

Model of internal and external determinants of affiliation motivation among elementary school teacher education students in ethnoscience-based inquiry learning

Aisyah Ali^{1*} , Akhmad Kadir¹ , Ria Ristiani¹ , Suwita Suwita¹ , Lely Yustina Wati¹ , Endriani Endriani¹ 

¹ Cenderawasih University, INDONESIA

*Corresponding Author: aisyahali@fkip.uncen.ac.id

Citation: Ali, A., Kadir, A., Ristiani, R., Suwita, S., Wati, L. Y., & Endriani, E. (2026). Model of internal and external determinants of affiliation motivation among elementary school teacher education students in ethnoscience-based inquiry learning. *Pedagogical Research*, 11(4), em0292. <https://doi.org/10.29333/pr/19624>

ARTICLE INFO

Received: 28 Jul. 2026

Accepted: 16 Aug. 2026

ABSTRACT

This study examined individual, relational, and classroom-level factors associated with affiliation motivation among Elementary School Teacher Education students participating in ethnoscience-based inquiry learning. A cross-sectional explanatory survey involved 173 students drawn from four classes randomly selected from eight eligible classes. Self-efficacy, goal setting, social needs, sense of belonging, teacher-student relationships, peer support, recognition and appreciation, classroom climate, and affiliation motivation were measured at one time point and analyzed using Partial Least Squares Structural Equation Modeling. The eight predictors jointly explained 55.8% of the variance in affiliation motivation. All structural associations were positive and statistically significant ($\beta = .128-.187$, $p = .004-.041$), although individual effect sizes were small ($f^2 = .026-.053$). The findings indicate cumulative contributions of individual, interpersonal, and classroom-level resources to affiliation motivation. Because the study was cross-sectional, self-reported, and conducted at one institution, the findings should not be interpreted causally and should be generalized cautiously.

Keywords: affiliation motivation, wthnoscience, inquiry-based learning, internal determinants, external determinants, PLS-SEM

INTRODUCTION

Affiliation motivation refers to the desire to establish social bonds, gain acceptance, and maintain positive relationships within a group. This motivation is particularly relevant in ethnoscience-based inquiry learning, which integrates scientific inquiry with local cultural values and thereby makes learning more meaningful and relevant to students' lives (Parmiti et al., 2021). When students perceive cultural relevance in learning, they may develop a stronger sense of connection, participate more actively in discussions, and collaborate more effectively with others. Ethnoscience-based inquiry learning can also support students' social and emotional competencies (Mudana, 2023). In collaborative learning, affiliation motivation is associated with positive group dynamics in which students are encouraged to exchange ideas and feel accepted and appreciated (Jones et al., 2022). Such social participation can support knowledge construction as well as students' identity and involvement in the learning process (Baanqud et al., 2020). Therefore, affiliation motivation represents an important social-motivational construct to examine in ethnoscience-based inquiry learning.

An issue frequently encountered in ethnoscience-based inquiry learning is students' low social and emotional engagement in collaborative and meaningful learning activities (Yafie et al., 2022a). In many education systems, learning remains teacher-centered and focused on memorization rather than contextual collaboration (Ghaleb, 2024). Consequently, students are less motivated to interact, participate in discussions, and develop a sense of belonging, weakening the affiliation motivation needed to support inquiry learning and local cultural integration.

In addition, globalization and homogenization of culture through media and technology lead to a diminishing appreciation of local wisdom among the younger generation. When students do not see the connection between the subject matter and their cultural identity, they typically lack the drive to participate fully (Owens et al., 2020). This poses a major challenge to the ethnoscience-based inquiry approach, which relies on the integration of cultural values as a means to foster engagement and meaning in learning (Efendi & Muliadi, 2023). It is necessary to overcome low affiliation motivation in the face of contemporary educational obstacles if culture-based learning and inquiry are to be successful and have an impact.

In the framework of inquiry-based learning based on ethnoscience, the issue of poor affiliation motivation is intriguing to study because it touches on important aspects of modern learning, namely social engagement, meaningfulness of learning, and preservation of local cultural values. Amidst the challenges of globalization and individualistic learning approaches, understanding and finding solutions to the lack of student participation in culture-based collaborative processes is crucial to creating an inclusive, relevant and identity-enhancing learning environment. Research on this variable is expected to contribute to designing learning models that are not only academically effective, but also build social connectedness and cultural values in learners.

Affiliation motivation may be associated with both individual and environmental resources in ethnoscience-based inquiry learning. At the individual level, self-efficacy, clear learning goals, social needs, and a sense of belonging are relevant to students' willingness to participate and connect with others in collaborative learning (Chung et al., 2021). At the interpersonal level, a supportive learning environment can provide important social resources for students' participation (Asvio et al., 2017). Positive teacher-student relationships may provide students with a sense of safety and comfort during classroom interactions (Nekhorosheva, 2020). while peer support can facilitate cooperative and mutually supportive learning relationships (Latifah & Ichsan, 2023). At the classroom level, an inclusive and supportive climate provides conditions that are conducive to social participation and interaction (Debasu & Yitayew, 2024). Together, these individual, interpersonal, and classroom-level resources provide a basis for examining affiliation motivation within ethnoscience-based inquiry learning.

Ecological systems theory provides the primary framework for the proposed model. At the individual level, self-efficacy and goal setting represent competence and self-regulatory resources, while social needs and sense of belonging represent relational orientation and experienced inclusion. At the interpersonal level, teacher-student relationships, peer support, and recognition and appreciation represent sources of support and validation. At the classroom level, classroom climate represents the broader proximal environment in which these resources are experienced. The study therefore examines affiliation motivation as an outcome associated with resources operating across multiple ecological levels.

Ecological systems theory provides the broader framework for understanding how individual, interpersonal, and classroom-level resources are related to affiliation motivation, while construct-specific theories provide complementary explanations for these relationships. Self-efficacy theory suggests that students who believe in their own capabilities are more willing to participate actively in collaborative activities (Sökmen, 2021). Goal-setting theory similarly emphasizes that clear and challenging goals can direct students' effort and persistence during learning (From a needs perspective, the desire for acceptance and belonging represents an important social need that can shape students' interpersonal behavior (Crandall et al. 2020). Teacher student relationships can provide emotional security that supports students' openness and participation (Zheng, 2022). while peer support provides interpersonal resources within collaborative learning environments (Luan et al., 2023). Recognition and appreciation may further reinforce valued forms of participation through positive reinforcement (Maisarah, 2024). These individual and interpersonal resources operate within the broader classroom environment described by ecological systems theory.

Previous ethnoscience research has primarily examined outcomes such as scientific literacy, conceptual understanding, retention, and science-process skills. Less is known about the social motivational conditions that enable preservice teachers to participate effectively in culturally grounded inquiry. Existing studies have generally examined self-efficacy, belonging, teacher support, peer support, recognition, or classroom climate separately, leaving unclear how personal, relational, and classroom-level resources operate simultaneously in relation to affiliation motivation (Irwandi et al., 2022).

This gap is important in preservice elementary teacher education because future teachers must learn to connect scientific inquiry with learners' cultural backgrounds while collaborating with peers. The setting of Universitas Cenderawasih in Papua provides a relevant context because students prepare to teach in culturally diverse communities and encounter multiple local knowledge traditions. The contribution of the study therefore lies not in geography alone, but in explaining the social-motivational conditions associated with culturally grounded teacher education.

The novelty of this study lies in integrating individual, interpersonal, and classroom level resources into one explanatory model of affiliation motivation among preservice elementary teachers participating in ethnoscience-based inquiry learning.

Accordingly, this study aimed to determine the extent to which self-efficacy, goal setting, social needs, sense of belonging, teacher student relationships, peer support, recognition and appreciation, and classroom climate are associated with affiliation motivation in ethnoscience-based inquiry learning.

LITERATURE REVIEW

Self-Efficacy (X1)

Self-efficacy refers to an individual's confidence in completing tasks and achieving goals. In this study, self-efficacy is expected to strengthen students' affiliation motivation in ethnoscience-based inquiry learning by encouraging active participation and collaboration in accordance with local cultural values (Syahmani et al., 2022). Students who believe in their abilities are more willing to interact and work with peers (Dunbar et al., 2018). Higher self-efficacy also strengthens students' sense of belonging, as they feel able to contribute meaningfully and gain acceptance within the learning community, thereby increasing their affiliation motivation (Chans & Castro, 2021). The dimensions and indicators of self-efficacy used in this study are presented in **Table 1**.

Table 1. Dimensions and indicators of self-efficacy

Dimension	Indicators	Source
Confidence in Abilities	1. Students feel capable of understanding ethnoscience-based learning materials. 2. Students are confident in completing group tasks successfully. 3. Students feel confident participating in class discussions.	Schunk and DiBenedetto (2021)
Ability to Overcome Challenges	1. Students are able to deal with difficulties in assignments without giving up. 2. Students believe they can solve problems that arise during learning activities. 3. Students have strategies to overcome difficulties in group work.	
Motivation to Achieve Goals	1. Students set clear goals in learning activities. 2. Students strive to achieve the best results in group projects. 3. Students are motivated to study harder when facing challenges.	
Independent Learning	1. Students can study independently without much guidance. 2. Students feel capable of finding solutions independently during learning. 3. Students are confident to take initiative in learning tasks.	
Sense of Responsibility in Group Work	1. Students feel responsible for tasks assigned in group work. 2. Students try to maintain good communication with group members. 3. Students feel it is important to contribute to the completion of group projects.	

Table 2. Dimensions and indicators of goal setting

Dimension	Indicators	Source
Clarity of Goals	1. Students define clear and specific learning goals 2. Students understand the steps needed to achieve their goals 3. Students align goals with inquiry-based learning tasks	Tosi et al. (1991)
Goal Commitment	1. Students show dedication to achieving set goals 2. Students maintain focus on goals despite challenges 3. Students prioritize tasks related to their learning goals	
Goal Relevance	1. Students choose goals relevant to ethnoscience contexts 2. Students relate goals to real-life and cultural issues 3. Students ensure goals support group inquiry activities.	
Goal Monitoring	1. Students regularly review their progress towards goals 2. Students adjust strategies based on goal achievement 3. Students reflect on outcomes to refine their goals.	
Collaborative Goal Setting	1. Students set group goals together with peers 2. Students agree on shared responsibilities for group tasks 3. Students communicate goals clearly within the group	

Goal Setting (X2)

Goal setting is the process of establishing clear and challenging objectives to achieve desired learning outcomes. In ethnoscience-based inquiry learning, goal setting guides students in planning learning activities, setting targets related to local cultural exploration, and completing tasks systematically (Bektiarso et al., 2024). Clear goals also help students focus their efforts, particularly during collaborative learning activities (Zheng, 2021). Goal-directed students are more consistent in their engagement, develop stronger affiliation with their groups, and demonstrate greater self-regulation throughout the inquiry process (Lai et al., 2018). As a result, shared learning goals strengthen affiliation motivation while promoting active participation, collaboration, and meaningful learning outcomes. The dimensions and indicators of goal setting are presented in **Table 2**.

