



Cooperative learning, positive classroom climate, school environment, and mindset: Unraveling their impact on students' social-emotional learning

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Abstract

This study investigates the complex dynamics between cooperative learning, positive classroom climate, school environment, and mindset in fostering students' social-emotional learning (SEL). Using Partial Least Squares Structural Equation Modeling (PLS-SEM) and mediation analysis of data from 1,111 early secondary students in Northern Thailand, the findings reveal a nuanced interplay of factors. Cooperative learning emerged as the strongest direct influencer on SEL, demonstrating a medium effect size ($f^2 = 0.176$), followed by growth mindset ($f^2 = 0.076$). Notably, school environment exhibited the highest total effect ($b = 0.537$) and indirect effect ($b = 0.447$), primarily channeled through positive classroom climate and cooperative learning. Both fixed and growth mindsets demonstrated remarkable mediating capabilities when integrated with supportive environmental factors, achieving full mediation in two distinct pathways (VAF = 0.8050 for fixed mindset and VAF = 0.8255 for growth mindset). These findings underscore the critical importance of aligning external educational ecosystems with students' internal mindsets, offering valuable insights for educators and policymakers in designing comprehensive SEL interventions across diverse educational contexts.

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Introduction

Social-Emotional Learning (SEL) is a critical component in fostering an environment that nurtures students' holistic development. When students develop skills in perceiving and managing their emotions, understanding others, and building positive relationships with peers and teachers, it creates an atmosphere of

mutual trust and respect in the classroom. This enhances learning motivation, leading to better academic performance and personal well-being (Weissberg et al., 2015). With high learning motivation, students become more expressive, confident, and able to analyze and solve problems effectively (Durlak et al., 2011; Taylor et al., 2017). Furthermore, developing social and emotional skills encourages students to take greater responsibility

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for their learning and actions as they gain better self-awareness and self-management (Collaborative for Academic, Social, and Emotional Learning, 2020).

However, promoting SEL in classrooms faces numerous challenges. Many teachers lack the knowledge and training to integrate SEL activities into their lessons effectively, potentially due to insufficient professional development in this area (Schonert-Reichl et al., 2017). Excessive teaching workloads limit teachers' time for planning and implementing SEL-promoting activities (Humphries et al., 2018). Large class sizes hinder personalized attention to students' needs (Durlak et al., 2011). Additionally, cultural norms in some societies prioritize academic achievement over social-emotional development, which could undermine SEL initiatives (Collie et al., 2015). Finally, underlying behavioral, emotional, or family-related issues may impede SEL development if appropriate support is not provided (Greenberg et al., 2017). These factors pose significant obstacles that require collaboration from all stakeholders—teachers, administrators, parents, and researchers—to overcome and achieve holistic student development.

Students' SEL development results from the interplay of various internal and external factors. Specifically: (i) Cooperative Learning fosters social-emotional skills by encouraging teamwork, communication, and acceptance of differing viewpoints (Johnson & Johnson, 2009). It develops emotional intelligence, self-confidence, intrinsic motivation, empathy, responsibility, and conflict resolution (Bialik & Tinari, 2015; Slavin, 2014), (ii) A Positive Classroom Climate characterized by empathetic teacher-student interactions promotes SEL competencies like self-expression, emotion regulation, and resilience (Caniëls et al., 2019; Jennings & Greenberg, 2009; Reyes et al., 2012). It reduces undesirable behaviors such as aggression and anxiety while enhancing engagement and achievement, (iii) A supportive School Environment lays the foundation for SEL by creating safe, inclusive spaces that encourage positive relationships, respect differences, and provide opportunities for experiential learning (Barr, 2016; Thapa et al., 2013). It influences SEL indirectly through shaping classroom climates and enabling cooperative pedagogies.

The mediating role of Mindset is crucial in linking environmental factors to SEL outcomes. Growth Mindset, which views abilities as malleable through effort, fosters motivation, perseverance, and adaptability, conducive to SEL development (Burnette et al., 2013; Yeager & Dweck, 2012). Conversely, Fixed Mindset undermines potential by reinforcing beliefs that abilities are static

and unchangeable (Dweck, 2006). Cooperative learning and interactive environments cultivate Growth Mindset, promoting SEL-conducive traits such as confidence, perspective-taking, communication, empathy, and teamwork (Alzahrani et al., 2019; Zhao et al., 2021). Thus, studying the mediating role of Mindset between external factors (school environment, classroom climate, cooperative learning) and adolescents' SEL provides theoretical and practical insights into the mechanisms driving these developmental trajectories.

This study aims to comprehensively understand how cooperative learning, positive classroom climate, school environment, and Mindset shape adolescents' social-emotional learning (SEL). It examines the mediating role of Mindset between these factors and SEL outcomes among 1,111 early secondary students in Northern Thailand. By employing Bronfenbrenner's (1979) Ecological Systems Theory and the bioecological model of human development (Bronfenbrenner & Morris, 2006), together with Dweck's (2006) Mindset Theory, the findings will inform strategies for creating nurturing educational ecosystems that promote desirable mindsets and unlock students' full potential.

