Perceived Teaching Performance and Inquiry-Based Teaching Strategies as Predictors of Science Identity among Senior High School Learners

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ABSTRACT

A weak science learning identity among Grade 12 STEM students remains a challenge in science education. This study utilized a descriptive-diagnostic research design and adapted survey questionnaires to examine how perceived teaching performance and inquiry-based teaching strategies influence the science identity of 230 respondents. Multiple regression analysis revealed that perceived teaching performance significantly predicts science learning identity, highlighting the vital role of effective instruction, teacher support, and positive learning experiences. Conversely, inquiry-based teaching strategies did not yield a statistically significant direct influence. Consequently, the study recommends enhancing pedagogical practices, integrating structured classroom scaffolding, and establishing meaningful recognition for students to effectively strengthen learners' science identities.

Keywords: Perceived teaching performance, inquiry-based teaching strategies, predictors of science learning identity, senior high school

INTRODUCTION

The Problem and Its Setting

A weak science learning identity among secondary students remains a critical barrier to STEM persistence, despite international educational reforms. In countries like the US and the UK, many learners fail to see themselves as recognized members of the scientific community, which can lead to psychological disengagement. This fragile self-perception is driven by rigid instructional environments that neglect student competence and recognition, continuously deterring capable individuals from pursuing advanced scientific fields (Dou & Cian, 2022; Lucas & Spina, 2022; McCartney et al., 2022).

In the Philippines, this national challenge was particularly evident among senior high school learners who struggle to engage with the K–12 science curriculum. Regionally, within the Davao context, this issue manifests acutely as low science self-efficacy, falling academic motivation, and a fragile sense of personal capability due to limited localized instructional support (Bangga, 2021). Consequently, local students cultivate a weak science identity, viewing the subject as a rigid academic hurdle rather than an accessible future pathway.

This persistent deficiency highlighted an urgent academic gap, as existing local literature heavily prioritizes general student engagement and broad academic performance over identity development. There was a critical need to investigate how perceived teaching performance and inquiry-based strategies directly influence a learner's science self-perception. Without identifying the precise classroom mechanisms that rescue students from a weak science identity, national efforts to expand the STEM workforce will remain fundamentally compromised.

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Significance of the Study

This study supported Sustainable Development Goal 4 (SDG 4) by promoting quality, inclusive, and equitable education that fosters strong science identity among learners. As the demand for scientifically literate individuals continues to grow, strengthening students' engagement, confidence, and participation in STEM is essential. In the Philippine context, the study contributes to efforts to improve science education and develop innovative, globally competitive citizens. It also aligns with the vision, mission, and goals of Holy Cross of Davao College by advancing academic excellence, transformative learning, and holistic development. The findings offered valuable insights into how perceived teaching performance and inquiry-based teaching strategies can enhance learners' sense of belonging and identity in science learning, ultimately supporting sustainable development and nation-building.

Statement of the Problem

This study aimed to determine the degree of influence of perceived teaching performance and inquiry-based teaching strategies on science identity among senior high school learners. Specifically, this study aimed to determine:

1. To determine the level of perceived teaching performance in terms of content, knowledge, and pedagogy, learning environment, diversity of learners, curriculum and planning, assessment and reporting, and community linkages, and professional engagement; the level of inquiry-based teaching strategies in terms of inquiry-based instruction, learning obligation, learning effort, and collaboration learning; and the level of science learning identity of senior high school learners in terms of performance, competence, recognition, and interest.

2. The significance of the correlation on the relationship between perceived teaching performance, inquiry-based teaching, and science learning identity of senior high school learners.

3. The individual and combined significant influence of perceived teaching performance and inquiry-based teaching on science learning identity.

Hypotheses

The following hypotheses were tested at 0.05 level of significance:

H_O1.There is no significant relationship between perceived teaching performance, inquiry-based teaching, and science learning identity of senior high school learners.

H_O2. There is no individual and combined significant influence of perceived teaching performance and inquiry-based teaching on science learning identity.

Theoretical Framework

This study was anchored in Vygotsky's (1978) Sociocultural Theory of Cognitive Development, which posits that learning occurs through social interaction and guidance from more knowledgeable others within the Zone of Proximal Development (ZPD). The theory emphasizes that learners develop knowledge, skills, and self-perceptions through collaboration and meaningful learning experiences. In science education, these interactions help shape students' science identity (Dou & Cian, 2022; McCartney et al., 2022).