Social Needs (X3)

Social needs refer to the psychological desire for meaningful interpersonal relationships, acceptance, companionship, and social connection. In collaborative learning environments, these needs are relevant to how students interact with teachers and peers (Hernández-Sellés et al., 2019). In ethnoscience-based inquiry learning, opportunities to collaboratively explore local cultural knowledge may provide a meaningful context for fulfilling students' need for social connection (Tsai et al., 2023). When social needs are adequately fulfilled, students may show stronger motivation to participate, collaborate, and persist in group-based learning activities (Anamezie & Gumbo, 2024; Järvenoja et al., 2020). In the present model, however, social needs are conceptually distinguished from teacher student relationships, peer support, recognition and appreciation, and sense of belonging: social needs refer to the underlying desire for interpersonal connection, whereas the other constructs represent particular relational resources or experienced relational states. The dimensions and indicators used to measure social needs are presented in **Table 3**.

Table 3. Dimensions and indicators of social needs

Dimension	Indicators	Source
Peer Relationship	1. Students build positive and respectful relationships with peers 2. Students collaborate effectively with others in group tasks 3. Students provide and receive support during inquiry activities	Martinot et al. (2022)
Teacher Support	1. Students perceive emotional and academic support from the teacher 2. Students feel encouraged and motivated by teacher interactions 3. Students receive constructive feedback that enhances social connection.	
Social Interaction Opportunities	1. Students are given frequent chances to engage in cooperative learning 2. Students interact with diverse peers during inquiry-based projects 3. Students are encouraged to share cultural insights with others.	
Recognition and Respect	1. Students feel that their ideas and contributions are valued 2. Students experience fairness and respect in group settings 3. Students are acknowledged for both effort and achievement.	

Table 4. Dimensions and indicators sense of belonging

Dimension	Indicators	Source
Emotional Attachment	1. Students feel emotionally connected to the learning environment. 2. Students experience a sense of happiness when engaging in learning activities. 3. Students show concern for the success of their group or class.	Zhao et al. (2012)
Inclusion	1. Students perceive themselves as accepted members of the classroom 2. Students are invited to participate in discussions and group work 3. Students feel that their presence matters to others	
Identity Affirmation	1. Students feel that their cultural identity is acknowledged in class 2. Students see their background as a valued part of learning 3. Students are encouraged to share experiences related to their culture.	
Peer Connection	1. Students build strong social bonds with classmates 2. Students feel supported and cared for by their peers 3. Students collaborate willingly in group inquiry projects	Amaliyah et al. (2023)
Teacher Support	1. Students feel respected and understood by the teacher 2. Students feel that the teacher listens to their opinions 3. Students receive encouragement that fosters their inclusion	

Sense of Belonging (X4)

Sense of belonging refers to an individual's feeling of acceptance, inclusion, and value within a social or academic environment, which strongly influences motivation, engagement, and persistence in learning (Yu et al., 2020). In ethnoscience-based inquiry learning, this sense is reinforced as students recognize the relevance of their cultural background in academic content, strengthening their identity and emotional connection to learning (Khery et al., 2025). When students feel socially and culturally accepted, they are more willing to collaborate, participate actively, and build stronger relationships with peers and teachers, thereby enhancing affiliation motivation, learning engagement, and academic outcomes. Therefore, fostering a strong sense of belonging is essential for creating inclusive and effective learning experiences (Dobson et al., 2024). In the present model, sense of belonging is treated as an experienced state of acceptance and inclusion, whereas affiliation motivation represents the motivational inclination to seek and maintain positive interpersonal relationships. The dimensions and indicators of sense of belonging are presented in **Table 4**.

Teacher-Student Relationship (X5)

Teacher student relationship refers to the quality of communication, respect, and emotional connection between teachers and students, which strongly influences students' motivation, confidence, and engagement in learning (Pastore & Luder, 2021). In inquiry-based learning, supportive teacher relationships foster trust, open communication, and a safe environment for students to participate actively and overcome learning challenges (Wall, 2021). Within ethnoscience-based inquiry learning, culturally responsive teachers who value students' cultural backgrounds strengthen students' affiliation motivation by promoting curiosity, collaboration, and ownership of learning (Akram & Li, 2024). Therefore, improving the teacher-student relationship is essential for promoting a sense of belonging and cultural significance in the classroom in addition to academic success. The dimensions and indicators of teacher-student relationships are presented in **Table 5**.

Table 5. Dimensions and indicators of teacher-student relationship

Dimension	Indicators	Source
Trust and Respect	1. Students feel that the teacher respects their opinions. 2. Teachers treat all students fairly and consistently. 3. Students trust the teacher to support their learning needs.	Pastore and Luder (2021)
Emotional Support	1. Teachers show empathy toward students' challenges. 2. Students feel comfortable sharing concerns with the teacher. 3. Teachers create a warm and welcoming classroom environment.	
Communication Quality	1. Teachers encourage open dialogue during lessons. 2. Students understand the teacher's instructions clearly. 3. Teachers respond to students' questions with patience and clarity.	Artola Bonanno et al. (2024)
Academic Encouragement	1. Teachers provide constructive feedback to support growth. 2. Teachers motivate students to explore and solve problems. 3. Teachers acknowledge student efforts and improvements.	
Cultural Responsiveness	1. Teachers integrate students' cultural backgrounds in the learning process. 2. Teachers show interest in students' local knowledge and experiences. 3. Teachers validate cultural contributions in classroom discussions.	

Table 6. Dimensions and indicators of peer support

Dimension	Indicators	Source
Emotional Encouragement	1. Students feel emotionally supported by their peers. 2. Peers offer encouragement during difficult tasks. 3. Students are comfortable expressing concerns to classmates.	Turyamureeba (2024)
Collaborative Learning	1. Students work together to solve problems. 2. Peers help each other understand learning materials. 3. Group discussions involve mutual contributions.	
Respect and Inclusivity	1. Students show respect for different viewpoints. 2. Peers include one another in activities and discussions. 3. Students value diverse cultural perspectives.	Yogeesha (2016)
Feedback Exchange	1. Students give constructive feedback to peers. 2. Peers accept suggestions and support improvement. 3. Feedback sessions are used to enhance learning outcomes.	
Sense of Belonging among Peers	1. Students feel accepted by their peer group. 2. Peer relationships contribute to classroom community. 3. Students identify as part of a supportive learning team.	

Peer Support (X6)

Peer support refers to the social, emotional, and academic assistance students provide to one another, promoting collaboration, motivation, and confidence in inquiry-based learning (Allen et al., 2018). Supportive peer interactions encourage students to exchange ideas, solve problems collaboratively, and actively participate in learning activities (Byrom, 2018). In ethnoscience-based inquiry learning, peer support also helps students appreciate diverse cultural perspectives, fostering inclusivity, shared responsibility, and stronger connections to both the learning content and classroom community (Mittelmeier et al., 2018). Consequently, strong peer support enhances affiliation motivation, learning engagement, and students' sense of belonging. The dimensions and indicators of peer support are presented in **Table 6**.

Recognition and Appreciation (X7)

Recognition and appreciation refer to acknowledging and valuing students' efforts, achievements, and contributions, which strengthen motivation and engagement in learning (Tong et al., 2022). In ethnoscience-based inquiry learning, recognition from teachers and peers reinforces students' confidence, validates their culturally rooted knowledge, and encourages active participation, thereby enhancing affiliation motivation (Bonner et al., 2018). By affirming both academic performance and cultural identity, recognition and appreciation foster an inclusive learning environment where students feel respected, increasing their sense of belonging and involvement in collaborative learning activities (Mahmud et al., 2020). The dimensions and indicators of recognition and appreciation are presented in **Table 7**.

Table 7. Dimensions and indicators of Recognition and Appreciation

Dimension	Indicators	Source
Acknowledgment of Effort	1. Teachers recognize students' attempts regardless of outcome. 2. Students feel encouraged when their efforts are noticed. 3. Recognition is given for persistence and hard work.	Bliven and Jungbauer (2021)
Celebration of Achievement	1. Students receive praise for reaching academic goals. 2. Achievements are shared and celebrated in the classroom. 3. Both individual and group accomplishments are acknowledged.	
Cultural Appreciation	1. Cultural knowledge shared by students is valued. 2. Students' cultural contributions are highlighted in discussions. 3. Teachers show appreciation for diverse perspectives.	
Peer Recognition	1. Students acknowledge each other's contributions. 2. Peer compliments are encouraged and modeled. 3. Group members express appreciation during teamwork.	Shinde (2025)
Motivational Reinforcement	1. Recognition is used to motivate future participation. 2. Praise is specific and linked to student actions. 3. Encouragement reinforces students' belief in their abilities.	

Table 8. Dimensions and indicators of classroom climate

Dimension	Indicators	Source
Emotional Safety	1. Students feel safe expressing their ideas. 2. Class discussions are respectful and supportive. 3. Mistakes are treated as part of learning.	Wang et al. (2022)
Inclusivity and Equity	1. Every student has equal opportunity to participate. 2. Diverse cultural backgrounds are respected. 3. Teachers accommodate different learning needs.	
Supportive Teacher Interaction	1. Teachers respond empathetically to students' concerns. 2. Teachers encourage student participation. 3. Teachers provide guidance during challenges.	
Collaborative Environment	1. Students frequently engage in group tasks. 2. Students help each other during learning. 3. Classroom promotes shared responsibility.	Tormis et al., (2025)
Positive Learning Atmosphere	1. The classroom atmosphere is motivating and engaging. 2. Students are enthusiastic to learn. 3. Ethnoscience-based materials create real-world relevance.	

Classroom Climate (X8)

Classroom climate refers to the emotional, social, and academic environment created through interactions among students, teachers, and the learning setting (Kariippanon et al., 2018). In ethnoscience-based inquiry learning, a safe, respectful, and inclusive classroom climate encourages students to explore, share ideas, and value cultural knowledge. Such an environment promotes active participation, collaboration, and meaningful discussion while fostering students' emotional security and sense of belonging (Hard & RaoShah, 2022). Consequently, a positive classroom climate strengthens affiliation motivation, enhances engagement in inquiry activities, and supports deeper connections between cultural experiences and scientific concepts (Yildiz, 2021). The dimensions and indicators of classroom climate are presented in **Table 8**.