Literature Review

Social-Emotional Learning (SEL) has gained prominence since the 1990s as educators realized its importance alongside academics for thriving in today's complex society. Early research examined SEL programs' impact on students' achievement, behavior, and mental health (Durlak et al., 2011; Jones & Bouffard, 2012). Subsequent studies expanded to factors influencing program effectiveness, such as classroom climate, school culture, teaching approaches (Jennings & Greenberg, 2009; Oberle et al., 2016), and learners' self-perception and regulation processes (Taylor et al., 2017; Yang et al., 2019). A key finding was that SEL fosters higher emotional intelligence for better emotion control, focus, and effective learning (Brackett et al., 2011); stronger social skills for building positive relationships, collaboration, empathy, and constructive conflict resolution (Durlak et al., 2011); and promotes a positive learning environment conducive to academic success (Panayiotou et al., 2019).

Current SEL research explores program design, long-term evaluation, and applications for addressing societal issues (Brackett et al., 2019; Mahoney et al., 2020), contributing valuable knowledge to continuously enhance SEL instruction for developing learners' essential competencies. The CASEL Framework systematically

outlines five core SEL components: self-awareness, self-management, social awareness, relationship skills, and responsible decision-making (Durlak et al., 2015; Weissberg et al., 2015). This comprehensive theory provides clarity on necessary SEL competencies, guides program/curriculum development and evaluation (Lawson et al., 2019), and highlights SEL's connections to academic learning, well-being, and positive behaviors (Yang et al., 2018). Thus, it serves as a valuable foundation for effectively and sustainably developing SEL.

Positive classroom climate significantly impacts adolescents' social-emotional learning. A warm, supportive atmosphere enhances motivation, engagement, and achievement through empathetic, respectful teacher-student interactions (Durlak et al., 2011; Jennings & Greenberg, 2009; Reyes et al., 2012). It also reduces undesirable adolescent behaviors like aggression, anxiety, and depression while building resilience during challenging transitions (Domitrovich et al., 2017). For instance, when students feel connected to their teachers and peers, they are more likely to develop SEL competencies like self-confidence, emotion regulation, and intrinsic motivation for self-improvement.

Cooperative learning powerfully develops social-emotional skills and collaborative concepts, promoting achievement and social skills through small-group interactions and peer support (Bandura, 1977; Johnson & Johnson, 2009; Johnson et al., 2000; Roseth et al., 2008; Sharan, 2010). It cultivates respect for diversity, effective communication, creative teamwork, leadership/follower roles, understanding responsibilities, and group processing (Slavin, 2014). Additionally, cooperative learning fosters intrinsic motivation, self-expression, confidence, and critical thinking—key traits of 21st-century learners (Bialik & Tinari, 2015). These findings align with Vygotsky's (1978) Social Learning Theory emphasizing how interactive environments facilitate cognitive and social growth.

School environment significantly shapes adolescents' SEL development, as schools serve as their primary daily context. A positive, safe, and orderly school climate promotes emotional well-being, positive attitudes, and appropriate social behaviors (Roeser et al., 1996; Thapa et al., 2013). Supportive policies, collaborative teaching methods, respectful student participation opportunities, and conducive physical spaces enable effective cooperative learning and positive classroom climates (Barr, 2016; Durlak et al., 2011; Johnson & Johnson, 2009). Overall, a positive school environment lays the crucial foundation for comprehensively developing students' social-emotional skills for future

success. This encapsulates Bronfenbrenner's (1979) Ecological Systems Theory which underscores how macro-level environmental factors influence micro-level developmental processes.

Mindset refers to beliefs about abilities and potential, categorized into two types: Fixed Mindset (FIX) and Growth Mindset (GRO). Fixed mindset assumes that abilities are innate and unchangeable, potentially undermining motivation and adaptability (Dweck, 2006). Conversely, growth mindset views abilities as malleable through effort and practice, fostering intrinsic motivation, perseverance, and adaptability conducive to SEL development (Burnette et al., 2013; Dweck, 2016; Romero et al., 2014; Yeager & Dweck, 2012). Research shows that growth mindset amplifies the effects of supportive environments and interactive pedagogies, promoting SEL-conducive traits like confidence, perspective-taking, communication, empathy, and teamwork (Alzahrani et al., 2019; Zhao et al., 2021). While growth mindset demonstrates stronger individual mediation effects than fixed mindset, both mindsets exhibit comparable mediation when dynamically integrated alongside school environment, classroom climate, and cooperative learning factors. This suggests that mindsets alone are insufficient catalysts; their actualization hinges upon being nurtured through conducive schoolwide foundations and interactive pedagogies (Hattie, 2008).

Mediation analysis is theoretically and practically significant for understanding how external factors (school environment, classroom climate, cooperative learning) influence internal SEL outcomes via mindset mediators. Specifically, single mediator models examine the role of mindset between independent variables and SEL, while series mediation models investigate combined influences of multiple mediators (Hayes, 2018). Variance Accounted For (VAF = IE/TE) quantifies mediation magnitude: full ($VAF > 0.80$), partial ($0.20 < VAF < 0.80$), or no mediation ($VAF < 0.20$). For example, results indicate that growth mindset exhibits more pronounced individual mediation in single paths but diminishes when integrated with additional mediators. Both mindsets fully mediate in joint mediator models, suggesting their realization depends on supportive schoolwide foundations and interactive pedagogies.