This study examined two independent variables: Perceived Teaching Performance, which referred to students' evaluations of their teachers' instructional delivery, classroom management, and assessment quality (Stronge, 2018), and Inquiry-Based Teaching Strategies, which encompass student-centered approaches that engage learners through collaborative investigation and critical problem-solving (Gholam, 2019). The dependent variable was Science Identity, operationally defined as students' self-perceptions as competent, recognized, actively learning, and capable participants in science. This definition builds upon Carlone and Johnson's (2007)

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and Hazari et al.'s (2020) frameworks, which conceptualize science learning identity through the interaction of competence, performance, and recognition.

Research suggests that meaningful social interactions, recognition, and successful learning experiences strengthen science learning identity and encourage students' persistence in STEM fields (Hazari et al., 2022; Dou & Cian, 2022; McCartney et al., 2022).

This study was fully comprehensive in its scope, adopting all primary variables derived from the established framework without exclusion. Thus, this study was completely grounded in Vygotsky's Sociocultural Theory.

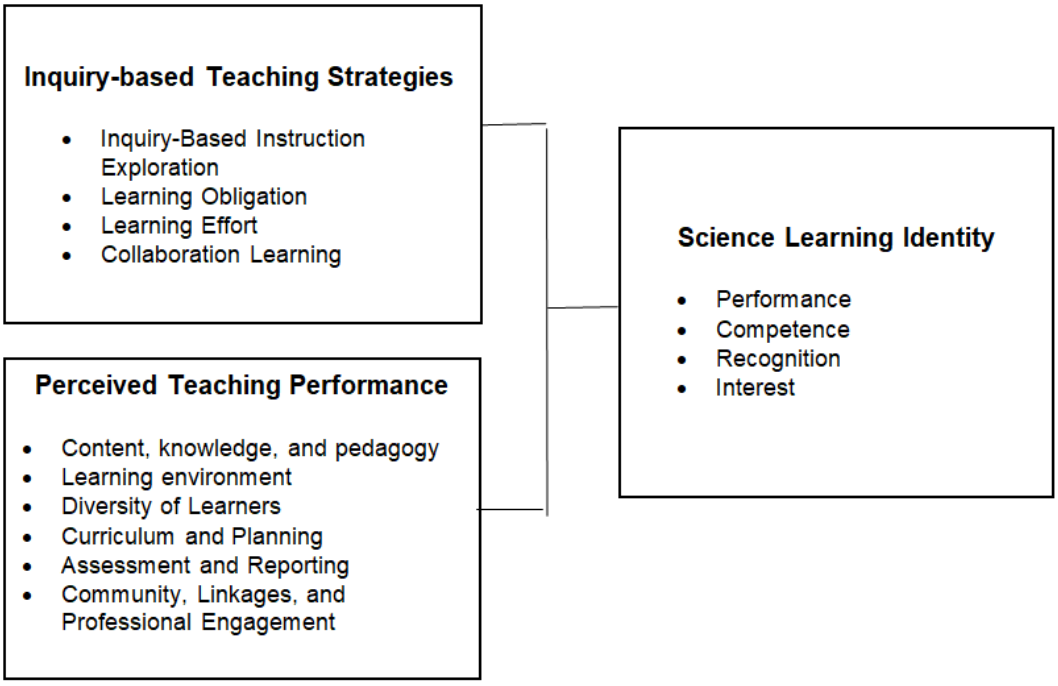

Figure 1. Conceptual Framework

METHOD

This chapter outlined the research design, participants, data collection procedures, and analytical methods used to explore the relationship between perceived teaching performance, inquiry-based teaching strategies, and science identity among senior high school learners.

Research Design

This study employed a quantitative descriptive-predictive research design. The descriptive component was used to determine the levels of perceived teaching performance, inquiry-based teaching strategies, and science identity among senior high school learners. The predictive component examined the extent to which perceived teaching performance and inquiry-based teaching strategies predict students' science identity using regression analysis. This design is appropriate because it describes existing conditions while determining the predictive influence of the independent variables on the dependent variable without manipulating them (Cohen et al., 2018; Creswell & Creswell, 2018).

Locale of the Study

The study was conducted in a private sectarian institution located in Davao City. The school offers a senior high school program that includes the STEM strand, making it an ideal setting for investigating the science identity of Grade 12 learners. The participants in the study were aged 18 and above, ensuring that they had reached a level of cognitive and emotional maturity suitable for reflecting on their science learning experiences. The institution's emphasis on both academic excellence and holistic development provides a rich

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environment for exploring how perceived teaching performance and inquiry-based strategies impact students' engagement with science.

