicate ideas, and participate collaboratively during scientific inquiry activities. Qualitative findings additionally showed that supportive teacher interaction and child-friendly pedagogy strengthened students' emotional confidence and inquiry engagement. The study highlights psychological safety as an important pedagogical foundation for meaningful participation in primary science education.



INTRODUCTION

Science learning in primary education is increasingly expected to move beyond content transmission toward inquiry-oriented learning environments that encourage questioning, experimentation, reasoning, and collaborative knowledge construction. Contemporary science pedagogy emphasizes active student engagement through inquiry-based practices in which learners investigate scientific phenomena, formulate explanations, communicate ideas, and participate in evidence-based discussion (Abd-El-Khalick et al., 2021; Cairns & Areepattamannil, 2019). Within this perspective, meaningful participation becomes a central component of scientific learning because students are positioned not merely as recipients of information, but as active constructors of scientific understanding.

Despite the growing emphasis on inquiry-based science learning, many primary classrooms continue to demonstrate limited student participation during scientific discussion and experimentation. Students frequently hesitate to ask questions, communicate uncertainty, challenge ideas, or express alternative explanations due to fear of making mistakes, receiving criticism, or being negatively evaluated by teachers and peers (Zhou & Li, 2022). Such emotionally restrictive classroom climates may weaken inquiry engagement and reduce opportunities for authentic scientific exploration. In many cases, inquiry activities become procedural routines focused on obtaining correct answers rather than exploratory processes that support curiosity and reflective reasoning.

Existing studies in primary science education predominantly focus on cognitive achievement, conceptual understanding, scientific literacy, and instructional effectiveness (Hwang et al., 2022; Oliveira et al., 2021). Research concerning inquiry learning has also extensively examined the influence of learning models, technology integration, STEM approaches, and collaborative learning environments on student outcomes. However, substantially less attention has been directed toward the socio-emotional dimensions of science learning, particularly psychological safety and child protection as foundational conditions for meaningful scientific participation.

Psychological safety refers to an individual's perception that they can express ideas, ask questions, make mistakes, and participate without fear of embarrassment, humiliation, rejection, or punishment (Edmondson & Lei, 2014). Although originally developed within organizational research, psychological safety has increasingly gained relevance in educational settings because emotionally secure classrooms are closely associated with participation, engagement, collaboration, and student agency (Carmeli et al., 2021). In primary education, psychologically safe learning environments allow children to communicate openly, explore uncertainty, and engage confidently in learning processes without experiencing intimidation or emotional threat.

The importance of psychological safety becomes particularly significant in science learning because inquiry-based activities inherently involve uncertainty, trial-and-error processes, experimentation, and intellectual risk-taking. Scientific inquiry requires students to test assumptions, communicate incomplete understanding, negotiate meaning collaboratively, and respond constructively to failure. Consequently, emotionally unsafe learning environments may discourage participation and reduce students' willingness to engage in inquiry practices (Furtak et al., 2021). Students who fear making mistakes are more likely to remain passive observers rather than active participants in scientific investigation.

From a child protection perspective, emotionally safe learning environments are closely connected to child-friendly pedagogy and students' rights within educational settings. Child-friendly education emphasizes emotional well-being, participation rights, inclusive interaction, and respectful teacher-student relationships that protect children from psychologically harmful experiences (UNICEF, 2021). In classroom contexts, child protection extends beyond physical safety toward ensuring that children feel respected, heard, emotionally supported, and free from verbal intimidation or humiliating interaction. Previous studies have shown that supportive classroom climates positively influence children's academic engagement, emotional development, and participation confidence (Aldridge et al., 2018).

Within primary science education, the intersection between child protection, psychological safety, and inquiry participation remains underexplored. Although research has acknowledged the importance of supportive classroom environments, few studies have specifically investigated how emotional safety and child-friendly interaction shape students' willingness to participate in scientific inquiry activities. This limitation is important because inquiry-based science learning cannot function optimally when students experience fear, emotional insecurity, or participation anxiety. Understanding the relationship between psychological safety and scientific participation therefore becomes essential for developing more inclusive and child-friendly science learning environments.