To address the conceptual framework's alignment with data analysis, this study examines whether POC, COO, FIX, and GRO act as mediators linking SEC to SEL outcomes. Hypotheses H6-H17 explore these mediation effects, informed by empirical evidence showing that mindset mediates relationships between external factors and SEL. For instance, H16 ($SEC \rightarrow POC \rightarrow COO \rightarrow$

FIX → SEL) and H17 (SEC → POC → COO → GRO → SEL) demonstrate near-equal full mediation effects, underscoring the importance of integrating mindset into educational ecosystems.

Organizing the literature review around relationships between SEL and related factors ensures coherence and flow from general to specific. Studies confirm that school environment indirectly influences SEL through shaping classroom climates and enabling cooperative pedagogies (Collie et al., 2015). For example, supportive school policies promote inclusivity, safety, and experiential learning, creating conditions conducive to SEL development. Similarly, a positive classroom climate enhances trust, respect, and engagement, while cooperative learning facilitates teamwork, communication, and empathy—all integral to fostering SEL competencies.

Methodology

Participants

Participants for this study were 1,111 early secondary school students from various schools in the northern region of Thailand. The selection process utilized a multi-stage random sampling method, ensuring diversity and representativeness across different school sizes and geographic locations. The sample size was determined using power analysis, considering 10 latent variables and 22 observed variables in the hypothesized model. A power level ($1-\beta$) of 0.80 was chosen, reflecting a 20 percent probability of failing to reject a false null hypothesis. An effect size (f^2) of 0.15 was selected as medium based on prior research recommendations, and a significance level (α) of 0.05 was applied, representing a 5 percent probability of error (Cohen, 1992). This yielded a minimum required sample size of 876 participants, which was exceeded by the actual data collection.

Schools in Northern Thailand were categorized into three strata based on size: (i) small schools: Fewer than 300 students, (ii) medium schools: Between 300–600 students, and (iii) large schools: More than 600 students.

In the northern region, small schools constituted the majority (56.61%) of all schools. Using stratified random sampling, schools were proportionally selected from each category to ensure balanced representation. For schools with multiple classrooms at the target grade levels (Grades 7–9), classrooms were randomly selected using cluster sampling. Specifically:

- In small schools, where there were fewer classrooms

per grade, all available classrooms were included.

- In medium and large schools, one classroom was randomly selected to avoid over-representation.

This approach ensured that students from diverse classroom environments were included in the study. The demographic characteristics of participants were 11–17 years, with an average age of approximately 13.713 years, male (41.4%, $n = 460$) and female (58.6%, $n = 650$), grade 7 (34.7%, $n = 385$), grade 8 (32.4%, $n = 361$), and grade 9 (32.9%, $n = 365$). Students completed questionnaires without time limits, taking approximately 12–19 minutes per questionnaire. Researchers contacted schools, introduced the study, explained instruments and procedures to students, and ensured confidentiality throughout the data collection process.

Data Collection

To measure the variables in this study, a 5-point rating scale questionnaire was developed. The scale ranged from 1 = strongly disagree/never practiced to 5 = strongly agree/always practiced, ensuring comprehensive coverage of the observed variables in the hypothesized model. To ensure content validity, the questionnaire was reviewed by four experts in education and psychology, and their feedback was incorporated to improve completeness before piloting with 100 students. The pilot data were analyzed for discriminant validity using item-total correlation via Pearson's correlation coefficients (r_{xy}), and reliability was assessed for each observed variable using Cronbach's alpha coefficients (α). Below is an explanation of how each variable was measured, along with sample items for clarity.

Positive Classroom Climate (POC) reflects teacher-student and peer interactions characterized by understanding, support, respect, friendliness, relaxation, and safety, fostering self-confidence and motivation for self-development. It comprises three observed variables: autonomy (CLA1), challenge (CLA2), and promoting respect for others (CLA3), measured by nine items such as “I am given opportunities to express my opinions in class,” “My teacher encourages me to try new things that challenge me,” and “The classroom atmosphere helps me recognize the value of diversity.” Discriminant values ranged from 0.291–0.663, and reliability (Cronbach's alpha) was 0.861, indicating good internal consistency.

Cooperative Learning (COO) emphasizes positive student interactions through teamwork, exchanging viewpoints, and collaborative problem-solving. It includes four observed variables: positive interdependence (COO1), exchanging viewpoints (COO2), small group

work (COO3), and group processing (COO4), measured by twelve items such as “When working in groups, we all depend on each other to succeed,” “I listen to others’ ideas during group activities and incorporate them into our work,” “Group tasks help me understand the material better than working alone,” and “We discuss how to improve our group dynamics after completing tasks.” Discriminant values ranged from 0.491–0.680, and reliability (Cronbach’s alpha) was 0.895, reflecting robust measurement properties.

