

Research Article

The comfortable educational environment as a contextual condition of students' school connectedness: How school and family support interact in Kazakhstan's secondary education

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School connectedness has become a central priority in contemporary education systems, particularly in reform-oriented contexts where schools are expected to promote students' psychosocial development alongside academic achievement. Grounded in Bioecological Theory, this study examines how school-based and family support mechanisms relate to students' school connectedness and how these relationships are conditioned by the comfortable educational environment. Using survey data from 11,524 secondary school students in Kazakhstan, the study applies Partial Least Squares Structural Equation Modeling to test direct and moderating relationships among personal development support, psychological and pedagogical support, family engagement in education, the comfortable educational environment, and school connectedness. The results indicate that all three support mechanisms and the comfortable educational environment are positively associated with students' school connectedness. Moreover, the findings reveal consistent negative moderation effects: as students' perceptions of environmental comfort increase, the strength of the associations between each support mechanism and school connectedness decreases. Importantly, these interaction effects reflect attenuation rather than substitution, suggesting that the contribution of targeted supports varies across contextual conditions. By demonstrating that relational supports operate differently depending on the broader environmental climate, the study advances a context-sensitive understanding of school connectedness within centralized reform systems. The findings offer practical implications for policymakers and school leaders, highlighting the importance of aligning structured support strategies with the overall psychological quality of educational environments rather than assuming uniformly additive effects.

Keywords: Bioecological theory; Comfortable educational environment; Personal development support; Psychological-pedagogical support; Secondary education; Kazakhstan

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1. Introduction

Over the past two decades, school connectedness has emerged as a central construct in educational research, reflecting a growing recognition that students' sense of belonging, safety, and attachment

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to school is foundational to both academic and psychosocial development (Bond et al., 2007; Libbey, 2004; Peng & Paterson, 2025). Schools are increasingly understood not only as institutions of cognitive instruction but also as relational environments in which students develop attachment, trust, and identification with the school community (Wang & Degol, 2016). A strong sense of school connectedness has been consistently associated with higher academic engagement, lower risk behaviors, improved emotional adjustment, and greater social integration (Ecclestone, 2012; Loukas et al., 2010; Salavera et al., 2024; Shochet et al., 2006).

School connectedness is widely conceptualized as students' perception that they are respected, supported, and valued members of the school community. It reflects both relational experiences with teachers and peers and broader perceptions of school climate and safety (Libbey, 2004; Peng & Paterson, 2025). Empirical research demonstrates that students who perceive their schools as safe and emotionally supportive are more likely to report strong attachment to school and a sense of belonging (Bond et al., 2007; Wang & Degol, 2016). Moreover, the recent studies across school contexts show that students' abilities to communicate, collaborate, and form constructive peer relationships are closely associated with emotionally supportive school climates, psychologically responsive pedagogy, and stable family-school relationships (Hanson et al., 2016; Piñeiro-Cossio et al., 2021; Wong Aitken et al., 2024).

These issues have become particularly salient in education systems undergoing reform and modernization, where policy agendas increasingly emphasize student-centered learning, inclusive environments, and psychosocial development alongside academic achievement (Fullan, 2020). In Kazakhstan, recent reforms have prioritized modernization of infrastructure, strengthening psychological services, and promoting inclusive school climates (Kuzhabekova et al., 2018; Myrzatayeva et al., 2023; Pak et al., 2020). While these reforms highlight the importance of relational and environmental quality, empirical evidence examining how different support mechanisms interact within such reform-oriented systems remains limited.

From a bioecological perspective (Bronfenbrenner, 1979, 2000), students' sense of school connectedness emerges from dynamic interactions across nested systems. Within the school microsystem, daily teacher-student interactions, classroom practices, and psychological support services shape students' relational experiences. At the mesosystem level, family engagement in education links home and school contexts, reinforcing shared expectations and emotional stability (Hill & Tyson, 2009; Somerton et al., 2022). Together, these systems provide relational resources that contribute to students' attachment to school.

Within schools, multiple structured support mechanisms are implemented to foster student development. Personal development support includes initiatives aimed at strengthening autonomy, self-awareness, and interpersonal skills (Amholt et al., 2020; Ecclestone, 2012; Li, 2021; Piñeiro-Cossio et al., 2021). Psychological and pedagogical support encompasses emotionally responsive teaching practices and access to psychological services that address students' academic and personal challenges (Holopainen et al., 2012; Salavera et al., 2024). Family engagement in education represents collaborative communication and shared involvement between families and schools, which has been consistently associated with stronger school bonding and attachment (Ambhore & Ofori, 2023; Hill & Tyson, 2009; Peng & Paterson, 2025).

A substantial body of research shows that these relational supports are positively associated with school connectedness (Libbey, 2004; Peng & Paterson, 2025; Wang & Degol, 2016). However, much of the existing literature treats these factors as additive predictors, assuming that increasing support mechanisms uniformly enhances connectedness. Less attention has been devoted to understanding whether the broader environmental context of the school conditions the strength of these associations.