Accordingly, this study investigates the role of psychological safety and child protection in shaping student participation and inquiry engagement within primary science classrooms. Using a mixed methods approach, the study examines students' perceptions of psychological safety, the relationship between emotional safety and inquiry participation, and the influence of child-friendly classroom interaction on students' willingness to engage in scientific exploration and discussion. The study addresses the following research questions:

RQ1: How do students perceive psychological safety in primary science classrooms?

RQ2: What is the relationship between psychological safety and student participation in inquiry-based science learning?

RQ3: How do child-friendly classroom interactions influence students' inquiry engagement and willingness to participate?

LITERATURE REVIEW

1. Psychological Safety in Learning Environments

Psychological safety refers to individuals' perceptions that they can express ideas, ask questions, and make mistakes without fear of humiliation or negative consequences (Edmondson, 1999). In educational settings, psychological safety is increasingly recognized as a crucial factor influencing student engagement, participation, collaborative interaction, and learning confidence (Frazier et al., 2017; Zinsser et al., 2022). Recent studies indicate that emotionally supportive classrooms encourage students to communicate more openly, participate actively in discussions, and engage more confidently in exploratory learning processes (Carmeli & Gittell, 2009; Osher et al., 2020).

Within primary education, psychological safety becomes particularly important because children are highly sensitive to teacher responses, peer judgment, and classroom emotional climate. Emotionally unsafe learning environments may reduce students' willingness to ask questions, communicate uncertainty, or participate during classroom interaction (Aldridge et al., 2018). In science education contexts, this issue becomes more critical because inquiry-oriented learning inherently involves experimentation, conceptual risk-taking, and trial-and-error processes (Jaber et al., 2021; Kang & Keinonen, 2018). Consequently, psychologically safe classrooms may function as foundational conditions for meaningful scientific participation and inquiry engagement.

Child Protection and Child-Friendly Education

Contemporary perspectives on child protection emphasize that educational environments should support not only physical safety but also emotional well-being, participation rights, dignity, and inclusive interaction (UNICEF, 2019). Child-friendly education promotes respectful communication, emotional support, non-threatening pedagogy, and recognition of children as active participants in learning processes (Osher et al., 2020).

Recent educational research demonstrates that fear-based instruction, verbal intimidation, and emotionally harmful interaction negatively affect students' confidence, participation, and classroom engagement (Aldridge et al., 2018; Zinsser et al., 2022). In contrast, child-friendly classrooms characterized by supportive teacher interaction and emotional responsiveness contribute positively to students' agency, collaborative learning, and emotional security (UNESCO, 2021).

In science learning environments, child-friendly pedagogy becomes increasingly relevant because scientific inquiry requires students to express ideas, test explanations, and communicate uncertainty openly. Therefore, emotionally supportive classroom climates may strengthen students' willingness to engage in experimentation and inquiry-based participation.

2. Inquiry-Based Science Learning

Inquiry-based science learning positions students as active investigators who construct scientific understanding through questioning, experimentation, evidence interpretation, and collaborative reasoning (National Research Council, 2000). Contemporary science education frameworks consistently identify inquiry as an essential component of scientific literacy, critical thinking, and conceptual understanding (OECD, 2019; Chen & Yang, 2019).

However, recent studies suggest that effective inquiry participation depends not only on instructional design but also on classroom emotional climate and interactional quality (Jaber et al., 2021). Students may become passive during inquiry activities when they experience fear of mistakes, excessive correction, or authoritarian teacher interaction (Kang & Keinonen, 2018). Conversely, psychologically supportive science classrooms encourage exploratory dialogue, collaborative experimentation, and student agency during scientific investigation (Osborne, 2014).

Despite increasing discussions regarding inquiry learning and student well-being, limited studies have specifically examined the intersection between psychological safety, child protection, and inquiry participation in primary science education. Therefore, this study seeks to address this gap by exploring how psychologically safe and child-friendly learning environments influence students' participation and inquiry engagement in elementary science classrooms.