Sample and Sampling Technique

The respondents in this study were all Grade 12 STEM learners aged 18 years and above from a private sectarian institution. Using total enumeration, the study included the entire population of 230 learners to ensure comprehensive and representative data collection. This census-based approach enabled the researcher to gather information from every member of the target population, thereby minimizing sampling bias and providing a complete representation of the respondents' perceptions (Saunders et al., 2019; Creswell & Creswell, 2018).

Research Instruments

The study utilized an adapted, multi-part survey questionnaire evaluated on a 5-point Likert scale. The integrated instrument underwent expert validation and pilot testing, yielding a Cronbach's alpha coefficient of 0.87, confirming high reliability.

The first part was the perceived teaching performance has 33 items adapted from Gepila (2020) and structured from the Philippine Professional Standards for Teachers (DepEd Order No. 42, s. 2017), this section evaluates the following: content knowledge and pedagogy with 8 items, learning environment with 6 items, diversity of learners with 5 items, curriculum and planning with 5 items, assessment and reporting with 5 items, and Community Linkages and Professional Engagement with 4 items.

The second part comprised inquiry-based teaching strategies, with 37 items adapted from Chan et al. (2016). This segment measured students' perceptions of inquiry-oriented practices across four indicators: inquiry-based instruction (12 items), learning obligation (9 items), learning effort (8 items), and collaborative learning (8 items).

The third part, science learning identity, had 23 items, adapted from Chen & Wei (2022). This section assessed learners' self-perception in science across four components: performance (6 declarative statements), competence (5 declarative statements), recognition (4 declarative statements), and interest (8 declarative statements).

Data Gathering Technique

Data collection began with securing permission from the Research and Planning Officer and the Senior High School Principal through a formal request letter outlining the study's objectives and procedures. Upon approval, coordination with the adviser was conducted to schedule the survey administration. An adapted structured questionnaire was distributed to the respondents, who were informed of the study's purpose and that participation was voluntary. To ensure confidentiality and anonymity, students completed the survey individually during a scheduled session. The completed questionnaires were collected immediately after administration to ensure accurate, organized, and timely data gathering with minimal disruption to academic activities.

Data Analysis Technique

The study employed descriptive, correlational, and regression analyses to interpret the data. A summary matrix was prepared to present the statistical technique corresponding to each problem statement and to explain the purpose of each statistical tool used in the study. The collected data were analyzed using three primary statistical tools: Mean and Standard Deviation were computed to determine the average levels and score dispersion of the variables, providing a baseline descriptive profile of the respondents' perceptions. Pearson Product-Moment Correlation Coefficient (r) was then used to assess the strength, direction, and significance of linear relationships among perceived teaching performance, inquiry-based strategies, and science learning identity. Finally, Multiple Linear Regression Analysis was utilized to determine the specific predictive influence of the independent variables on the learners' science identity.

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In addition, a scale matrix was used to present the mean ranges, descriptive levels, and corresponding interpretations for each variable examined in the study.

The following range of means was used to describe the perceived teaching performance of Science teachers.

Range of Means	Description	Interpretation
4.20 – 5.00	Very High	The perceived teaching performance is excellent
3.40 – 4.19	High	The perceived teaching performance is very good
2.60 – 3.39	Moderate	The perceived teaching performance of is good.
1.80 – 2.59	Low	The perceived teaching performance is poor.
1.00 – 1.79	Very Low	The perceived teaching performance is poor.

The following range of means was used to describe the inquiry-based teaching strategies of Science teachers.

Range of Means	Description	Interpretation
4.20 – 5.00	Very High	The inquiry-based teaching strategies are excellent.
3.40 – 4.19	High	The inquiry-based teaching strategies are very good.
2.60 – 3.39	Moderate	The inquiry-based teaching strategies are good.
1.80 – 2.59	Low	The inquiry-based teaching strategies are poor.
1.00 – 1.79	Very Low	The inquiry-based teaching strategies are very poor.

The following range of means was used to describe the science learning identity.

Range of Means	Description	Interpretation
4.20 – 5.00	Very High	The science learning identity is excellent
3.40 – 4.19	High	The science learning identity is very good.
2.60 – 3.39	Moderate	The science learning identity is good
1.80 – 2.59	Low	The science learning identity is poor.
1.00 – 1.79	Very Low	The science learning identity is very poor.