The comfortable educational environment - characterized by psychological safety, inclusive norms, accessible infrastructure, and emotional comfort - has been widely studied as a direct correlate of student outcomes (Bond et al., 2007; Wang & Degol, 2016). Yet, ecological theory suggests that environmental characteristics do not merely exert direct effects; they also shape how

proximal processes operate (Bronfenbrenner, 2000). In environments where students already perceive high levels of safety and inclusion, relational supports may function differently compared to settings where environmental comfort is lower.

Empirically, there is limited quantitative evidence examining this conditioning role, particularly in secondary education and in centralized reform contexts such as Kazakhstan. Understanding whether support mechanisms demonstrate similar associations with school connectedness across schools with varying levels of environmental comfort is crucial for both theory and policy. Without such evidence, educational reforms risk relying on uniform support strategies that may not account for contextual variation.

Responding to this gap, the present study investigates how personal development support, psychological and pedagogical support, and family engagement relate to students' school connectedness and whether these relationships are moderated by the comfortable educational environment. Grounded in bioecological theory, the study conceptualizes environmental comfort as a contextual condition that shapes the strength of associations between relational supports and school connectedness.

Using survey data from secondary school students in Kazakhstan and applying structural equation modeling, the study tests three moderation hypotheses. By situating the analysis within a reform-oriented, centralized education system, the study offers contextually grounded evidence on how environmental conditions interact with structured support mechanisms.

This study contributes to the literature in three ways. First, it advances a contextualized model of school connectedness by examining moderation rather than assuming additive effects. Second, it empirically differentiates microsystem supports, mesosystem engagement, and broader environmental climate within a unified bioecological framework. Third, by providing evidence from Kazakhstan, the study extends school connectedness research beyond predominantly Western contexts and contributes to understanding how relational dynamics operate within centralized reform systems.

The remainder of the article proceeds as follows. The next section presents the theoretical framework and hypotheses development. This is followed by the methodology and results sections. The article concludes with a discussion of findings, implications for educational policy and practice, and directions for future research.

2. Theoretical Framework

This study adopts a bioecological perspective (Bronfenbrenner, 1979, 2000) to explain the development of school connectedness in secondary education. School connectedness refers to students' belief that adults and peers in the school care about their learning and about them as individuals (Libbey, 2004; Resnick et al., 1997). The recent literature conceptualizes school connectedness as a multidimensional construct encompassing feelings of belonging, supportive teacher-student relationships, and positive peer attachment (Wilkins et al., 2022). Rather than representing an individual trait, school connectedness is understood as a relational and contextual developmental outcome emerging from students' interactions within school environments (Peng & Paterson, 2025).

Bioecological theory posits that development unfolds through reciprocal interactions between individuals and nested environmental systems (Bronfenbrenner, 2000). Within the school microsystem, proximal processes - such as daily interactions with teachers, support staff, and peers - play a central role in shaping students' perceptions of inclusion and belonging. The recent research consistently demonstrates that teacher support, positive peer relationships, and safe school climates are strong predictors of school connectedness (Peng & Paterson, 2025).

Personal development support and psychological-pedagogical support operates within the school microsystem by structuring meaningful adult-student interactions and reinforcing inclusive relational norms (Hernández-Torrano et al., 2021; Somerton et al., 2022). Through guidance, encouragement, and accessible psychological resources, these supports strengthen

students' perceptions that they are valued members of the school community (van der Westhuizen et al., 2023).

Family engagement in education represents a mesosystem process linking home and school contexts. When communication and expectations are aligned across these settings, students experience relational continuity that reinforces their sense of stability and belonging. Empirical evidence indicates that parental attachment and supportive family relationships are positively associated with school bonding and connectedness (Oladele & Komolafe, 2025). Thus, family engagement contributes indirectly to school connectedness by promoting coherence across developmental contexts (Bidi et al., 2024; Hanson et al., 2016).

A central principle of bioecological theory is that contextual conditions influence how proximal processes operate. Environmental characteristics do not merely exert direct effects; they shape the strength and effectiveness of relational supports (Piñeiro-Cossio et al., 2021). The comfortable educational environment - characterized by psychological safety, emotional comfort, and inclusive norms - is therefore conceptualized as a contextual condition that moderates the influence of support mechanisms on school connectedness (Ng, 2020).

In schools where safety and relational warmth are embedded in everyday institutional practices, many of the social and emotional functions typically provided through targeted support initiatives may already be present in the school climate. In such contexts, the incremental contribution of structured supports to school connectedness may be attenuated. Conversely, in less comfortable environments, targeted supports become more critical in compensating for contextual deficiencies and strengthening students' attachment to school contexts (Kuld et al., 2021; Li, 2021).