METHOD

1. Research Design

This study employed a mixed methods approach using a convergent parallel design to examine how psychological safety and child protection shape student participation within primary science learning environments. The convergent design enabled quantitative and qualitative data to be collected concurrently, analyzed independently, and integrated during interpretation to obtain a comprehensive understanding of students' inquiry experiences and emotional engagement during science learning (Creswell & Plano Clark, 2018). The quantitative component focused on identifying the relationship between psychological safety and student participation, while the qualitative component explored students' lived experiences regarding emotional safety, classroom interaction, and inquiry

engagement. The integration of both datasets was intended to strengthen interpretive depth and contextual understanding of child-friendly science learning practices.

2. Participants and Context

The study involved 60 fifth-grade students from a public primary school implementing inquiry-oriented science learning activities. Participants were selected purposively because the classroom regularly incorporated experimentation, collaborative discussion, and scientific inquiry tasks. The students ranged between 10 and 11 years old and had prior experience participating in group-based science investigations. For the qualitative phase, five students were selected based on variation in classroom participation levels, including highly active, moderately active, and less active participants. This variation was intended to capture diverse perceptions regarding emotional safety and participation during science learning. In addition, one science teacher participated in a semi-structured interview to provide contextual insights into classroom interaction and child-friendly pedagogical practices. Ethical approval was obtained from the school prior to data collection. Parental consent and student assent were additionally secured to ensure compliance with ethical standards involving child participants. Participant anonymity and confidentiality were maintained throughout the research process.

3. Research Instruments

3.1. Psychological Safety Scale

The Psychological Safety Scale was adapted from Edmondson's (1999) psychological safety framework and contextualized for primary science learning environments. The instrument measured students' perceptions of emotional security and interpersonal safety during science activities. The indicators included: (1) freedom to ask questions, (2) comfort expressing opinions, (3) fear of making mistakes, (4) teacher emotional support, and (5) peer acceptance. Responses were measured using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5).

3.2. Student Participation Scale

Student participation was measured using a participation scale adapted from student engagement frameworks emphasizing behavioral and collaborative participation in classroom learning (Fredricks et al., 2004). The instrument focused on students' active involvement during inquiry-based science activities. The indicators included: (1) asking scientific questions, (2) contributing to classroom discussion, (3) participating in experiments, (4) communicating scientific ideas, and (5) collaborative engagement. Prior to implementation, both instruments underwent expert review to ensure content validity and contextual appropriateness for elementary-level participants.

3.3. Qualitative Data Collection

Qualitative data were collected through classroom observations and semi-structured interviews to explore the emotional dimensions of participation within inquiry-based science learning. Classroom observations were conducted during science lessons involving experimentation, collaborative discussion, and inquiry activities. Observation focused on: (1) teacher-student interaction, (2) emotional classroom climate, (3) student participation behavior, (4) responses toward mistakes and questioning, and (5) collaborative inquiry processes.

To deepen interpretive understanding, semi-structured interviews were conducted with five students and one science teacher. Student interviews explored emotional comfort, fear of making mistakes, confidence in asking questions, and perceptions of classroom interaction during science learning. The teacher interview focused on instructional strategies, emotional support practices, and efforts to establish a child-friendly inquiry environment. All interviews were audio-recorded and transcribed verbatim prior to analysis.

4. Data Analysis

Quantitative data were analyzed using IBM SPSS version 26. Descriptive statistics were used to identify students' levels of psychological safety and participation. Pearson correlation analysis was conducted to examine the relationship between psychological safety and student participation, while simple regression analysis was employed to determine the predictive contribution of psychological safety toward inquiry participation in science learning. Qualitative data were analyzed using thematic analysis following Braun and Clarke's (2006) framework, involving data familiarization, coding, theme generation, and interpretive analysis. Thematic analysis enabled the identification of recurring patterns related to emotional safety, participation confidence, and child-friendly classroom interaction. Finally, quantitative and qualitative findings were integrated during interpretation to examine convergence across datasets and provide a richer explanation regarding the role of psychological safety and child protection in supporting participation within primary science inquiry environments.

5. Data Collection Procedure

Data collection was conducted in four stages over a four-week period. First, permission and parental consent were obtained to ensure ethical compliance and child protection during the study. Second, the Psychological Safety Scale and Student Participation Scale were administered to 60 fifth-grade students after science learning activities. Third, classroom observations were conducted during inquiry-based science lessons to examine classroom interaction, emotional climate, and student participation. Finally, semi-structured interviews were conducted with five selected students (S) and one science teacher (T) to explore students' emotional experiences and inquiry engagement in greater depth.