Mindset refers to students’ beliefs about their abilities and potential, categorized into two types: Fixed Mindset (FIX) and Growth Mindset (GRO). FIX assumes that abilities are innate and unchangeable, measured by three items such as “My intelligence is something I cannot change much” (FIX1), “I cannot significantly improve my skills no matter how hard I try” (FIX2), and “Talent determines success more than effort” (FIX3). Discriminant values ranged from 0.533–0.731, and reliability (Cronbach’s alpha) was 0.712. GRO views abilities as malleable through intentional effort and practice, also measured by three items such as “No matter who we are, we can always develop our intelligence” (GRO1), “Humans can always change their intelligence with practice” (GRO2), and “I believe I can always improve my intelligence regardless of my starting point” (GRO3). Discriminant values ranged from 0.702–0.747, and reliability (Cronbach’s alpha) was 0.795, confirming the distinct roles of both mindsets in SEL development. These items were adapted from Dweck (2006) and modified for adolescent learners.

School Environment (SEC) encompasses physical and social characteristics that promote peaceful coexistence, acceptance of differences, respect, adaptability, and harmonious living. It includes four observed variables: spaces promoting interaction (ENV1), extracurricular activities for social learning (ENV2), freedom to choose activities (ENV3), and promoting acceptance of identities (ENV4), measured by twelve items such as “Our school provides areas where students can interact and collaborate effectively,” “School activities help me develop friendships and social skills,” “I have the opportunity to choose activities that interest me,” and “Our school respects and celebrates cultural diversity among students.” Discriminant values ranged from 0.534–0.707, and reliability (Cronbach’s alpha) was 0.928, demonstrating high validity and reliability.

Social-Emotional Learning (SEL) was operationalized into five core components: Self-awareness (SEA), Self-management (SEM), Social Awareness (SOA), Relationship Skills (RES), and Responsible Decision-

making (RDM). Each component was measured using specific items: SEA (9 items), SEM (15 items), SOA (16 items), RES (15 items), and RDM (10 items). Discriminant values and reliability scores were reported for each aspect, with composite reliability (CR) ranging from 0.7995 (POC) to 0.8860 (SEL) and average variance extracted (AVE) ranging from 0.5078 (POC) to 0.7097 (GRO).

Data collection involved contacting schools, introducing the study objectives, explaining instruments and procedures to students while ensuring confidentiality. Students completed questionnaires without time limits, taking approximately 12–19 minutes per set. Out of 1,200 distributed questionnaires, 1,111 valid responses were collected, with only four excluded due to incomplete answers exceeding 30 percent. This study received ethical approval from the Chiang Mai University Ethics Committee (COA No. 053/66; CMUREC No. 66/085).

Data Analysis

To analyze the relationships between the variables in this study, Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed. This method is particularly suitable for studying causal relationships among multivariate constructs and aligns well with the hypothesized model’s complexity (Hair et al., 2017). Parameters were estimated using the PLS algorithm, while significance was tested through Bootstrapping with 5,000 resamples (Hair et al., 2017).

Given that the hypothesized model included formative-formative higher-order constructs, the disjoint two-stage approach was used to reduce complexity, prevent multicollinearity, and minimize measurement error (Sarstedt et al., 2019). In the first stage, a model with lower-order constructs and mediators was analyzed to obtain standardized lower-order construct scores. These scores were then used as indicators for newly created higher-order constructs in the second stage, re-analyzing the model while maintaining the mediating roles of mindset (FIX/GRO) between external factors (SEC, POC, COO) and social-emotional learning (SEL).

The analysis was conducted using ADANCO version 2.4 software (Henseler & Dijkstra, 2015), which facilitates robust estimation of parameters for complex models with multiple mediators. Below are the key steps followed in the data analysis process: (i) Overall Model Fit Assessment: The Standardized Root Mean Square Residual (SRMR) was used to evaluate the overall fit of the model. A value below 0.080 indicates good alignment between the estimated and empirical covariance matrices

(Hair et al., 2017), (ii) Measurement Model Evaluation: Reflective measurement structures were assessed using loadings, Cronbach's Alpha coefficients (CA), construct reliability measures (ρ_A), composite reliabilities (CR), and average variance extracted (AVE). For discriminant validity, both the Heterotrait-Monotrait Ratio of Correlations (HTMT) and Fornell-Larcker Criterion were applied. HTMT values less than 0.85 and square roots of AVE greater than correlations with other latent variables confirmed adequate discriminant validity (Fornell & Larcker, 1981; Sarstedt et al., 2019), and (iii) Structural Model Assessment: Path coefficients, R^2 values, and f^2 effect sizes were calculated to evaluate the structural model. Indirect effects (IE) and total effects (TE) were also assessed to determine the mediating role of mindset (FIX/GRO) between independent variables (SEC, POC, COO) and the dependent variable (SEL). Variance Accounted For ($VAF = IE/TE$) quantified the magnitude of mediation effects, categorized as full ($VAF > 0.80$), partial ($0.20 < VAF < 0.80$), or no mediation ($VAF < 0.20$) (Hayes, 2018).