Ethical Considerations

This study strictly adhered to established ethical standards to protect the rights, welfare, and safety of all participants. Formal institutional clearance and ethical approval were secured from the Holy Cross of Davao College Graduate School and its Society of Moral Integrity and Legal Ethics (SMILE) Board. Prior to data collection, administrative permission was obtained from the Research and Planning Officer and the Senior High School Principal. Informed consent was systematically obtained from all respondents, explicitly emphasizing that participation was entirely voluntary and that they had the right to withdraw at any stage without penalty. To ensure absolute privacy, strict protocols for anonymity and confidentiality were maintained throughout the process. All collected data were securely stored, handled exclusively by the

researcher, and utilized solely for academic purposes in full compliance with the Data Privacy Act and ethical research guidelines.

RESULTS

This chapter presents, analyzes, and interprets the gathered data. Results are presented in the following order: level of perceived teaching performance, inquiry-based teaching strategies, and science learning identity; correlation and regression analysis of the variables.

Descriptive Results

Table 1. Descriptive Levels (n=230)

Variables and Indicators	**SD**	**Mean**	**Descriptive Level**
Perceived Teaching Performance	0.48	4.12	**High**
Content, Knowledge, and Pedagogy	0.50	4.16	High
Learning Environment	0.61	4.13	High
Diversity of Learners	0.67	4.18	High
Curriculum and Planning	0.64	4.10	High
Assessment and Reporting	0.67	4.09	High
Community, Linkages, and Professional Engagement	0.75	4.08	High
Inquiry-based Teaching Strategies	**0.60**	**3.95**	**High**
Inquiry-based Instruction	0.65	4.03	High
Learning Obligation	0.74	3.99	High
Learning Effort	0.71	3.83	High
Collaboration Learning	0.68	3.97	High
Science Learning Identity	**0.59**	**3.93**	**High**
Performance	0.57	4.07	High
Competence	0.66	3.93	High
Recognition	0.98	3.69	High
Interest	0.61	4.04	High

Table 1 presents descriptive statistics for the variables under study, including their means, standard deviations, descriptive levels, and interpretations. The overall mean score for perceived teaching performance is 4.12 with an SD of 0.48, which corresponds to a high descriptive level. This indicates that the respondents perceive their science teachers' teaching performance as very good. Among its indicators, diversity of learners received the highest mean score of 4.18 with an SD of 0.67, suggesting that teachers are highly responsive to the varied backgrounds and needs of their students. Conversely, community, linkages, and professional engagement

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obtained the lowest mean score of 4.08 with an SD of 0.75, which still falls within the high category and denotes very good performance.

Similarly, inquiry-based teaching strategies yielded an overall mean score of 3.95 with an SD of 0.60, reflecting a high descriptive level. This implies that the inquiry-oriented practices utilized by science teachers are very good. Looking closely at the indicators, inquiry-based instruction garnered the highest mean rating of 4.03, with an SD = 0.65, showcasing a strong implementation of inquiry methods in science instruction. In contrast, learning effort registered the lowest mean score of 3.83 with an SD of 0.71, which remains descriptively high, indicating that students still exert a very good amount of effort during inquiry-based classroom activities.

Lastly, science learning identity obtained an overall mean score of 3.93 with an SD of 0.59, indicating a high descriptive level and establishing that the senior high school learners possess a very good self-perception in science. The performance indicator received the highest mean score of 4.07, with an SD of 0.57, reflecting students' robust confidence in their ability to apply scientific knowledge and skills. Meanwhile, recognition had the lowest mean score at 3.69, with an SD of 0.98. While this is still descriptively high, it highlights that students feel relatively less acknowledged by their teachers or peers regarding their scientific capabilities compared to other identity facets.

In summary, the findings reveal that perceived teaching performance, inquiry-based teaching strategies, and science learning identity all consistently rank at a high level. These results underscore a strong, positive ecosystem for science instruction and a healthy sense of identification with the subject among the learners. Structurally, while teachers are seen as highly competent in managing diverse learners and driving inquiry, student data suggest a need to pivot more instructional attention toward outward recognition and validation to further strengthen the students' developing science identities.

Correlation Analysis

The second objective of this study is to determine the significant relationship between Perceived Teaching Performance, Inquiry-Based Teaching Strategies, and Science Identity among senior high school learners. The correlation analysis results are shown in Table 2.