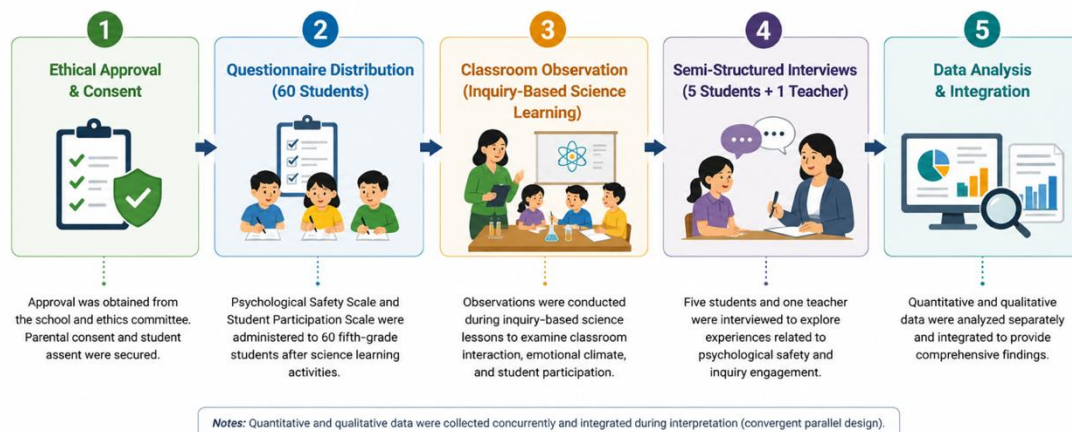


Figure 1. Overview of data collection procedure

To strengthen data credibility, triangulation was conducted across questionnaire results, classroom observations, and interview findings.

RESULT AND DISCUSSION

1. Students' Perceptions of Psychological Safety in Primary Science Classrooms (RQ1)

Descriptive statistical analysis revealed that students generally perceived the primary science classroom as moderately to highly psychologically safe. Most students reported feeling comfortable participating in science discussions and asking questions during inquiry activities. Positive perceptions were particularly visible in indicators related to teacher emotional support and peer acceptance. However, several students still expressed hesitation in communicating ideas publicly, particularly when they were uncertain about the correctness of their answers. Fear of making mistakes remained evident among some participants, especially during classroom discussion and experimental reporting activities. The descriptive findings are presented in Table 1.

Table 1. Students' Perceptions of Psychological Safety

Indicator	Mean	Category
Freedom to ask questions	4.12	High
Comfort expressing opinions	3.98	Moderate-High
Fear of making mistakes	3.21	Moderate
Teacher emotional support	4.34	High
Peer acceptance	4.08	High

The findings indicate that emotionally supportive teacher interaction contributed positively to students' sense of safety during science learning. Nevertheless, the persistence of fear-related

responses suggests that some students still experienced uncertainty when engaging in inquiry-oriented participation. Qualitative findings further strengthened the quantitative results. Several students reported that they felt more confident participating when teachers responded positively toward incorrect answers and encouraged exploratory discussion.

One student stated:

“I am not afraid to answer when the teacher says that mistakes are part of learning science” (S3).

Another participant explained:

“Students tend to participate more actively when they feel emotionally supported and not judged for incorrect answers” (T1).

These findings suggest that emotional acceptance and supportive interaction played a central role in establishing psychologically safe inquiry environments.

2. Relationship Between Psychological Safety and Student Participation in Inquiry-Based Science Learning (RQ2)

Pearson correlation analysis demonstrated a significant positive relationship between psychological safety and student participation in inquiry-based science learning activities ($r = 0.68$, $p < .001$). The findings indicate that students who perceived higher emotional safety tended to participate more actively during discussion, experimentation, and collaborative inquiry processes. Relationship between psychological safety and inquiry-based participation among primary school students as show in figure 1.