To test single mediator models, the direct effect (DE) was compared before (C) and after (C') adding the mediator, along with indirect effects (IE) and total effects (TE). Significance levels for both direct and indirect effects were tested at the 0.01 level. For series mediation analysis, additional mediators were included sequentially based on hypotheses H12-H17. This approach ensured a systematic evaluation of mediation pathways, reflecting the interplay between school environment, classroom climate, cooperative learning, and mindset in influencing SEL outcomes.

The justification for using PLS-SEM over traditional SEM lies in its suitability for handling complex models with formative constructs and mediation pathways. It also provides robust estimates even when data distributions deviate from normality, enhancing the reliability and validity of findings (Hair et al., 2017). Furthermore, the disjoint two-stage approach ensures accurate handling of measurement error by analyzing lower-order constructs separately before integrating them into higher-order constructs, reducing multicollinearity and increasing confidence in the reported results (Sarstedt et al., 2019).

Results

Overall and Measurement Model Assessment

After analyzing the higher-order construct model using Partial Least Squares Structural Equation Modeling

(PLS-SEM), the SRMR value of 0.0614 indicates good fit between the estimated and empirical covariance matrices. Evaluating the reflective measurement structures reveals observed variable means ranging from 3.374 (CLA1) to 4.339 (GRO3), with standard deviations between 0.770 (COO3) and 1.111 (CLA1), except for the standardized social-emotional learning variable derived from z-scores in the first step of analysis. Data distribution is approximately normal based on skewness (-0.995 to -0.194) and kurtosis (-0.580 to 0.679). Loadings for each observed variable range from 0.7301 (SEA and FIX3) to 0.8467 (GRO2), all significantly different from zero at the 0.01 level. Reliability assessments show Cronbach's Alpha values between 0.7137 (FIX) and 0.8427 (SEL), construct reliability measures between 0.7184 (FIX) and 0.8749 (SEC), composite reliabilities between 0.7995 (POC) and 0.8860 (SEL), and AVE values from 0.5078 (POC) to 0.7097 (GRO), all exceeding recommended thresholds. These results demonstrate good measurement model quality, reliability, and suitability for structural model analysis. Details are presented in Table 1.

Discriminant Validity Assessment

The discriminant validity assessment confirms that latent variables exhibit good separation. The HTMT values range from 0.1404 (FIX-POC) to 0.8034 (SEL-COO), meeting the criterion of $HTMT < 0.85$. Additionally, the square roots of AVE shown diagonally in parentheses exceed correlations with other latent variables below the diagonal AVEs. This supports discriminant validity across all six latent variables, ensuring accurate measurement of intended constructs. Results are detailed in Table 2 and Table 3.

Structural Model Assessment

The structural model analysis revealed that the latent variables collectively explained 53.10 percent of the variance in social-emotional learning (SEL). This finding aligns with Bronfenbrenner's (1979) Ecological Systems Theory emphasizing how macro-level environmental factors interact with micro-level processes to shape developmental trajectories. Specifically, the school environment (SEC) emerged as the most influential variable with the highest total effect ($b = 0.537$) and indirect effect ($b = 0.447$) on SEL, indicating its foundational role in fostering SEL outcomes through supportive classroom climates and cooperative learning environments.

Cooperative Learning (COO) demonstrated the

Table 1 Measurement model result

Construct	Mean	SD	Sk	Kur	Loading	CA	ρ_A	CR	AVE
Social-emotional Learning ^a (SEL)									
SEA	0.000	1.000	-0.194	-0.006	0.7301**	0.8428	0.8495	0.8860	0.6155
SEM	0.000	1.000	-0.210	-0.430	0.8003**				
SOA	0.000	1.000	-0.396	0.534	0.7244**				
RES	0.000	1.000	-0.445	0.136	0.8415**				
RDM	0.000	1.000	-0.379	-0.229	0.8192**				
Fix Mindset (FIX)									
FIX1	3.589	0.946	-0.533	0.190	0.8273**	0.7137	0.7184	0.8402	0.6375
FIX2	3.474	0.932	-0.383	0.130	0.8337**				
FIX3	3.558	0.974	-0.418	-0.077	0.7301**				
Growth Mindset (GRO)									
GRO1	4.292	0.812	-0.995	0.679	0.8446**	0.7961	0.7992	0.8800	0.7097
GRO2	4.120	0.858	-0.627	-0.341	0.8467**				
GRO3	4.339	0.773	-0.971	0.425	0.8361**				
Positive Classroom (POC)									
CLA1	3.374	1.111	-0.339	-0.580	0.7714**	0.7325	0.7995	0.7995	0.5078
CLA2	3.489	1.024	-0.458	-0.177	0.7411**				
CLA3	3.849	0.851	-0.305	-0.406	0.7538**				
Cooperative Learning (COO)									
COO1	3.992	0.822	-0.464	-0.178	0.7501**	0.7912	0.7941	0.8645	0.6148
COO2	3.929	0.829	-0.476	0.105	0.8107**				
COO3	4.006	0.770	-0.470	0.082	0.7966**				
COO4	3.869	0.807	-0.419	0.096	0.7777**				
School Environment (SEC)									
ENV1	3.827	0.963	-0.565	-0.077	0.7818**	0.8093	0.8749	0.8749	0.6362
ENV2	3.845	0.831	-0.337	-0.114	0.8161**				
ENV3	3.895	0.889	-0.579	0.219	0.8121**				
ENV4	3.719	0.898	-0.458	0.179	0.7798**				