Affiliation Motivation (AM)

Affiliation motivation refers to individuals' motivational inclination to establish social connections, gain acceptance, and maintain positive interpersonal relationships within the learning environment. In educational settings, this motivation is particularly relevant to collaborative participation because students are required to communicate, cooperate, and work toward shared goals with others (Li & Xue, 2023). Students with stronger affiliation motivation may also be more willing to cooperate with peers and respond constructively to others' ideas. In ethnoscience-based inquiry learning, where cultural knowledge sharing and collaborative problem-solving are central, students' motivation to affiliate may be particularly relevant when they experience social connection with teachers and peers (Shteynberg et al., 2020). Such social connections can contribute to supportive and culturally responsive learning communities (Borup et al., 2020). Conceptually, however, affiliation motivation should be distinguished from general academic engagement, inquiry skills, sense of belonging, psychological well-being, and learning outcomes. The dimensions and indicators of affiliation motivation are presented in **Table 9**.

Table 9. Dimensions and indicators of affiliation motivation

Dimension	Indicators	Source
Active participation in ethnoscience-based inquiry-based learning	1. Students can formulate questions and hypotheses during inquiries. 2. Students are able to experiment and interpret results. 3. Students are able to reflect and present findings. 4. Students actively discuss and develop arguments. 5. Students are able to elaborate on ideas and use learning strategies.	Kourti (2019)
Development of collaborative and empathetic teaching skills	1. Students are able to appreciate others' perspectives. 2. Students have a sense of caring for others 3. Students actively participate in group work 4. Students can interact and align group goals	Davis (1983); Thornhill-Miller et al. (2023)
Strengthening a sense of belonging in the learning community;	1. Students actively engage in teamwork. 2. Students willingly assist peers during tasks. 3. Students prioritize group success over individual recognition.	Aksah et al. (2023)
Higher academic engagement and classroom involvement	1. Students demonstrate Behavioral Engagement through activeness, effort, and attendance. 2. Students demonstrate Emotional Engagement through enthusiasm, interest, and a sense of belonging in class 3. Students demonstrate Cognitive Engagement through concentration and learning strategies. 4. Students demonstrate Agentic Engagement through initiative and active participation in the learning process	Zhao et al. (2022)
Improved well-being and emotional satisfaction.	1. Students have a positive affect so they are enthusiastic, passionate and inspired. 2. Students have relatedness satisfaction, have a sense of acceptance and emotional connection. 3. Students have Subjective Well-Being / Life Satisfaction 4. Students feel comfortable and receptive to collaborative learning. 5. Students experienced a decrease in negative feelings such as stress or anxiety.	Collie (2022); Schnell et al. (2025)

Research Hypotheses

Based on the theoretical and empirical evidence, the revised model proposes that individual, interpersonal, and classroom-level resources are positively associated with students' affiliation motivation. The individual-level determinants include self-efficacy, goal setting, social needs, and sense of belonging, while the interpersonal-level determinants include teacher-student relationships, peer support, and recognition and appreciation. Classroom climate represents the broader classroom-level environment. Because the present study employs a cross-sectional design, the hypotheses are formulated in terms of associations rather than causal effects:

- H1:** Self-efficacy is positively associated with affiliation motivation.
- H2:** Goal setting is positively associated with affiliation motivation.
- H3:** Social needs are positively associated with affiliation motivation.
- H4:** Sense of belonging is positively associated with affiliation motivation.
- H5:** Teacher-student relationships are positively associated with affiliation motivation.
- H6:** Peer support is positively associated with affiliation motivation.
- H7:** Recognition and appreciation are positively associated with affiliation motivation.
- H8:** Classroom climate is positively associated with affiliation motivation.

These hypotheses provide the basis for the structural model tested using Partial Least Squares Structural Equation Modeling (PLS-SEM), with affiliation motivation specified as the single endogenous construct.

METHODOLOGY

Research Design

This study employed a cross-sectional explanatory survey design. The primary objective was to estimate the simultaneous associations of eight exogenous latent constructs self-efficacy, goal setting, social needs, sense of belonging, teacher-student relationships, peer support, recognition and appreciation, and classroom climate with affiliation motivation as the single endogenous construct. All variables were measured once after students had completed course-based ethnoscience inquiry activities. PLS-SEM was used to estimate the measurement and structural models involving multiple latent constructs. The proposed research model is presented in **Figure 1**.

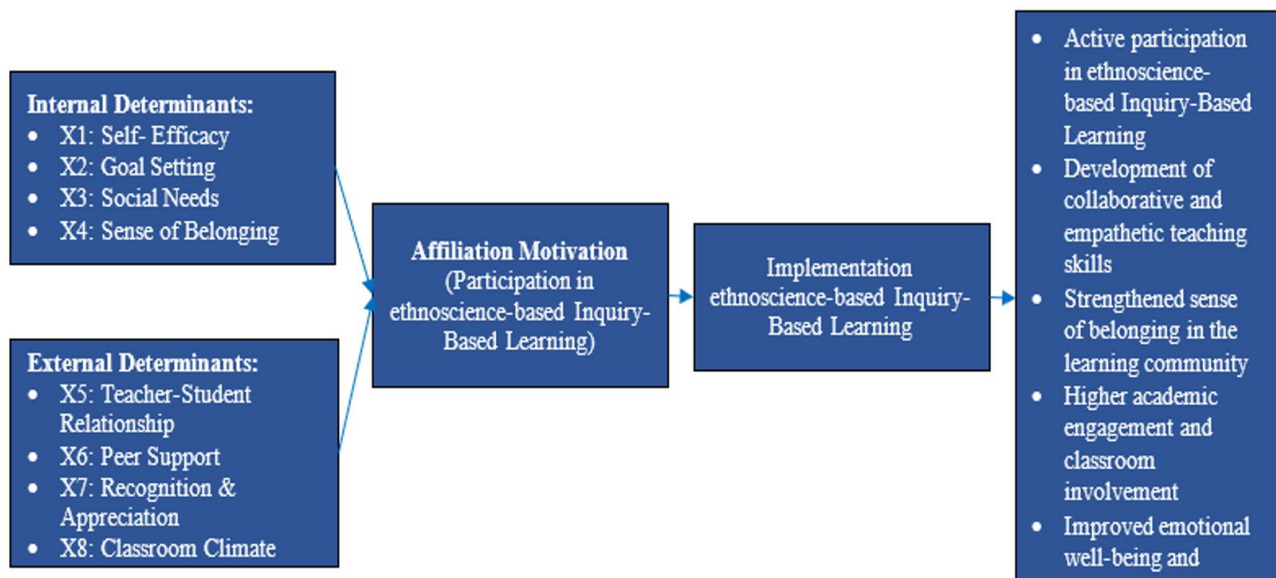


Figure 1. Research model (Source: Authors' own elaboration)

Population and Sample

The population comprised students enrolled in the Elementary School Teacher Education Study Program, Faculty of Teacher Training and Education, Universitas Cenderawasih, who were distributed across eight classes. Cluster random sampling was used at the class level. Four of the eight classes were randomly selected as the study clusters, yielding a final sample of 173 eligible students. Students were eligible to participate if they (a) were actively enrolled in the Basic Concepts of Elementary Science course in the Elementary School Teacher Education Study Program, (b) had attended at least 75% of the course sessions, and (c) provided informed consent to participate. Students with attendance below 75% were excluded from the study. Sample Size Adequacy. The adequacy of the sample size was evaluated using statistical power analysis for a multiple-predictor model with eight predictors of affiliation motivation. Assuming a medium effect size ($f^2 = .15$), an alpha level of .05, and statistical power of .80, the minimum required sample was approximately 109 participants. The final sample of 173 students therefore exceeded this minimum requirement and was considered adequate for estimating the proposed structural model.

The adequacy of the sample size was evaluated using statistical power analysis for a multiple-predictor model with eight predictors of affiliation motivation. Assuming a medium effect size ($f^2 = .15$), an alpha level of .05, and statistical power of .80, the minimum required sample was approximately 109 participants. The final sample of 173 students exceeded this minimum requirement and was therefore considered adequate for estimating the proposed structural model.

The ethnosciencebased inquiry activities served as the common instructional context for the survey rather than as a controlled experimental intervention. The learning sequence involved identifying a culturally situated phenomenon, formulating questions or hypotheses, planning and conducting an investigation, interpreting evidence, discussing findings collaboratively, and presenting or reflecting on the conclusions. Lecturers facilitated scientific questioning, guided the evaluation of evidence, and supported culturally respectful discussion, while students worked collaboratively to connect local knowledge with relevant scientific concepts.

Ethical Considerations

Ethical approval for this study was obtained from the Institute for Research and Community Service (LPPM), Cenderawasih University, under approval number 1165/UN20.2.1/PG/2026, dated 10 August 2026. Participation was entirely voluntary, and participants were informed that they could decline to participate or withdraw from the study without penalty. Participants' privacy and confidentiality were protected throughout the research process, and no personally identifying information was included in the dataset or reported in the study. Research data were stored securely and used solely for academic and scientific purposes. The study involved only non-invasive questionnaire-based data collection and was therefore classified as minimal risk. Participants' cultural backgrounds and local knowledge were treated respectfully throughout the ethnoscience-based learning context.

Data Collection Technique

Data were collected using a structured, closed-ended questionnaire measuring self-efficacy, goal setting, social needs, sense of belonging, teacher-student relationships, peer support, recognition and appreciation, classroom climate, and affiliation motivation. All questionnaire statements were rated using a Likert-type response scale. The questionnaire items were reviewed before administration to assess their relevance, clarity, and contextual appropriateness for the ethnoscience-based inquiry learning context. The questionnaire was administered after participants had completed the relevant learning activities. Participation was voluntary, and respondents' confidentiality was maintained throughout the data-collection process.

For the PLS-SEM analysis, questionnaire statements belonging to each theoretically defined dimension were aggregated by calculating the mean score for that dimension. Consequently, the indicators labeled SE1–SE5, GS1–GS5, SN1–SN4, SB1–SB5,

Table 10. Distribution of Respondent Characteristics (N=173)

No	Category	Sub-Category	Frequency (n)	Percentage
1	Age	18 - 20 Years	64	37.0%
		21 - 23 Years	86	49.7%
		≥ 24 Years	23	13.3%
2	Gender	Male	61	35.3%
		Female	112	64.7%
3	Year of Study	1 st Year	28	16.2%
		2 nd Year	46	26.6%
		3 rd Year	55	31.8%
		≥ 4 th Year	44	25.4%
4	Participation in PjBL	High Involvement	102	59.0%
		Moderate Involvement	51	29.5%
		Low Involvement	20	11.6%
5	Ethnoscience Exploration	Active (field projects, local culture)	97	56.1%
		Limited (classroom-based only)	76	43.9%
6	Prior Teaching Experience	Yes (tutoring, practicum, etc.)	68	39.3%
		No	105	60.7%
7	Campus Activity Participation	Active (students orgs, community projects)	89	51.4%
		Passive/Non-participative	84	48.6%
8	Type of Funding	Government Scholarship (KIP, Beasiswa, etc.)	113	65.3%
		Self-funded/Family Support	60	34.7%

TSR1–TSR5, PS1–PS5, RA1–RA5, CC1–CC5, and AM1–AM5 represent dimension-level composite scores rather than individual questionnaire statements. The aggregation followed the a priori dimensional structure presented in **Tables 1–9** rather than a data-driven item-parceling procedure.