Table 2. Correlation Table (n=230)

	Science Identity of Senior High School Students			
Independent Variables				
	r	**p-value**	**Decision on H_o**	**Interpretation**
Perceived Teaching Performance	.192	.004	Reject	Significant
Inquiry-based Teaching Strategies	.124	.060	Failed to Reject	Not Significant

The data confirm a statistically significant positive relationship between perceived teaching performance and science learning identity, with an r value of 0.192 and a p value of 0.004. Because the p-value falls below the standard 0.05 threshold, the null hypothesis is rejected, which may thoroughly support that students who view their teachers as highly effective tend to develop a stronger science learning identity.

Conversely, the table indicates that the relationship between inquiry-based teaching strategies and science learning identity is not statistically significant, with an r of 0.124 and a p-value of 0.060. With a p-value exceeding 0.05, the null hypothesis failed to be rejected. This completely substantiates the narrative's interpretation that the observed relationship does not provide strong enough statistical evidence of a direct effect and might merely be due to chance.

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Consequently, it is accurate to deduce that while these strategies are utilized in the classroom, their direct impact on shaping science identity is either limited or heavily mediated by other external factors, such as intrinsic student motivation, personal interest, or family encouragement.

Regression Analysis

The third objective of this study is to determine the significant influence of Perceived Teaching Performance and Inquiry-Based Teaching Strategies on Science Identity. The regression analysis results are presented in Table 3.

Table 3. Test of Combined Influence (n=230)

	Science Identity of Senior High School Students						
	Unstandardized Coefficients		Standardized Coefficients				
Independent Variables	B	Std. Error	Beta	t	Sig.	Decision on H_0	Interpretation
(Constant)	2.980	.329		9.057	.000		
Perceived Teaching Performance	.209	.092	.179	2.258	.025	Reject	Significant
Inquiry-based Teaching Strategies	.022	.077	.023	.285	.776	Failed to Reject	Not Significant

$R = .193$; $R^2 = .037$; F-value = 4.375; p-value = 0.014

The regression analysis in Table 3 confirms that Perceived Teaching Performance significantly influences the science learning identity of senior high school students with B= 0.209, t = 2.258, p = 0.025). Because this significance falls below the 0.05 threshold, the null hypothesis is rejected, reinforcing the idea that higher teacher competence actively fosters a stronger science learning identity. Conversely, inquiry-based teaching strategies do not significantly predict science learning identity (B = 0.022, t = 0.285, p = 0.776), failing to reject the null hypothesis and indicating that these classroom strategies have no direct statistical impact on how students view themselves in science.

Overall, the regression model yields an R^2 value of 0.037, which demonstrates that these two independent variables combined account for only 3.7% of the variance in science learning identity. Although the model is statistically stable (F = 4.375, p = 0.014), this low percentage suggests that the remaining 96.3% of the variance may be attributable to unmeasured external factors, such as students' personal interests, intrinsic motivation, and outside support.

SUMMARY OF FINDINGS

Based on the results, it was found that:

1. The levels of perceived teaching Performance, inquiry-based teaching strategies, and science learning identity were very good.

2. Perceived teaching performance showed a significant positive relationship with science learning identity, while inquiry-based teaching strategies did not show a significant relationship with science learning identity.

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3. Individually, perceived teaching performance significantly influences science learning identity, whereas inquiry-based teaching strategies do not significantly influence science learning identity. Their 3.7% combined degree of influence on the latter is significant.

DISCUSSIONS

This chapter presents the discussion of the study's results and findings. Specifically, includes the conclusion and recommendations in this study.

Correlation of Inquiry-Based Teaching Strategies and Science Learning Identity

The present study revealed no significant relationship between Inquiry-Based Teaching Strategies and Science Learning Identity, suggesting that inquiry-based teaching alone may not be sufficient to strengthen students' science learning identity. This finding contradicts the studies of Jiang and Wei (2023), who reported that inquiry-oriented and collaborative learning environments promote science learning identity by increasing students' engagement, participation, and sense of belonging in science, and Taconis et al. (2023), who found that authentic challenge-based learning and meaningful interactions with STEM professionals strengthen students' science learning identity through inquiry and collaboration.

Conversely, the present finding affirms the study of Lee (2023), who found that science motivation and science achievement were stronger predictors of science learning identity than instructional factors. This variation may be attributed to differences among participants, educational settings, and the variables examined, suggesting that inquiry-based teaching may require teacher guidance, recognition, and motivational support to foster students' science learning identity effectively. While Lee examined 186 high school students, the present study was conducted among 230 Grade 12 STEM learners.