Note: a: Used standardized z-scores in the first step of the analysis; CA: Cronbach's Alpha; CR: composite reliability; ρ_A : construct reliability measure; AVE: average variance extracted.

largest direct effect ($b = 0.404$) and medium-sized direct impact ($f^2 = 0.176$), reflecting its critical role in promoting SEL skills such as teamwork, communication, and empathy. Growth Mindset (GRO) followed closely with a significant direct effect ($b = 0.212$) but smaller direct impact ($f^2 = 0.076$), highlighting its importance

in enhancing intrinsic motivation and perseverance for SEL development. Positive Classroom Climate (POC) exhibited the third-largest direct effect ($b = 0.171$) and small direct impact ($f^2 = 0.042$), yet it had the second-highest indirect effect ($b = 0.130$) and third-highest total effect ($b = 0.302$) on SEL. These results underscore the

Table 2 Discriminant validity assessment

Latent	SEL	FIX	GRO	POC	COO	SEC
SEL						
FIX	0.3245					
GRO	0.5933	0.2283				
POC	0.6775	0.1404	0.4302			
COO	0.8034	0.2279	0.5352	0.6911		
SEC	0.6488	0.2238	0.4275	0.7117	0.8111	

Table 3 Discriminant validity: Fornell-Larcker criterion

Latent	SEL	FIX	GRO	POC	COO	SEC
SEL	(0.6155)					
FIX	0.0638	(0.6375)				
GRO	0.2387	0.0299	(0.7097)			
POC	0.2515	0.0097	0.0992	(0.5078)		
COO	0.4349	0.0296	0.1815	0.2562	(0.6148)	
SEC	0.2884	0.0287	0.1187	0.2812	0.4255	(0.6362)

interplay between external factors (SEC, POC, COO) and internal mediators (FIX/GRO) in shaping SEL competencies.

Mediation Effects Analysis

Two paths exhibited full mediation: SEC → POC → COO → FIX → SEL: With VAF = 0.8050 (this supports H16) and SEC → POC → COO → GRO → SEL: with VAF = 0.8255 (this supports H17). These findings confirm that both mindsets fully mediate the relationship between SEC and SEL when combined with appropriate learning approaches and positive classroom climates, as suggested by Bronfenbrenner's theory.

Six paths demonstrated partial mediation, with VAF values ranging from 0.2689 to 0.7875: 1) POC → GRO → SEL: VAF = 0.2689 (supporting H7), 2) SEC → GRO → SEL: VAF = 0.4446 (supporting H11), 3) SEC → POC → FIX → SEL: VAF = 0.5474 (supporting H12), 4) SEC → POC → GRO → SEL: VAF = 0.6456 (supporting H13), 5) SEC → COO → FIX → SEL: VAF = 0.7573 (supporting H14), and 6) SEC → COO → GRO → SEL: VAF = 0.7875 (supporting H15).

When considering joint mediators, both Fixed Mindset (FIX) and Growth Mindset (GRO) exhibited comparable mediation effects, particularly in serial mediation models. However, as single mediators, only Growth Mindset demonstrated mediation potency, underscoring its prominence in individual mediation paths. This aligns with Hayes' (2018) framework for conditional process analysis, which emphasizes the importance of examining multiple mediators simultaneously.

Serial Mediation Analysis

The serial mediation analysis investigated the combined influence of SEC, POC, and COO on SEL through FIX/GRO as mediators. Seven out of eight paths followed a serial rather than parallel mediation pattern. Notably, when school environment (SEC) was included

as the primary independent variable, both mindsets (FIX/GRO) fully mediated the relationship between SEC and SEL. The near-equal full mediation effects were observed for SEC → POC → COO → FIX → SEL (VAF = 0.8050) and SEC → POC → COO → GRO → SEL (VAF = 0.8255). This suggests that while mindset plays a crucial role, its actualization depends on being nurtured through conducive schoolwide foundations and interactive pedagogies. Results are detailed in Table 4.

Table 3 presents the discriminant validity assessment using the Fornell-Larcker Criterion. The square roots of Average Variance Extracted (AVE) shown diagonally in parentheses exceeded the correlations of each latent variable with others below the diagonal AVEs. For example: 1) The square root of AVE for SEL (0.6155) was greater than its correlations with other variables (e.g., FIX: 0.0638, GRO: 0.2387, POC: 0.2515, COO: 0.4349, SEC: 0.2884). 2) Similarly, for School Environment (SEC), the square root of AVE (0.6362) surpassed its correlations with other constructs (e.g., SEL: 0.2884, FIX: 0.0287, GRO: 0.1187, POC: 0.2812, COO: 0.4255). This confirms adequate discriminant validity among all six latent variables, ensuring accurate measurement and suitability for further structural model analysis. Details are presented in Table 3, which also supports the conceptual framework's alignment with the data analysis. The structural model results are illustrated in Figure 1.