Data Analysis Technique

Data were analyzed using descriptive statistics and Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS. The measurement model was evaluated using indicator loadings, Cronbach's alpha, rho_A, composite reliability, average variance extracted (AVE), the Fornell-Larcker criterion, and the heterotrait–monotrait ratio of correlations (HTMT). Bootstrapping with 5,000 subsamples was used to obtain confidence intervals for the HTMT estimates. Indicator cross-loadings were also examined to determine whether each indicator was more strongly associated with its intended construct than with competing constructs. The structural model was assessed using inner variance inflation factors (VIF), path coefficients, 5,000-subsample bootstrapped t-values and p-values, R^2 , and f^2 . An approximate full-collinearity VIF diagnostic was used only as a supplementary check for severe common-method collinearity. Statistical significance was evaluated at $\alpha = .05$, while interpretation emphasized coefficient magnitude and effect size rather than p-values alone.

RESULT

Respondent Characteristics

To facilitate interpretation of the findings, this section describes the demographic and academic characteristics of the 173 Elementary School Teacher Education students who participated in the study. The characteristics include age, gender, year of study, participation in project-based learning, engagement in cultural exploration (ethnoscience), prior teaching experience, campus activities, and funding support, providing context for understanding the internal and external determinants of affiliation motivation in inquiry-based learning. The demographic characteristics of the respondents are presented in **Table 10**.

Note. Percentages may not total exactly 100% in some categories because of rounding. The analytical sample consisted of 173 students drawn from four classes randomly selected from eight available classes.

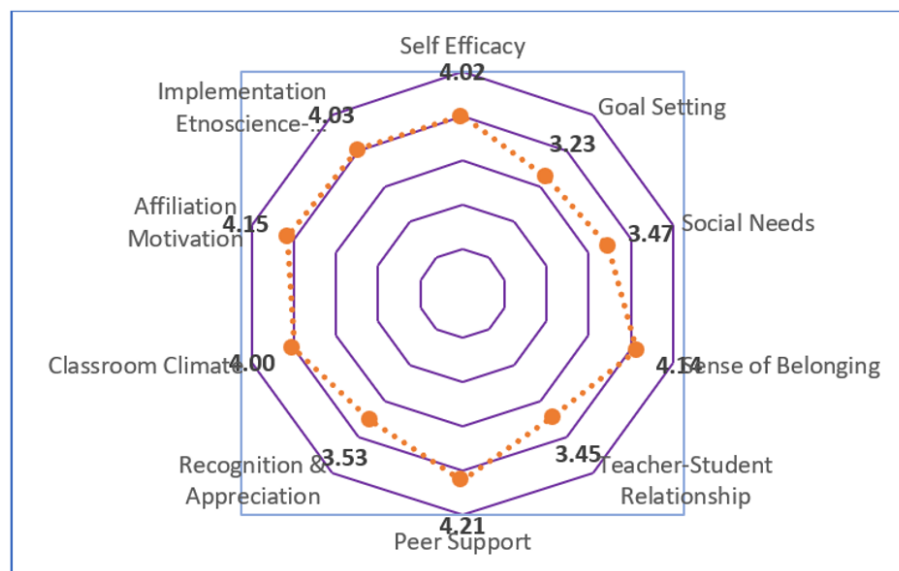
Most respondents were aged 21–23 years (49.7%) and female (64.7%). The largest proportion were third-year students (31.8%). High involvement in project-based learning was reported by 59.0% of respondents, while 56.1% reported active participation in ethnoscience-related cultural exploration. Prior teaching experience was reported by 39.3% of respondents, and 51.4% participated in campus or community activities. Government scholarship support was reported by 65.3% of respondents.

Descriptive Statistics and Correlations

This section presents the descriptive statistics for the nine retained constructs and their bivariate correlations with affiliation motivation. The correlations provide an initial descriptive view of the relationships among the constructs and are not interpreted causally. The descriptive statistics and correlations among the study variables are presented in **Table 11**.

Table 11. Descriptive statistics and correlations with affiliation motivation (AM)

No	Variable	Mean	Std. Deviation	Correlation with AM
1	Self Efficacy	4.02	0.69	0.481
2	Goal Setting	3.23	0.82	0.540
3	Social Needs	3.47	0.80	0.441
4	Sense of Belonging	4.14	0.60	0.362
5	Teacher-Student Relationship	3.45	0.91	0.544
6	Peer Support	4.21	0.56	0.482
7	Recognition & Appreciation	3.53	0.78	0.501
8	Classroom Climate	4.00	0.72	0.220
9	Affiliation Motivation	4.15	0.56	1.000

**Figure 2.** Radar chart of mean scores (Source: Authors' own elaboration)

The construct means ranged from 3.23 to 4.21. Peer Support had the highest mean ($M = 4.21$), followed by Affiliation Motivation ($M = 4.15$) and Sense of Belonging ($M = 4.14$), whereas Goal Setting had the lowest mean ($M = 3.23$). Teacher-Student Relationship ($r = .544$) and Goal Setting ($r = .540$) showed the strongest bivariate correlations with Affiliation Motivation, followed by Recognition and Appreciation ($r = .501$), Peer Support ($r = .482$), Self-Efficacy ($r = .481$), Social Needs ($r = .441$), Sense of Belonging ($r = .362$), and Classroom Climate ($r = .220$). The radar chart of mean scores is presented in **Figure 2**.

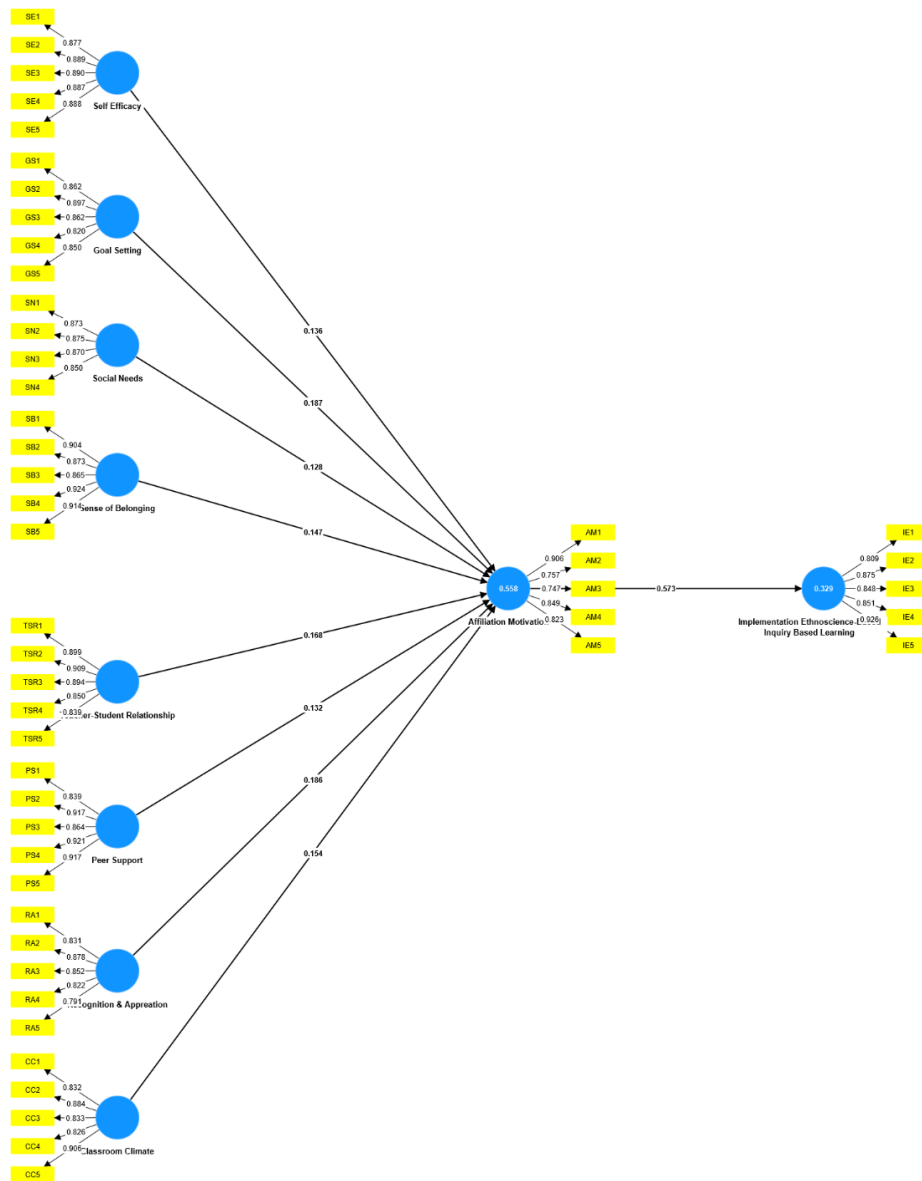


Figure 3. Outer model (Source: Authors' own elaboration, using PLS-SEM)

Outer Model Evaluation

Convergent validity - Outer loadings

Convergent validity, or the degree to which indicators represent the latent concept being measured, is evaluated primarily by outer loading. The outer model results are presented in **Figure 3**. A loading value above 0,70 indicates that the indicator has a strong contribution in explaining the latent variable. The outer loading values of the measurement indicators are presented in **Table 12**.

Table 12. Outer loading of indicators

Latent Variable	Code	Outer Loading
Self Efficacy (X1)	SE1	0.877
	SE2	0.889
	SE3	0.890
	SE4	0.887
	SE5	0.888
Goal Setting (X2)	GS1	0.862
	GS2	0.897
	GS3	0.862
	GS4	0.820
	GS5	0.850
Social Needs (X3)	SN1	0.873
	SN2	0.875
	SN3	0.870
	SN4	0.850
Sense of Belonging (X4)	SB1	0.904
	SB2	0.873
	SB3	0.865
	SB4	0.924
	SB5	0.914
Teacher Student Relationship (X5)	TSR1	0.899
	TSR2	0.909
	TSR3	0.894
	TSR4	0.850
	TSR5	0.839
Peer Support (X6)	PS1	0.839
	PS2	0.917
	PS3	0.864
	PS4	0.921
	PS5	0.917
Recognition & Appreciation (X7)	RA1	0.831
	RA2	0.878
	RA3	0.852
	RA4	0.822
	RA5	0.791
Classroom Climate (X8)	CC1	0.832
	CC2	0.884
	CC3	0.833
	CC4	0.826
	CC5	0.906
Affiliation Motivation (Z)	AM1	0.906
	AM2	0.757
	AM3	0.747
	AM4	0.849
	AM5	0.823

Note that indicator codes represent dimension-level composite scores calculated from the questionnaire statements within each theoretically defined dimension, as described in the Methodology.