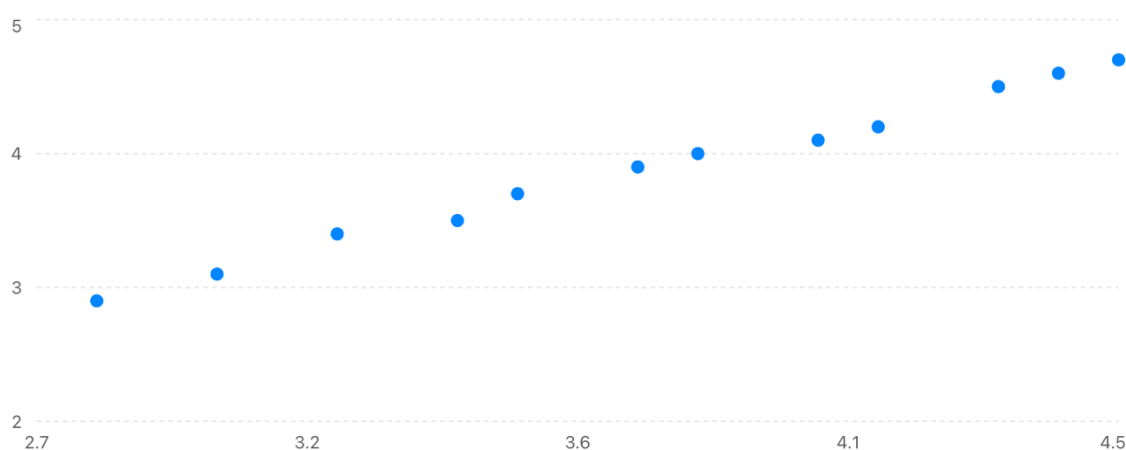


Figure 1. Relationship between psychological safety and inquiry-based participation among primary school students.

Simple regression analysis additionally showed that psychological safety significantly predicted student participation in science inquiry activities ($\beta = .64, p < .001$), explaining approximately 41% of the variance in participation behavior. Students demonstrating higher psychological safety scores were more likely to:

- (1) ask scientific questions,
- (2) contribute during discussions,
- (3) communicate hypotheses,
- (4) engage collaboratively during experiments.

Conversely, students with lower psychological safety tended to remain passive and relied primarily on teacher direction rather than exploratory participation.

3. Influence of Child-Friendly Classroom Interaction on Inquiry Engagement (RQ3)

The qualitative findings revealed that child-friendly classroom interaction substantially shaped students' inquiry engagement and willingness to participate during primary science learning. Thematic analysis identified three interconnected themes associated with emotional safety, participation confidence, and inquiry agency within science classroom interaction.

3.1. Supportive Teacher Interaction as a Catalyst for Inquiry Participation

Students consistently described supportive teacher interaction as a central factor influencing their confidence to participate in inquiry-based science activities. Classrooms characterized by respectful communication, emotional encouragement, and acceptance of mistakes appeared to foster stronger participation during questioning, experimentation, and scientific discussion. Observation findings demonstrated that students became more willing to communicate ideas when teachers responded constructively to incorrect answers and framed mistakes as part of the scientific learning process. Rather than emphasizing correctness, teachers in psychologically supportive classrooms encouraged exploration and collaborative reasoning. One participant explained:

“When the teacher says that wrong answers are normal in science, I feel more confident to speak.” (S3)

Another student stated:

“The teacher listens to our opinions first before correcting them, so we are not afraid to answer.” (S1)

Classroom observations additionally showed that supportive verbal responses such as “interesting idea,” “let’s explore it together,” and “good attempt” reduced students’ hesitation during inquiry discussion. These interaction patterns contributed to emotionally secure participation and encouraged students to engage more openly in scientific exploration.

3.2. Fear of Negative Evaluation Constrains Inquiry Engagement

Despite generally positive classroom conditions, several students reported experiencing anxiety and hesitation when presenting ideas publicly. Fear of negative evaluation emerged as a significant emotional barrier limiting participation during science inquiry activities. Students indicated that concern about giving incorrect answers or being judged by peers reduced their willingness to communicate scientific ideas openly. This tendency was particularly visible during whole-class discussion sessions and experimental reporting activities. One participant noted:

“Sometimes I want to answer, but I worry my answer will be wrong and my friends will laugh.” (S5)

Similarly, another student explained:

“I am more comfortable answering in small groups because I feel nervous speaking in front of the whole class.” (S2)

Observation data further revealed that students demonstrating lower participation levels often avoided eye contact, remained silent during questioning sessions, or relied heavily on peer responses before contributing. These findings suggest that inquiry participation is not solely determined by cognitive understanding, but is also shaped by emotional vulnerability and interpersonal classroom

dynamics.