Discussion

The comprehensive analysis of this study provides valuable insights into the intricate interplay between cooperative learning, positive classroom climate, school environment, and mindset in shaping students' social-emotional learning (SEL). These findings not only confirm theoretical frameworks like Bronfenbrenner's (1979) Ecological Systems Theory but also offer practical implications for fostering holistic development within educational ecosystems.

Table 4 Result of mediation and serial mediation analysis

Path	Effect	Coefficients	t-value	VAF	Conclusion
POC → FIX → SEL	TE	0.1903**	7.2695	0.0568	No Mediation (Not Support H6)
	DE (C)	0.1802**	6.9774		
	DE (C')	0.1795**	6.9163		
	IE	0.0108*	2.4265		
POC → GRO → SEL	TE	0.2435**	8.9399	0.2689	Partial Mediation (Support H7)
	DE (C)	0.1802**	6.9774		
	DE (C')	0.1780**	6.8266		
	IE	0.0655**	6.2636		
COO → FIX → SEL	TE	0.4213**	5.2405	0.0468	No Mediation (Not Support H8)
	DE (C)	0.4012**	12.7208		
	DE (C')	0.4016**	12.7383		
	IE	0.0197**	3.5672		
COO → GRO → SEL	TE	0.4905**	16.1784	0.1838	No Mediation (Not Support H9)
	DE (C)	0.4012**	12.7208		
	DE (C')	0.4003**	12.6577		
	IE	0.0902**	7.2381		
SEC → FIX → SEL	TE	0.1121**	3.3842	0.1748	No Mediation (Not Support H10)
	DE (C)	0.0917**	2.7561		
	DE (C')	0.0924**	2.7820		
	IE	0.0196**	3.3895		
SEC → GRO → SEL	TE	0.1635**	4.8057	0.4446	Partial Mediation (Support H11)
	DE (C)	0.0917**	2.7561		
	DE (C')	0.0908**	2.7125		
	IE	0.0727**	6.6313		
SEC → POC → FIX → SEL	TE	0.2013**	6.4813	0.5474	Partial Mediation (Support H12)
	DE (C)	0.0917**	2.7561		
	DE (C')	0.0911**	2.7160		
	IE	0.1102**	6.9734		
SEC → POC → GRO → SEL	TE	0.2540**	8.0337	0.6456	Partial Mediation (Support H13)
	DE (C)	0.0917**	2.7561		
	DE (C')	0.0900**	2.6753		
	IE	0.1640**	9.1492		
SEC → COO → FIX → SEL	TE	0.3725**	12.6620	0.7573	Partial Mediation (Support H14)
	DE (C)	0.0917**	2.7561		
	DE (C')	0.0904**	2.7053		
	IE	0.2821**	12.0973		
SEC → COO → GRO → SEL	TE	0.4255**	14.7021	0.7875	Partial Mediation (Support H15)
	DE (C)	0.0917**	2.7561		
	DE (C')	0.0904**	2.6927		
	IE	0.3351	14.1824		
SEC → POC → COO → FIX → SEL	TE	0.4638**	18.0467	0.8050	Full Mediation (Support H16)
	DE (C)	0.0917**	2.7561		
	DE (C')	0.0904**	2.6898		
	IE	0.3734**	14.2406		
SEC → POC → COO → GRO → SEL	TE	0.5175**	20.8781	0.8255	Full Mediation (Support H17)
	DE (C)	0.0917**	2.7561		
	DE (C')	0.0903**	2.6779		
	IE	0.4272**	16.2945		

Note: ** $p < .01$, VAF= Variance Accounted For, C: DE before mediator added, C': DE after mediator added

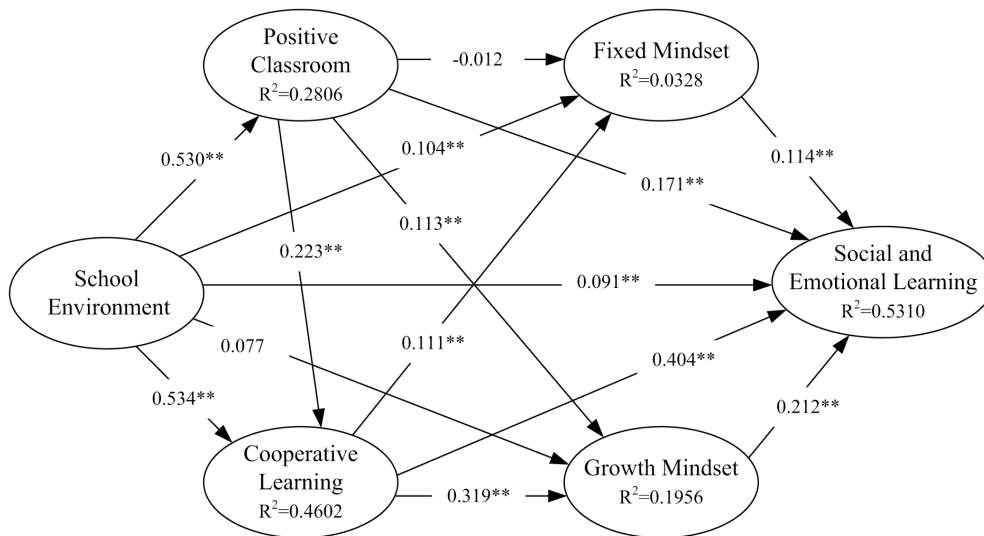


Figure 1 Results of the analysis of the influence of the five factors on social-emotional learning