All retained outer loadings exceeded .70, supporting indicator reliability and convergent validity within the estimated measurement model. The highest loadings were observed for SB4 (.924), PS4 (.921), and PS2 and PS5 (.917). AM2 (.757) and AM3 (.747) had lower loadings than the other affiliation-motivation indicators but remained above the conventional .70 threshold. These results support the retained measurement structure but do not, by themselves, establish content validity or resolve questions concerning the conceptual breadth of the constructs.

Discriminant validity - Fornell Larcker criterion

A construct's discriminant validity shows how different it is from other constructs. The Fornell-Larcker Criterion states that the correlation values between constructs in the relevant rows and columns for each variable should be less than the square root value of the AVE, which is situated on the table's diagonal. The discriminant validity assessment using the Fornell-Larcker criterion is presented in **Table 13**.

Table 13. Fornell-Larcker criterion

Variable	AM	CC	GS	PS	RA	SE	SB	SN	TSR
Affiliation Motivation	0.818								
Classroom Climate	0.220	0.857							
Goal Setting	0.540	0.026	0.859						
Peer Support	0.482	0.201	0.308	0.892					
Recognition & Appreciation	0.501	0.339	0.374	0.350	0.835				
Self Efficacy	0.481	-0.101	0.369	0.376	0.334	0.886			
Sense of Belonging	0.362	-0.090	0.230	0.293	0.146	0.402	0.896		
Social Needs	0.441	-0.060	0.465	0.329	0.203	0.339	0.208	0.867	
Teacher-Student Relationship	0.544	0.036	0.570	0.361	0.326	0.465	0.231	0.460	0.879

Table 14. Construct reliability and convergent validity

Variable	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Self Efficacy (X1)	0.932	0.934	0.948	0.785
Goal Setting (X2)	0.911	0.915	0.933	0.737
Social Needs (X3)	0.890	0.895	0.924	0.752
Sense of Belonging (X4)	0.939	0.946	0.953	0.803
Teacher Student Relationship (X5)	0.926	0.929	0.944	0.772
Peer Support (X6)	0.936	0.938	0.951	0.796
Recognition & Appreciation (X7)	0.891	0.892	0.920	0.698
Classroom Climate (X8)	0.912	0.943	0.932	0.734
Affiliation Motivation (Z)	0.875	0.884	0.910	0.670

The Fornell–Larcker results were consistent with discriminant validity because the square root of AVE for each construct exceeded its correlations with the other retained constructs. For example, the diagonal value for Affiliation Motivation (.818) was larger than its correlations with Teacher–Student Relationship (.544), Goal Setting (.540), and Recognition and Appreciation (.501). Similar patterns were observed for the remaining constructs. Nevertheless, the Fornell–Larcker criterion alone is insufficient to resolve possible overlap among the closely related relational constructs. The absence of the complete HTMT matrix, bootstrapped HTMT confidence intervals, and cross-loadings is therefore acknowledged as an important measurement limitation. The absence of the complete HTMT matrix, bootstrapped HTMT confidence intervals, and cross-loadings is therefore acknowledged as an important measurement limitation.

Internal consistency and convergent validity

Construct reliability testing is conducted to ensure that the indicators within a construct exhibit good internal consistency. Three main measures are used: Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE). The results of construct reliability and convergent validity assessment are presented in **Table 14**.

All nine retained constructs met the reported internal-consistency and convergent-validity thresholds. Cronbach's alpha, rho_A, and composite reliability exceeded .70, while AVE exceeded .50. Sense of Belonging (CR = .953; AVE = .803) and Peer Support (CR = .951; AVE = .796) showed the highest composite-reliability and AVE values, followed by Self-Efficacy (CR = .948; AVE = .785) and Teacher–Student Relationship (CR = .944; AVE = .772). Affiliation Motivation had the lowest values (CR = .910; AVE = .670), but both remained above the stated thresholds.

Collinearity assessment

Inner VIF values were 1.63 for Self-Efficacy, 1.71 for Goal Setting, 1.45 for Social Needs, 1.25 for Sense of Belonging, 1.78 for Teacher–Student Relationship, 1.42 for Peer Support, 1.48 for Recognition and Appreciation, and 1.27 for Classroom Climate. All values were below conventional concern thresholds, indicating that multicollinearity among the eight predictors was not severe.

Inner model evaluation

The inner model results are presented in **Figure 4**. The inner model evaluation was conducted by examining the coefficient of determination (R^2), effect size (f^2), and structural path coefficients to assess the relationships among latent variables and the explanatory capability of the model.

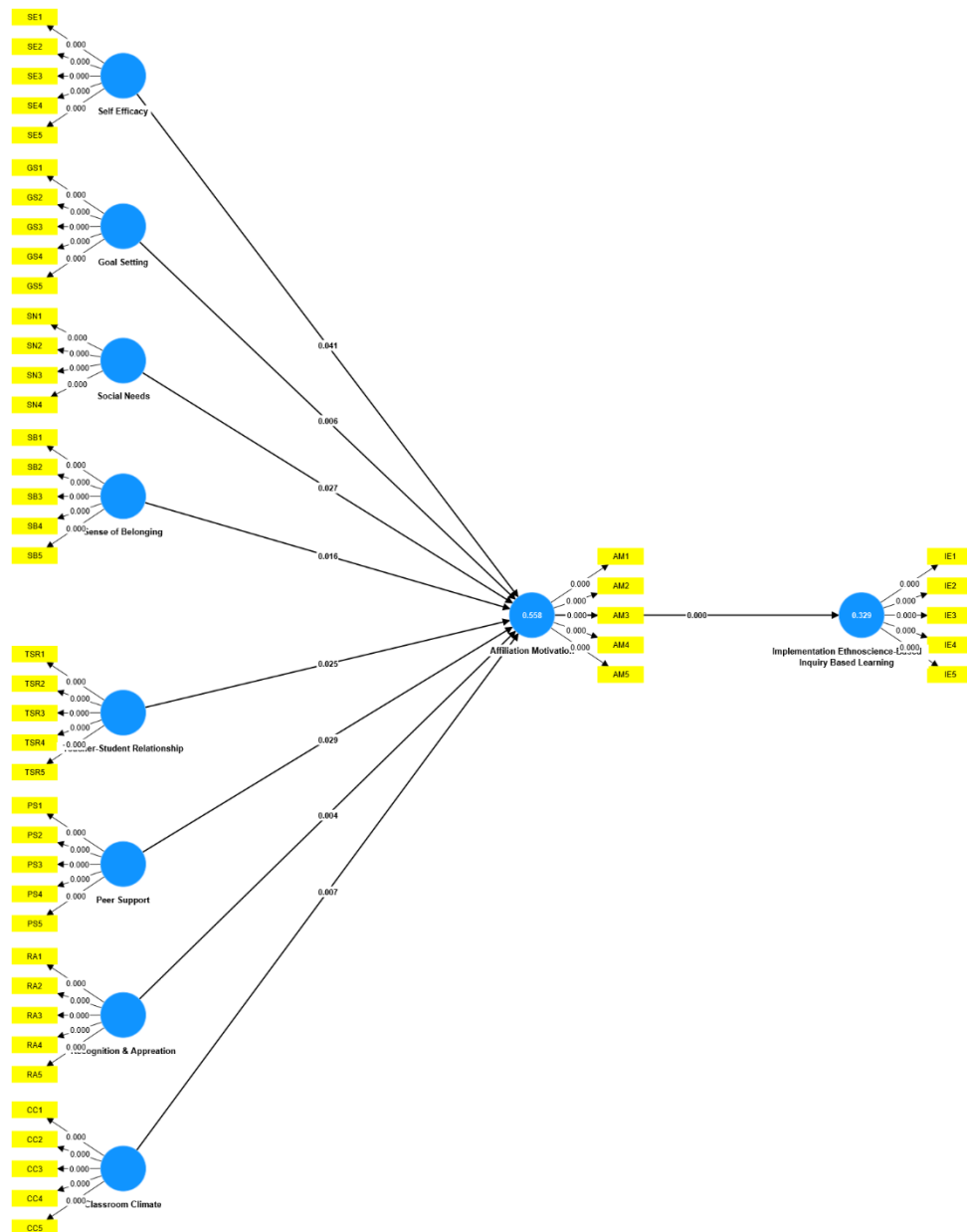


Figure 4. Inner model (Source: Authors' own elaboration, using PLS-SEM)

Table 15. Coefficient of determination for affiliation motivation

Endogenous Variable	R-square	R-square adjusted
Affiliation Motivation	0.558	0.536

Coefficient of determination (R^2)

The percentage of variance in the endogenous variables that can be accounted for by the exogenous variables in the model is shown by the R-squared (R^2) value. A greater explanatory ability of the model is shown by a higher R^2 . The coefficient of determination (R^2) for affiliation motivation is presented in **Table 15**.

The eight predictors jointly explained 55.8% of the variance in Affiliation Motivation ($R^2 = .558$; adjusted $R^2 = .536$). These values describe the variance explained by the predictors within the analyzed sample and should not be interpreted as evidence of causal prediction.

Effect size (f^2)

The contribution of each external variable to the endogenous variable's R^2 value is indicated by the effect size (f^2). Cohen's (1988) interpretation guidelines categorize effect size as follows: Small: 0.02, Medium: 0.15, Large: 0.35. The effect sizes (f^2) of each predictor on affiliation motivation are presented in **Table 16**.