3.3. Child-Friendly Inquiry Environments Foster Student Agency

The findings additionally demonstrated that child-friendly inquiry environments promoted stronger student agency during science learning. Classrooms characterized by emotional warmth, collaborative interaction, and respectful dialogue enabled students to participate more actively in inquiry processes. Students in supportive learning environments demonstrated greater willingness to:

- (1) ask scientific questions,
- (2) test hypotheses,
- (3) communicate uncertainty,
- (4) negotiate ideas collaboratively,
- (5) engage during experimentation activities.

Observation findings showed that emotionally supportive classrooms generated more interactive scientific dialogue and exploratory discussion compared to teacher-dominated instructional settings. Students appeared more willing to challenge ideas, propose explanations, and communicate curiosity when classroom interaction emphasized respect and emotional safety. One participant explained:

“Science becomes more interesting when we can discuss ideas freely without being afraid.” (S4)

The teacher interview also reinforced these findings:

“Students participate more actively when they feel emotionally comfortable and know that mistakes are accepted during learning.” (T1)

Collectively, these findings indicate that child-friendly classroom interaction functions as an important pedagogical foundation for meaningful inquiry participation in primary science learning environments. Emotional safety not only supports participation frequency, but also strengthens students’ confidence, exploratory behavior, and agency during scientific inquiry processes.

4. Discussion

The findings demonstrate that psychological safety plays a significant role in shaping student participation within inquiry-based primary science learning environments. Students who perceived the classroom as emotionally supportive and non-threatening showed greater willingness to ask questions, communicate ideas, and engage in collaborative scientific investigation. These findings reinforce the argument that inquiry-oriented science learning is not solely dependent on instructional strategy, but also on the emotional and interpersonal conditions that enable students to participate meaningfully.

The positive relationship between psychological safety and inquiry participation aligns with previous research emphasizing that emotionally safe learning environments encourage students to take intellectual risks, express uncertainty, and engage more openly in collaborative learning processes (Edmondson, 1999; Kahn, 1990). In science learning contexts, this becomes particularly important because inquiry activities inherently involve experimentation, hypothesis testing, and the possibility of failure. Students who fear embarrassment or negative evaluation are more likely to avoid participation and rely on passive learning behaviors rather than exploratory engagement.

The qualitative findings further indicate that teacher interaction strongly influenced students' emotional confidence during science learning. Supportive responses toward incorrect answers, respectful communication, and encouragement during discussion contributed to students' willingness to participate in inquiry activities. Conversely, fear of making mistakes remained evident among several students, particularly during whole-class discussion. This finding suggests that inquiry participation is closely associated with emotional vulnerability and classroom relational dynamics.

From a child protection perspective, these findings highlight that emotionally safe classroom interaction should be viewed as an essential component of child-friendly education rather than merely a supplementary pedagogical practice. Child-friendly learning environments are characterized not only by physical safety, but also by emotional acceptance, respect for student voice, and protection from psychologically harmful interaction (UNICEF, 2009). Within science education, emotionally unsafe interaction may suppress curiosity, reduce scientific confidence, and weaken students' willingness to engage in inquiry processes.

The findings additionally support contemporary perspectives in science education emphasizing student agency and participatory learning. Inquiry-based science learning requires students to negotiate ideas, communicate uncertainty, and construct understanding collaboratively (Osborne, 2014). Such processes become difficult to sustain when classroom climates are dominated by fear,

excessive correction, or teacher-centered authority. The present study therefore suggests that psychological safety functions as a pedagogical foundation for meaningful scientific participation in primary classrooms.

Importantly, this study extends existing science education literature by positioning psychological safety and child protection as integral dimensions of inquiry learning rather than peripheral socio-emotional variables. Previous studies in primary science education have frequently prioritized cognitive achievement, conceptual understanding, and instructional effectiveness, while limited attention has been given to how emotional security shapes inquiry participation and classroom engagement. The present findings indicate that emotionally supportive interaction and child-friendly pedagogy may significantly influence the quality of inquiry experiences among elementary students.