Note: ** $p < .01$, R2: coefficient of determination

The results highlight that the school environment (SEC) plays a foundational role in nurturing SEL outcomes, indirectly influencing them through positive classroom climate (POC) and cooperative learning (COO). This aligns with Bronfenbrenner's perspective that human development emerges from interactions across multiple ecological levels—macro (school policies), meso (classroom practices), and micro (individual mindsets). Specifically: Cooperative Learning (COO) emerged as the strongest direct influencer on SEL, emphasizing its critical role in promoting teamwork, communication, and empathy. This finding resonates with Vygotsky's (1978) Social Learning Theory which underscores how collaborative environments enhance cognitive and emotional growth. Growth Mindset (GRO) demonstrated significant mediation effects when combined with supportive external factors such as SEC, POC, and COO. While GRO was more prominent in single mediation paths, differences diminished in series mediation models, indicating that mindset alone cannot fully unlock SEL potential without conducive environmental foundations.

Creating an effective ecosystem for SEL requires intentional alignment between macro-level structures (e.g., school policies and culture) and micro-level processes (e.g., teacher-student interactions and peer collaboration). For instance: A positive classroom climate (POC) fosters trust, respect, and motivation, essential for SEL development. This supports Jennings & Greenberg's (2009) argument that empathetic teacher-student relationships significantly enhance student engagement and well-being. Cooperative learning (COO)

enables students to practice real-world skills such as negotiation, conflict resolution, and perspective-taking. It transforms classrooms into vibrant micro-societies where students learn to value diversity and work collaboratively, consistent with Johnson & Johnson's (2009) findings on the benefits of interactive pedagogies.

Interestingly, while both Fixed Mindset (FIX) and Growth Mindset (GRO) acted as mediators in series mediation models, their effectiveness depended heavily on the presence of supportive external factors. When integrated with SEC, POC, and COO, FIX exhibited near-equal full mediation potency alongside GRO, suggesting that even rigid beliefs can evolve under nurturing conditions. This insight challenges conventional views of mindset rigidity and reinforces Hattie's (2008) emphasis on the transformative power of systemic interventions.

The findings underscore the importance of integrating multiple factors to foster SEL competencies. For example: School Environment (SEC) had the highest total effect on SEL, primarily through indirect pathways mediated by POC and COO. This highlights the need for administrators to prioritize inclusive school cultures that promote safety, diversity appreciation, and participatory learning opportunities. The combination of SEC, POC, and COO amplified the mediating role of mindset, particularly in series mediation models. This suggests that fostering SEL is not merely about instilling desirable mindsets but also about creating contexts where these mindsets can flourish.

Moreover, the results suggest that while Growth Mindset is crucial for individual perseverance and

adaptability, its actualization hinges upon being embedded in supportive systems. This echoes Dweck's (2006) call for aligning external stimuli with internal self-theories to catalyze meaningful change.

Conclusion and Recommendation

This study reveals significant insights into how cooperative learning, positive classroom climate, school environment, and mindset shape students' social-emotional learning (SEL). Cooperative learning (COO) and growth mindset (GRO) demonstrate the strongest direct effects, while school environment (SEC) shows the highest total and indirect effects through mediating variables. These factors collectively explain 53.10 percent of SEL outcomes variance. The findings confirm that cooperative learning serves as a micro-society fostering teamwork, communication, empathy, and conflict resolution skills, while growth mindset acts as a crucial mediator when combined with supportive environmental factors. Additionally, school environment ($b = 0.537$) fundamentally influences SEL through indirect pathways mediated by positive classroom climate and cooperative learning.

For effective implementation, teachers should design cooperative activities fostering psychological safety and teamwork, model growth mindset through constructive feedback, integrate SEL into daily teaching practices, and collaborate to address implementation barriers. School administrators should focus on cultivating inclusive school cultures prioritizing safety and diversity, investing in professional development for SEL integration, and building partnerships with parents and community stakeholders to create comprehensive support systems. Parents can contribute by encouraging team-based activities, emphasizing effort over natural talent, supporting balanced educational policies, and maintaining consistent communication with educators.

Future research should examine digital SEL platforms and AI-driven applications, investigate equity and accessibility in implementation, study cross-cultural patterns and adaptations, and develop integrated policy frameworks. This research emphasizes the importance of aligning educational ecosystems with students' internal mindsets to foster holistic development. Through intentional design of collaborative, inclusive learning environments, we can empower students to become adaptive, empathetic global citizens prepared for future challenges.

Conflict of Interest

The author declares that there is no conflict of interest.

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