Table 16. Effect sizes of predictors on affiliation motivation

Exogenous Variable	Affiliation Motivation (Z)
Self Efficacy (X1)	0.026 (Small)
Goal Setting (X2)	0.046 (Small)
Social Needs (X3)	0.026 (Small)
Sense of Belonging (X4)	0.039 (Small)
Teacher Student Relationship (X5)	0.036 (Small)
Peer Support (X6)	0.028 (Small)
Recognition & Appreciation (X7)	0.053 (Small)
Classroom Climate (X8)	0.042 (Small)

Table 17. Direct associations with affiliation motivation

No	Hypothesis	Pathways	Coefficient (O)	T-Statistics	P-Value	Decision
1	H1	X1 → Z (SE → AM)	0.136	2.044	0.041	Supported
2	H2	X2 → Z (GS → AM)	0.187	2.733	0.006	Supported
3	H3	X3 → Z (SN → AM)	0.128	2.210	0.027	Supported
4	H4	X4 → Z (SB → AM)	0.147	2.417	0.016	Supported
5	H5	X5 → Z (TSR → AM)	0.168	2.241	0.025	Supported
6	H6	X6 → Z (PS → AM)	0.132	2.180	0.029	Supported
7	H7	X7 → Z (RA → AM)	0.186	2.851	0.004	Supported
8	H8	X8 → Z (CC → AM)	0.154	2.705	0.007	Supported

All eight predictors had small individual effect sizes on Affiliation Motivation ($f^2 = .026-.053$). Recognition and Appreciation showed the largest individual contribution ($f^2 = .053$), followed by Goal Setting (.046), Classroom Climate (.042), Sense of Belonging (.039), Teacher–Student Relationship (.036), Peer Support (.028), and Self-Efficacy and Social Needs (.026 each). Thus, no single determinant was practically dominant. The model’s explained variance appears to reflect the cumulative contribution of multiple individual, relational, and classroom-level resources.

Structural associations

The direct structural associations were evaluated using path coefficients, bootstrapped t-values, and p-values. Because the predictors and affiliation motivation were measured at the same time, the estimated paths are interpreted as adjusted cross-sectional associations rather than causal effects. The retained model does not include an additional outcome or test mediation. The archived output did not retain percentile or bias-corrected bootstrap confidence intervals. Therefore, confidence intervals were not reconstructed or presented as original SmartPLS bootstrap results. The results of hypothesis testing and structural path coefficients are presented in **Table 17**.

All eight hypothesized associations were positive and statistically significant. Goal Setting ($\beta = .187$, $t = 2.733$, $p = .006$) and Recognition and Appreciation ($\beta = .186$, $t = 2.851$, $p = .004$) had the largest coefficients, followed by Teacher–Student Relationship ($\beta = .168$, $t = 2.241$, $p = .025$), Classroom Climate ($\beta = .154$, $t = 2.705$, $p = .007$), Sense of Belonging ($\beta = .147$, $t = 2.417$, $p = .016$), Self-Efficacy ($\beta = .136$, $t = 2.044$, $p = .041$), Peer Support ($\beta = .132$, $t = 2.180$, $p = .029$), and Social Needs ($\beta = .128$, $t = 2.210$, $p = .027$). Although all eight associations were statistically significant, the coefficients and effect sizes were modest. Several p-values were also relatively close to .05, particularly for Self-Efficacy, Teacher–Student Relationship, Peer Support, and Social Needs. The results should therefore be interpreted as small and potentially sample-sensitive associations rather than strong practical effects.

Common Method Bias Diagnostic

Because all constructs were measured using self-reports collected from the same participants on the same occasion, common method variance remained a design concern. As a supplementary diagnostic, approximate full-collinearity VIFs reconstructed from the retained construct-correlation matrix ranged from 1.30 to 2.26 (AM = 2.26; CC = 1.32; GS = 1.79; PS = 1.46; RA = 1.56; SE = 1.67; SB = 1.30; SN = 1.48; TSR = 1.85). These values were below the conservative 3.3 reference value. However, this supplementary diagnostic cannot rule out common method bias and does not substitute for independent, time separated, observational, or lecturer-rated measurement sources.

DISCUSSION

The findings showed that individual, interpersonal, and classroom-level resources were positively associated with affiliation motivation. Self-efficacy, goal setting, social needs, sense of belonging, teacher–student relationships, peer support, recognition and appreciation, and classroom climate jointly explained 55.8% of the variance in affiliation motivation. However, each predictor had only a small individual effect size, indicating that the constructs operated cumulatively rather than through one dominant determinant.

The positive association between self-efficacy and affiliation motivation is consistent with evidence linking students’ self-beliefs with engagement and motivation across learning contexts (Lai et al., 2018; Schunk & DiBenedetto, 2021). Students with stronger self-efficacy may be more willing to participate socially and academically, which is consistent with a stronger orientation toward affiliation with others. Goal setting was also positively associated with affiliation motivation, aligning with Goal Setting

Theory (Tosi et al., 1991) and previous research emphasizing the importance of clear and challenging goals for persistence and coordinated participation in collaborative learning (Chung et al., 2021; Jeong et al., 2023).

Relational resources also showed positive associations with affiliation motivation. Teacher-student relationships were positively associated with affiliation motivation, consistent with evidence linking warmth, clarity, and teacher presence with students' academic motivation and engagement (Artola Bonanno et al., 2024; Yafie et al., 2022b). Peer support was likewise positively associated with affiliation motivation, consistent with findings that supportive peer networks and feedback are related to persistence, belonging, and emotional resilience in face-to-face and digital learning environments (Byrom, 2018; Luan et al., 2023). These findings highlight the relevance of interpersonal support within learning communities while not implying that teacher or peer support causally increases affiliation motivation.

The positive association between classroom climate and affiliation motivation is consistent with research highlighting the relevance of supportive learning environments for students' academic and psychological experiences (Wang et al., 2022). Inclusive, safe, and collaborative classroom conditions may provide an environment in which students are more comfortable seeking interpersonal connection. Recognition and appreciation were also positively associated with affiliation motivation, consistent with research indicating that acknowledgment of students' efforts can support motivation and accountability (Bliven & Jungbauer, 2021; Yafie et al., 2024). Recognition may contribute to students' self-confidence (Latifah & Ichsan, 2023) while also communicating that their participation and contributions are valued within the learning community.

Both sense of belonging and social needs were positively associated with affiliation motivation, consistent with previous research emphasizing belonging as an important component of student engagement and connectedness (Davies et al., 2025; van Kessel et al., 2025). Belonging has also been associated with social self-efficacy and broader academic outcomes (Beatson et al., 2024). Nevertheless, the two constructs represent conceptually different relational processes in the present model: social needs refer to the desire for interpersonal connection, whereas sense of belonging refers to the experienced state of acceptance and inclusion. Their simultaneous associations with affiliation motivation suggest that both the desire for connection and the experience of inclusion may be relevant in collaborative learning contexts.

This result is consistent with recent studies showing that ethnoscience-integrated inquiry learning significantly enhances retention, engagement, scientific literacy, and process skills when students are socially and culturally motivated (Anamezie & Gumbo, 2024; Mudana, 2023). Ethnoscience approaches inherently value collaboration and cultural context, making affiliation motivation a key driver of success. Moreover, research on inquiry-based and collaborative designs confirms that motivation to affiliate amplifies participation, problem-solving, and co-construction of knowledge (Bektiarso et al., 2024; Yafie et al., 2020).

Overall, the findings indicate that affiliation motivation is associated with a combination of individual, relational, and classroom-level resources. Although all eight associations were statistically significant, the small effect sizes indicate that no single determinant was practically dominant. The results should therefore be interpreted as evidence of cumulative cross-sectional relationships rather than causal effects.

Practical Implications for Teacher Education

Teacher educators can translate the cumulative pattern into a coordinated instructional design. Inquiry groups can establish shared goals and rotating responsibilities; lecturers can provide feedback that recognizes effort as well as culturally grounded contributions; peer-feedback protocols can require respectful acknowledgment before critique; and class norms can explicitly protect students' right to express local knowledge and revise scientific explanations. Periodic check-ins can identify students who feel excluded or uncertain about their role. These strategies should be implemented as complementary supports rather than as claims that any single practice will cause stronger affiliation motivation.

Limitations and Future Research

Several limitations qualify the findings. First, the cross-sectional design does not establish temporal order or causality. Second, although classes were randomly selected, the sample was drawn from a single study program at one institution, which limits the generalizability of the findings to broader preservice-teacher populations. Third, all constructs were measured by self-report at one time point, leaving residual common method risk despite acceptable full-collinearity VIFs. Fourth, the instrument was developed for this context and requires further psychometric work, including formal content-validity assessment, cognitive interviewing, pilot testing, item-level HTMT with bootstrapped confidence intervals, cross-loading inspection, and comparison with alternative higher-order models. Fifth, the small path coefficients and near-threshold p-values may be sensitive to sampling variation. Future studies should use multi-institutional samples, longitudinal or time-lagged designs, independent observational or lecturer-rated outcomes, and preregistered measurement validation.

CONCLUSION

This study found that self-efficacy, goal setting, social needs, sense of belonging, teacher-student relationships, peer support, recognition and appreciation, and classroom climate were positively associated with affiliation motivation among preservice elementary teachers participating in ethnoscience-based inquiry learning. Together, these predictors explained 55.8% of the variance in affiliation motivation. However, each predictor had a small individual effect size, indicating that affiliation motivation was associated with the cumulative contribution of personal, relational, and classroom-level resources rather than one dominant determinant.

Teacher education programs may therefore support affiliation motivation through coordinated strategies that strengthen students' confidence, shared goals, peer collaboration, cultural recognition, supportive teacher relationships, and inclusive classroom conditions. Because the study used cross-sectional, self-reported data from students drawn from randomly selected classes within a single institution, the findings do not establish causality and should be generalized cautiously.

Author contributions: **AA:** conceptualization, methodology, investigation, formal analysis, data curation, writing – original draft, project administration, correspondence; **AK:** conceptualization, supervision, validation, writing – review & editing; **RR:** investigation, data curation, resources, writing – review & editing; **SS:** methodology, validation, investigation, writing – review & editing; **LYW:** investigation, visualization, writing – review & editing; **EE:** supervision, validation, writing – review & editing. All authors agreed with the results and conclusions.

Funding: The authors declare that no specific funding was received for this research from any public, commercial, or not-for-profit funding agency.

Acknowledgements: The authors would like to express their sincere gratitude to the Faculty of Teacher Training and Education and the Faculty of Social and Political Sciences, Universitas Cenderawasih, for their academic support. The authors also thank all Elementary School Teacher Education students who participated voluntarily in this study.

Ethical statement: The authors stated that ethical approval for this study was obtained from the Institute for Research and Community Service (LPPM), Cenderawasih University, under approval number 1165/UN20.2.1/PG/2026, dated 10 August 2026. Participation was voluntary, and participants' confidentiality was maintained throughout the study.

AI statement: The authors stated that generative AI was used solely to improve grammar and language clarity. All revisions were reviewed and approved by the authors.