The study also carries practical implications for primary science instruction. Teachers should create emotionally supportive inquiry environments by normalizing mistakes as part of scientific exploration, encouraging open discussion, and valuing diverse student responses. Inquiry-based science learning may become less effective when participation occurs under conditions of fear or psychological pressure. Consequently, strengthening child-friendly pedagogical interaction may enhance not only emotional well-being, but also the quality of scientific participation and collaborative inquiry engagement.

CONCLUSION

This study demonstrates that psychological safety and child-friendly classroom interaction significantly influence student participation in inquiry-based primary science learning. Students who perceived the classroom as emotionally supportive and non-threatening were more willing to ask questions, express ideas, participate in experiments, and engage collaboratively during scientific inquiry activities. Conversely, fear of making mistakes and negative evaluation tended to reduce students' confidence and participation during science learning.

The findings indicate that inquiry-based science learning cannot be separated from emotional and interpersonal classroom conditions. Psychological safety functions as an important pedagogical foundation that enables students to participate meaningfully in scientific exploration and collaborative discussion. In this context, child protection should not be understood solely as physical safety, but also as the creation of emotionally secure learning environments that respect student voice, encourage participation, and support inquiry engagement. This study contributes to primary science education literature by positioning psychological safety and child-friendly pedagogy as integral dimensions of inquiry learning. The findings suggest that emotionally supportive teacher interaction and respectful

classroom communication may strengthen both student well-being and scientific participation in elementary classrooms.

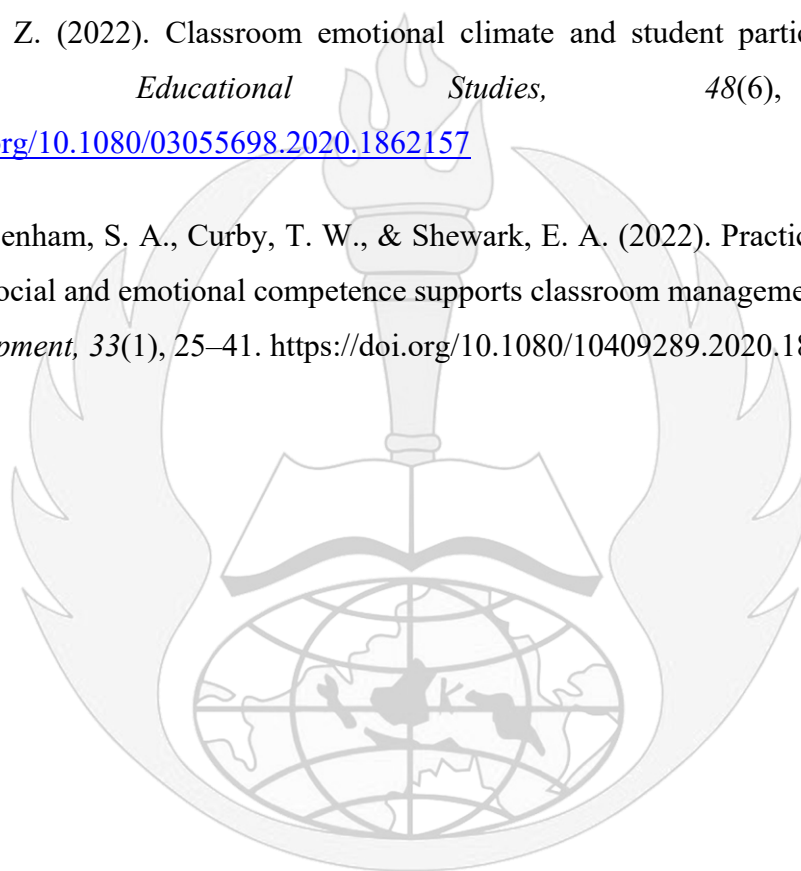
Several limitations should nevertheless be acknowledged. The study involved participants from a single primary school and employed a relatively small qualitative sample, which may limit broader generalization. Future research is therefore recommended to involve larger and more diverse educational contexts, longitudinal investigation, and additional variables such as scientific self-efficacy, classroom belonging, or inquiry confidence.

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Unipa Surabaya