Correlation of Perceived Teaching Performance and Science Identity

The findings revealed a significant positive relationship between Perceived Teaching Performance and Science Identity among the Grade 12 STEM learners, indicating that effective teaching strengthens learners' confidence and sense of belonging in science. This finding affirms the studies of Zhai et al. (2024), who reported that supportive teaching practices enhance students' science identity; Jiang and Wei (2023), whose systematic review emphasized the importance of teacher support, mentoring, and positive classroom experiences in fostering science identity; and Taconis et al. (2023), who also found that authentic learning environments and meaningful interactions.

Furthermore, these findings also affirm Vygotsky's Sociocultural Theory, which highlights the role of teacher guidance, social interaction, and scaffolding in the development of learners' knowledge and identity. However, the present finding contrasts with Vincent-Ruz and Schunn (2020), who found that competence and recognition were stronger predictors of science identity than classroom instructional experiences. This difference may be attributed to variations in the participants, educational settings, and variables examined.

Correlation Analysis Results

The correlation analysis revealed that Perceived Teaching Performance had a significant positive relationship with Science Identity, whereas Inquiry-Based Teaching Strategies did not show a significant relationship. The significant relationship between Perceived Teaching Performance and Science Identity affirms the studies of Zhai et al. (2024), who emphasized that science teachers' instructional practices and professional identity positively influence students' learning experiences and outcomes, and Jiang and Wei (2023), whose systematic review identified teacher support, mentoring, and positive learning environments as important factors in developing science identity. These findings also support Vygotsky's Sociocultural Theory, which emphasizes that teacher guidance, scaffolding, and meaningful social interaction facilitate cognitive development and identity formation.

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However, the finding that Inquiry-Based Teaching Strategies did not significantly relate to Science Identity contrasts with Huang et al. (2024), who reported that both web-based and traditional inquiry approaches improved students' science identity, suggesting that inquiry-based experiences can positively contribute to identity development. The difference may be attributed to variations in the educational context, participants, and the implementation of inquiry-based instruction. Overall, the findings suggest that teacher support, structured guidance, and positive learning environments remain more influential than inquiry-based teaching strategies alone in fostering students' science identity.

Regression Analysis Results

Regression analysis revealed that Perceived Teaching Performance significantly predicted Science Identity, whereas Inquiry-Based Teaching Strategies did not. This finding affirms the studies of Zhai et al. (2024), who emphasized that effective teaching practices and teacher support strengthen students' science identity, and Jiang and Wei (2023), whose systematic review concluded that teacher mentoring, supportive learning environments, and positive classroom experiences are essential in developing science identity. These findings also support Vygotsky's Sociocultural Theory, which emphasizes that learning and identity develop through teacher guidance, scaffolding, and meaningful social interaction.

However, this finding contrasts with Liou and Myoung (2023), who reported that inquiry-based instructional practices positively influenced students' motivational beliefs, suggesting that inquiry-based instruction can contribute to learners' engagement and identity development. The difference may be attributed to variations in the educational settings, research contexts, and outcome variables examined. Overall, the findings suggest that while inquiry-based learning promotes exploration and conceptual understanding, Perceived Teaching Performance remains a stronger predictor of Science Identity than Inquiry-Based Teaching Strategies alone.

CONCLUSION

The findings of this study partially validate Vygotsky's Sociocultural Theory, confirming that a student's science learning identity develops through social interaction, structured scaffolding, and knowledgeable teacher guidance. While high teacher competence and supportive pedagogy significantly foster a student's sense of belonging, inquiry-based teaching strategies alone do not directly influence a student's science learning identity. Together, these instructional variables account for only 3.7% of the variance in how students view themselves in the discipline, proving that identity formation is highly complex and heavily driven by external, unmeasured dimensions. Ultimately, these results underscore that hands-on inquiry tasks are insufficient on their own; instead, cultivating resilient science identities requires a structured classroom environment rich in targeted teacher feedback, meaningful collaboration, and strong pedagogical mastery.

RECOMMENDATIONS

Based on the conclusion, it is recommended that:

1. Future researchers are encouraged to employ mixed-methods research designs that combine surveys with interviews, classroom observations, and student reflections to gain a deeper understanding of science identity development. They may also conduct longitudinal studies to examine how teaching practices influence students' science identities over time.

2. Future studies should investigate the implementation of inquiry-based teaching strategies, particularly the quality of teacher scaffolding, teacher preparation, and the availability of instructional resources, to better understand their influence on students' science identity.

3. Future researchers may employ a qualitative research design and explore and conduct a quantitative study to investigate the remaining 96.3% of unmeasured external influences in depth.

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