Declaration of interest: No conflict of interest is declared by the authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

REFERENCES

- Akram, H., & Li, S. (2024). Understanding the role of teacher-student relationships in students' online learning engagement: Mediating role of academic motivation. *Perceptual and Motor Skills*, 131(4), 1415-1438. <https://doi.org/10.1177/00315125241248709>
- Aksah, J. S., Izni, N. A., Mahmood, N. A., Tajuddin, N. I. I., Zainuddin, N., & Rahmat, N. H. (2023). Affiliation, achievement and power in learning motivation: How do they relate? *International Journal of Academic Research in Business and Social Sciences*, 13(8), 1231-1248. <https://doi.org/10.6007/IJARBS/v13-i8/17742>
- Allen, K., Kern, M. L., Vella-Brodick, D., Hattie, J., & Waters, L. (2018). What schools need to know about fostering school belonging: A meta-analysis. *Educational Psychology Review*, 30(1), 1-34. <https://doi.org/10.1007/s10648-016-9389-8>
- Amaliyah, A., Yoenanto, N. H., & Prihastuti, P. (2023). Perception of classroom activity, sense of belonging, and self-regulated learning in students taking online learning. *Psikostudia: Jurnal Psikologi*, 12(2), 257. <https://doi.org/10.30872/psikostudia.v12i2.10212>
- Anamezie, R., & Gumbo, M. (2024). Integrating ethnoscience into optics teaching: Impact on students' retention, engagement, and learning outcome. *Africa Education Review*, 20(5), 78-92. <https://doi.org/10.1080/18146627.2024.2403684>
- Artola Bonanno, A., Briesch, A. M., Lifter, K., & Kemmerer, P. (2024). Measuring teacher-student relationships in adolescence: A systematic, cross-cultural review. *International Journal of School & Educational Psychology*, 12(2), 96-108. <https://doi.org/10.1080/21683603.2024.2328834>
- Asvio, N., Arpinus, & Suharmon. (2017). The influence of learning motivation and learning environment on undergraduate students' learning achievement of management of islamic education, study program of IAIN Batusangkar in 2016. *Noble International Journal of Social Sciences Research*, 2(2), 16–31. <https://ideas.repec.org/a/nap/nijssr/2017p16-31.html>
- Baanqud, N. S., Al-Samarraie, H., Alzahrani, A. I., & Alfarraj, O. (2020). Engagement in cloud-supported collaborative learning and student knowledge construction: A modeling study. *International Journal of Educational Technology in Higher Education*, 17, Article 56. <https://doi.org/10.1186/s41239-020-00232-z>
- Beatson, N., de Lange, P., Tharapos, M., O'Connell, B., Smith, J., Scott, S., & Greatbanks, R. (2024). An examination of self-efficacy and sense of belonging on accounting student achievement. *Accounting & Finance*, 64(1), 723-738. <https://doi.org/10.1111/acfi.13160>
- Bektiarso, S., Walukow, A. F., Narulita, E., & Ali, A. (2024). Khombouw in science learning: Development of teaching materials based on local wisdom guided inquiry model to improve students' interpersonal skills. *Tafkir: Interdisciplinary Journal of Islamic Education*, 5(4), 669-686. <https://doi.org/10.31538/tijie.v5i4.1186>
- Bliven, A., & Jungbauer, M. (2021). The impact of student recognition of excellence to student outcome in a competency-based educational model. *The Journal of Competency-Based Education*, 6(4), 195-205. <https://doi.org/10.1002/cbe2.1264>
- Bonner, P. J., Warren, S. R., & Jiang, Y. H. (2018). Voices from urban classrooms: Teachers' perceptions on instructing diverse students and using culturally responsive teaching. *Education and Urban Society*, 50(8), 697-726. <https://doi.org/10.1177/0013124517713820>
- Borup, J., Graham, C. R., West, R. E., Archambault, L., & Spring, K. J. (2020). Academic communities of engagement: An expansive lens for examining support structures in blended and online learning. *Educational Technology Research and Development*, 68(2), 807-832. <https://doi.org/10.1007/s11423-020-09744-x>

- Byrom, N. (2018). An evaluation of a peer support intervention for student mental health. *Journal of Mental Health*, 27(3), 240-246. <https://doi.org/10.1080/09638237.2018.1437605>
- Chans, G. M., & Portuguese Castro, M. (2021). Gamification as a strategy to increase motivation and engagement in higher education chemistry students. *Computers*, 10(10), Article 132. <https://doi.org/10.3390/computers10100132>
- Chung, H. Q., Chen, V., & Olson, C. B. (2021). The impact of self-assessment, planning and goal setting, and reflection before and after revision on student self-efficacy and writing performance. *Reading and Writing*, 34(7), 1885-1913. <https://doi.org/10.1007/s11145-021-10186-x>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.
- Collie, R. J. (2022). Social-emotional need satisfaction, prosocial motivation, and students' positive behavioral and well-being outcomes. *Social Psychology of Education*, 25(2-3), 399-424. <https://doi.org/10.1007/s11218-022-09691-w>
- Crandall, A., Powell, E. A., Bradford, G. C., Magnusson, B. M., Hanson, C. L., Barnes, M. D., Novilla, M. L. B., & Bean, R. A. (2020). Maslow's hierarchy of needs as a framework for understanding adolescent depressive symptoms over time. *Journal of Child and Family Studies*, 29(2), 273-281. <https://doi.org/10.1007/s10826-019-01577-4>
- Davies, C. A., Cordier, R., Graham, P., Littlefair, D., Speyer, R., & Melo, D. (2025). Interventions to improve connectedness, belonging, and engagement in secondary schools: A systematic review and meta-analysis. *Education Sciences*, 15(5), Article 582. <https://doi.org/10.3390/educsci15050582>
- Davis, M. H. (1983). Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology*, 44(1), 113-126. <https://doi.org/10.1037/0022-3514.44.1.113>
- Debasu, H., & Yitayew, A. (2024). Examining elements of designing and managing of creating inclusive learning environment: Systematic literature review. *International Journal of Special Education*, 39(1), 33-43. <https://doi.org/10.52291/ijse.2024.39.4>
- Dobson, S., Svoen, B., Agrusti, G., & Hardy, P. (Eds.). (2024). *Learning inclusion in a digital age*. Springer Nature Singapore. <https://doi.org/10.1007/978-981-99-7196-1>
- Dunbar, R. L., Dingel, M. J., Dame, L. F., Winchip, J., & Petzold, A. M. (2018). Student social self-efficacy, leadership status, and academic performance in collaborative learning environments. *Studies in Higher Education*, 43(9), 1507-1523. <https://doi.org/10.1080/03075079.2016.1265496>
- Efendi, M. H., & Muliadi, A. (2023). Ethnoscience-based science learning in Sasak ethnic culture: Literature review. *Jurnal Penelitian Pendidikan IPA*, 9(5), 22-33. <https://doi.org/10.29303/jppipa.v9i5.3769>
- Ghaleb, B. D. S. (2024). Effect of exam-focused and teacher-centered education systems on students' cognitive and psychological competencies. *International Journal of Multidisciplinary Approach Research and Science*, 2(2), 611-631. <https://doi.org/10.59653/ijmars.v2i02.648>
- Hard, B. M., & RaoShah, T. (2022). Developing collaborative thinkers: Rethinking how we define, teach, and assess class participation. *Teaching of Psychology*, 49(2), 176-184. <https://doi.org/10.1177/0098628320986953>
- Hernández-Sellés, N., Muñoz-Carril, P.-C., & González-Sanmamed, M. (2019). Computer-supported collaborative learning: An analysis of the relationship between interaction, emotional support and online collaborative tools. *Computers & Education*, 138, 1-12. <https://doi.org/10.1016/j.compedu.2019.04.012>
- Irwandi, I., Santoso, S., Sakroni, S., Lukitasari, M., & Hasan, R. (2022). School-community collaboration in inquiry-based learning to strengthen religious character and improve learning outcome of students. *International Journal of Instruction*, 15(3), 913-930. <https://doi.org/10.29333/iji.2022.15349a>
- Järvenoja, H., Malmberg, J., Törmänen, T., Mänty, K., Haataja, E., Ahola, S., & Järvelä, S. (2020). A collaborative learning design for promoting and analyzing adaptive motivation and emotion regulation in the science classroom. *Frontiers in Education*, 5, Article 111. <https://doi.org/10.3389/feduc.2020.00111>
- Jeong, Y. H., Healy, L. C., & McEwan, D. (2023). The application of goal setting theory to goal setting interventions in sport: A systematic review. *International Review of Sport and Exercise Psychology*, 16(1), 474-499. <https://doi.org/10.1080/1750984X.2021.1901298>
- Jones, C., Volet, S., Pino-Pasternak, D., & Heinimäki, O.-P. (2022). Interpersonal affect in groupwork: A comparative case study of two small groups with contrasting group dynamics outcomes. *Frontline Learning Research*, 10(1), 46-75. <https://doi.org/10.14786/flr.v10i1.851>
- Kariippanon, K. E., Cliff, D. P., Lancaster, S. L., Okely, A. D., & Parrish, A.-M. (2018). Perceived interplay between flexible learning spaces and teaching, learning and student wellbeing. *Learning Environments Research*, 21(3), 301-320. <https://doi.org/10.1007/s10984-017-9254-9>
- Khery, Y., Hakim, A., Rokhmat, J., & Sukarso, A. (2025). Effectiveness of ethnoscience oriented project to improve students performance. *Multidisciplinary Science Journal*, 7(8), Article 2025417. <https://doi.org/10.31893/multiscience.2025417>
- Kourti, S. K. (2019). Students' engagement in inquiry-based learning: Cognition, behavior and affect. In *Proceedings of the Eleventh Congress of the European Society for Research in Mathematics Education (CERME11)* (pp. 1461-1468).
- Lai, C.-L., Hwang, G.-J., & Tu, Y.-H. (2018). The effects of computer-supported self-regulation in science inquiry on learning outcomes, learning processes, and self-efficacy. *Educational Technology Research and Development*, 66(4), 863-892. <https://doi.org/10.1007/s11423-018-9585-y>

- Latifah, A., & Ichsan, I. (2023). Providing rewards as an effort to grow self-confidence in Madrasah Ibtidaiyah students. *Al-Aulad: Journal of Islamic Primary Education*, 6(1), 25-35. <https://doi.org/10.15575/al-aulad.v6i1.22270>
- Li, J., & Xue, E. (2023). Dynamic interaction between student learning behaviour and learning environment: Meta-analysis of student engagement and its influencing factors. *Behavioral Sciences*, 13(1), Article 59. <https://doi.org/10.3390/bs13010059>
- Luan, L., Hong, J.-C., Cao, M., Dong, Y., & Hou, X. (2023). Exploring the role of online EFL learners' perceived social support in their learning engagement: A structural equation model. *Interactive Learning Environments*, 31(3), 1703-1714. <https://doi.org/10.1080/10494820.2020.1855211>
- Mahmud, S. N. D., Husnin, H., & Tuan Soh, T. M. (2020). Teaching presence in online gamified education for sustainability learning. *Sustainability*, 12(9), Article 3801. <https://doi.org/10.3390/su12093801>
- Maisarah, M. (2024). Enhancing children's learning motivation through positive reinforcement: A classroom communication strategy. *Jurnal Smart*, 10(1), 81-95. <https://doi.org/10.52657/js.v10i1.2289>
- Martinot, D., Sicard, A., Gul, B., Yakimova, S., Taillandier-Schmitt, A., & Maintenant, C. (2022). Peers and teachers as the best source of social support for school engagement for both advantaged and priority education area students. *Frontiers in Psychology*, 13, Article 958286. <https://doi.org/10.3389/fpsyg.2022.958286>
- Mittelmeier, J., Rienties, B., Tempelaar, D., & Whitelock, D. (2018). Overcoming cross-cultural group work tensions: Mixed student perspectives on the role of social relationships. *Higher Education*, 75(1), 149-166. <https://doi.org/10.1007/s10734-017-0131-3>
- Mudana, W. (2023). The effect of ethnoscience-based course review horay learning towards cultural concept understanding and science process skills of the elementary school students. *Nurture*, 17(2), 137-148. <https://doi.org/10.55951/nurture.v17i2.253>
- Nekhorosheva, E. V. (2020). Creating security in the teacher-student relationship from the perspective of the existential-analytical approach. In E. Tareva & T. N. Bokova (Eds.), *Dialogue of cultures—Culture of dialogue: From conflicting to understanding* (European Proceedings of Social and Behavioural Sciences, Vol. 95, pp. 654-664). European Publisher. <https://doi.org/10.15405/epsbs.2020.11.03.69>
- Owens, D. C., Sadler, T. D., Barlow, A. T., & Smith-Walters, C. (2020). Student motivation from and resistance to active learning rooted in essential science practices. *Research in Science Education*, 50(1), 253-277. <https://doi.org/10.1007/s11165-017-9688-1>
- Parmiti, D. P., Rediani, N. N., Antara, I. G. W. S., & Jayadiningrat, M. G. (2021). The effectiveness of local culture-integrated science learning through project-based assessment on scientific attitudes and science process skills of elementary school students. *Jurnal Pendidikan IPA Indonesia*, 10(3), 439-446. <https://doi.org/10.15294/jpii.v10i3.31301>
- Pastore, G., & Luder, R. (2021). Teacher-student-relationship quality in inclusive secondary schools: Theory and measurement of emotional aspects of teaching. *Frontiers in Education*, 6, Article 643617. <https://doi.org/10.3389/feduc.2021.643617>
- Schnell, J., Saxer, K., Mori, J., & Hascher, T. (2025). Feeling well and doing well: The mediating role of school engagement in the relationship between student well-being and academic achievement. *European Journal of Psychology of Education*, 40, Article 48. <https://doi.org/10.1007/s10212-025-00947-5>
- Schunk, D. H., & DiBenedetto, M. K. (2021). Self-efficacy and human motivation. *Advances in Motivation Science*, 8, 153-179. <https://doi.org/10.1016/bs.adms.2020.10.001>
- Shinde, S. (2025). Peer-to-peer recognition systems and their impact on employee commitment: A case-based exploration of culture, motivation, and retention. *Research Review Journal of Social Science*, 5(1), 58-68. <https://doi.org/10.31305/rrjss.2025.v05.n01.007>
- Shteynberg, G., Hirsh, J. B., Bentley, R. A., & Garthoff, J. (2020). Shared worlds and shared minds: A theory of collective learning and a psychology of common knowledge. *Psychological Review*, 127(5), 918-931. <https://doi.org/10.1037/rev0000200>
- Sökmen, Y. (2021). The role of self-efficacy in the relationship between the learning environment and student engagement. *Educational Studies*, 47(1), 19-37. <https://doi.org/10.1080/03055698.2019.1665986>
- Syahmani, S., Rahmatilah, J., Winarti, A., Kusasi, M., Iriani, R., & Prasetyo, Y. D. (2022). Development of guided inquiry lesson based on ethnoscience e-modules to improve students' problem-solving ability in chemistry class. *Journal of Innovation in Educational and Cultural Research*, 3(4), 670-682. <https://doi.org/10.46843/jiecr.v3i4.363>
- Thornhill-Miller, B., Camarda, A., Mercier, M., Burkhardt, J.-M., Morisseau, T., Bourgeois-Bougrine, S., Vinchon, F., El Hayek, S., Augereau-Landais, M., Mourey, F., Feybesse, C., Sundquist, D., & Lubart, T. (2023). Creativity, critical thinking, communication, and collaboration: Assessment, certification, and promotion of 21st century skills for the future of work and education. *Journal of Intelligence*, 11(3), Article 54. <https://doi.org/10.3390/jintelligence11030054>
- Tong, D. H., Uyen, B. P., & Ngan, L. K. (2022). The effectiveness of blended learning on students' academic achievement, self-study skills and learning attitudes: A quasi-experiment study in teaching the conventions for coordinates in the plane. *Heliyon*, 8(12), Article e12657. <https://doi.org/10.1016/j.heliyon.2022.e12657>
- Tormis, M. B., Banaan, R. J., Magsucang, C. J. T., Juela, P. S., Butalid, M. S., Teña, S. J. S., Jikiri, S. S., Bais, R. L., Jr., & Esperat, H. P. (2025). Classroom climate as a predictor of academic performance: An empirical analysis. *Psychology and Education: A Multidisciplinary Journal*, 31(5), 536-541. <https://doi.org/10.5281/zenodo.14773224>
- Tosi, H. L. (1991). A theory of goal setting and task performance [Review of the book *A theory of goal setting and task performance*, by E. A. Locke & G. P. Latham]. *Academy of Management Review*, 16(2), 480-483. <https://doi.org/10.2307/258875>

- Tsai, C.-A., Song, M.-Y. W., Lo, Y.-F., & Lo, C.-C. (2023). Design thinking with constructivist learning increases the learning motivation and wicked problem-solving capability—An empirical research in Taiwan. *Thinking Skills and Creativity*, 50, Article 101385. <https://doi.org/10.1016/j.tsc.2023.101385>
- Turyamureeba, S. (2024). Collaborative learning environments: Encouraging peer-to-peer interaction. *Eurasian Experiment Journal of Humanities and Social Sciences*, 5(2), 1-4.
- van Kessel, G., Ryan, C., Paras, L., Johnson, N., Zariff, R. Z., & Stallman, H. M. (2025). Relationship between university belonging and student outcomes: A systematic review and meta-analysis. *The Australian Educational Researcher*, 52(3), 2511-2534. <https://doi.org/10.1007/s13384-025-00822-8>
- Wall, C. R. G. (2021). Relationship over reproach: Fostering resilience by embracing a trauma-informed approach to elementary education. *Journal of Aggression, Maltreatment & Trauma*, 30(1), 118-137. <https://doi.org/10.1080/10926771.2020.1737292>
- Wang, X., Hassan, A. B., Pyng, H. S., & Ye, H. (2022). Exploring the influence of teacher-student interaction strength, interaction time, interaction distance and interaction content on international student satisfaction with online courses. *International Journal of Learning, Teaching and Educational Research*, 21(2), 380-396. <https://doi.org/10.26803/ijlter.21.2.21>
- Yafie, E., Anisa, N., Maningtyas, R. D. T., Iriyanto, T., Jumaat, N. F., & Widiastih, R. M. (2024). Enhancing early childhood educator's digital competencies through AI-powered learning modules (AI-PEL) training program. *Al-Athfal: Jurnal Pendidikan Anak*, 10(1), 73-82. <https://doi.org/10.14421/al-athfal.2024.101-07>
- Yafie, E., Ashari, Z. M., & Samah, N. A. (2022a). Mobile parenting training program based on a ubiquitous learning context to improve parenting skill: The moderating role parental locus of control. *International Journal of Interactive Mobile Technologies*, 16(2), 42-58. <https://doi.org/10.3991/ijim.v16i02.27301>
- Yafie, E., Haqqi, Y. A., Robbaniyah, I., Maulidia, L. N., Azizah, A. R., & Astuti, W. (2022b). Effectiveness mobile peer support application to enhance teacher competence: The moderating role teacher self-efficacy. In *2022 2nd International Conference on Information Technology and Education (ICITE)* (pp. 347-352). IEEE. <https://doi.org/10.1109/ICITE54466.2022.9759861>
- Yafie, E., Samah, N. A., Mohamed, H., & Haqqi, Y. A. (2020). Collaborative mobile seamless learning (CMSL) based on Android apps to improving critical thinking in higher education in the post-COVID-19 era. *Journal of Advanced Research in Dynamical and Control Systems*, 12(Special Issue 7), 428-441. <https://doi.org/10.5373/JARDCS/V12SP7/20202125>
- Yildiz, N. G. (2021). School counselors' leadership role in creating a collaborative school climate for linguistically diverse students. *Journal of Education and Learning*, 10(6), 7-17. <https://doi.org/10.5539/jel.v10n6p7>
- Yogeesha, C. (2016). The influence of peer interaction on learning. *International Journal of Research and Analytical Reviews*, 3(3), 930-937.
- Yu, J., Huang, C., Han, Z., He, T., & Li, M. (2020). Investigating the influence of interaction on learning persistence in online settings: Moderation or mediation of academic emotions? *International Journal of Environmental Research and Public Health*, 17(7), Article 2320. <https://doi.org/10.3390/ijerph17072320>
- Zhao, L., Lu, Y., Wang, B., Chau, P. Y. K., & Zhang, L. (2012). Cultivating the sense of belonging and motivating user participation in virtual communities: A social capital perspective. *International Journal of Information Management*, 32(6), 574-588. <https://doi.org/10.1016/j.ijinfomgt.2012.02.006>
- Zhao, X., Ismail, I. S., & Narasuman, S. (2022). Measurement indicators of student engagement and investigation on student engagement in blended learning. In *Proceedings of the 2022 3rd International Conference on Artificial Intelligence and Education (IC-ICAIE 2022)* (pp. 823-829). Atlantis Press. https://doi.org/10.2991/978-94-6463-040-4_125
- Zheng, F. (2022). Fostering students' well-being: The mediating role of teacher interpersonal behavior and student-teacher relationships. *Frontiers in Psychology*, 12, Article 796728. <https://doi.org/10.3389/fpsyg.2021.796728>
- Zheng, J. (2021). A functional review of research on clarity, immediacy, and credibility of teachers and their impacts on motivation and engagement of students. *Frontiers in Psychology*, 12, Article 712419. <https://doi.org/10.3389/fpsyg.2021.712419>