Through this bioecological lens, the present study explains how microsystem supports, mesosystem engagement, and contextual environmental conditions jointly shape students' sense of connection to school.

3. Hypotheses Development

Personal development support includes structured initiatives aimed at fostering students' autonomy, interpersonal awareness, and personal growth (Ecclestone, 2012; Piñeiro-Cossio et al., 2021). Within a bioecological framework, such initiatives strengthen proximal processes between students and supportive adults in the school microsystem. Empirical research consistently identifies supportive teacher practices and developmental guidance as significant antecedents of school belonging and attachment (Libbey, 2004; Peng & Paterson, 2025). When students perceive that teachers are attentive to their personal development and respectful of their individual needs, they are more likely to internalize a sense of being valued members of the school community (Celia et al., 2024; Piñeiro-Cossio et al., 2021).

However, bioecological theory emphasizes that proximal processes operate within broader contextual conditions. In educational environments characterized by high psychological safety and inclusive norms, relational warmth may already be embedded in everyday school interactions (Kuld et al., 2021; Peng & Paterson, 2025). Under such circumstances, structured personal development initiatives may provide comparatively smaller incremental gains in students' school connectedness (Ng, 2020). Therefore, the positive association between personal development support and school connectedness is expected to weaken as the level of environmental comfort increases.

Hypothesis 1. The comfortable educational environment negatively moderates the relationship between personal development support and school connectedness, such that the positive association is weaker at higher levels of environmental comfort.

Psychological-pedagogical support encompasses emotionally responsive teaching, access to counseling services, and institutional practices addressing students' relational and emotional needs (Holopainen et al., 2012; Salavera et al., 2024). Research on school connectedness highlights that safe and supportive school climates are among the most consistent predictors of school bonding and attachment (Peng & Paterson, 2025; Resnick et al., 1997). When students perceive

psychological and pedagogical resources as accessible and responsive, they are more likely to experience trust, inclusion, and attachment to school (Makoelle, 2020). Peng and Paterson (2025) highlights that safe and supportive school climates are among the most consistent predictors of school bonding and attachment. Students who perceive that psychological and pedagogical resources are accessible and responsive are more likely to develop stronger attachment to school (Celia et al., 2024).

Nevertheless, when the broader educational environment is already perceived as emotionally safe and inclusive, many of the relational benefits typically delivered through psychological-pedagogical support may be embedded in routine classroom norms and institutional culture (Peng & Paterson, 2025; Salavera et al., 2024). Under such circumstances, the strength of the relationship between psychological-pedagogical support and school connectedness may diminish. Accordingly, the positive association between psychological-pedagogical support and school connectedness is expected to decrease as environmental comfort increases.

Hypothesis 2. The comfortable educational environment negatively moderates the relationship between psychological-pedagogical support and school connectedness, such that the positive association is weaker at higher levels of environmental comfort.

Family engagement in education reflects active communication, collaboration, and shared expectations between families and schools (Hanson et al., 2016). From a bioecological perspective, family engagement represents a mesosystem process linking home and school contexts (Attri et al., 2025). Peng and Paterson (2025) reports that parental attachment and supportive family relationships are positively associated with students' school connectedness. When home and school expectations are aligned, students experience relational continuity that reinforces their attachment to the school environment (Bidi et al., 2024).

However, the relative importance of family engagement may vary depending on the relational quality of the school context. In schools characterized by strong peer support, inclusive norms, and emotionally responsive teacher-student relationships, the school itself may provide substantial relational resources that foster connectedness (Amholt et al., 2020; Peng & Paterson, 2025; van der Westhuizen et al., 2023). In such settings, the association between family engagement and school connectedness may be comparatively weaker. Therefore, the positive relationship between family engagement in education and school connectedness is expected to weaken as environmental comfort increases.

Hypothesis 3. The comfortable educational environment negatively moderates the relationship between family engagement in education and school connectedness, such that the positive association is weaker at higher levels of environmental comfort.

3.1. Conceptual Model and Research Framework

Building on bioecological theory (Bronfenbrenner, 2000) and the recent literature on school connectedness (Libbey, 2004; Peng & Paterson, 2025), this study proposes a conceptual model in which school connectedness is shaped by multiple interrelated support mechanisms operating within the educational ecosystem. Specifically, the model integrates three sources of support - personal development support, psychological-pedagogical support, and family engagement in education - and examines how their associations with school connectedness are conditioned by the comfortable educational environment.

School connectedness is conceptualized as a relational developmental outcome reflecting students' perceptions of belonging, teacher support, and positive peer attachment (Bond et al., 2007; Peng & Paterson, 2025; Resnick et al., 1997). Consistent with the bioecological framework, school-based supports operate primarily within the school microsystem by structuring proximal processes between students and significant adults, while family engagement functions within the mesosystem by linking home and school contexts.

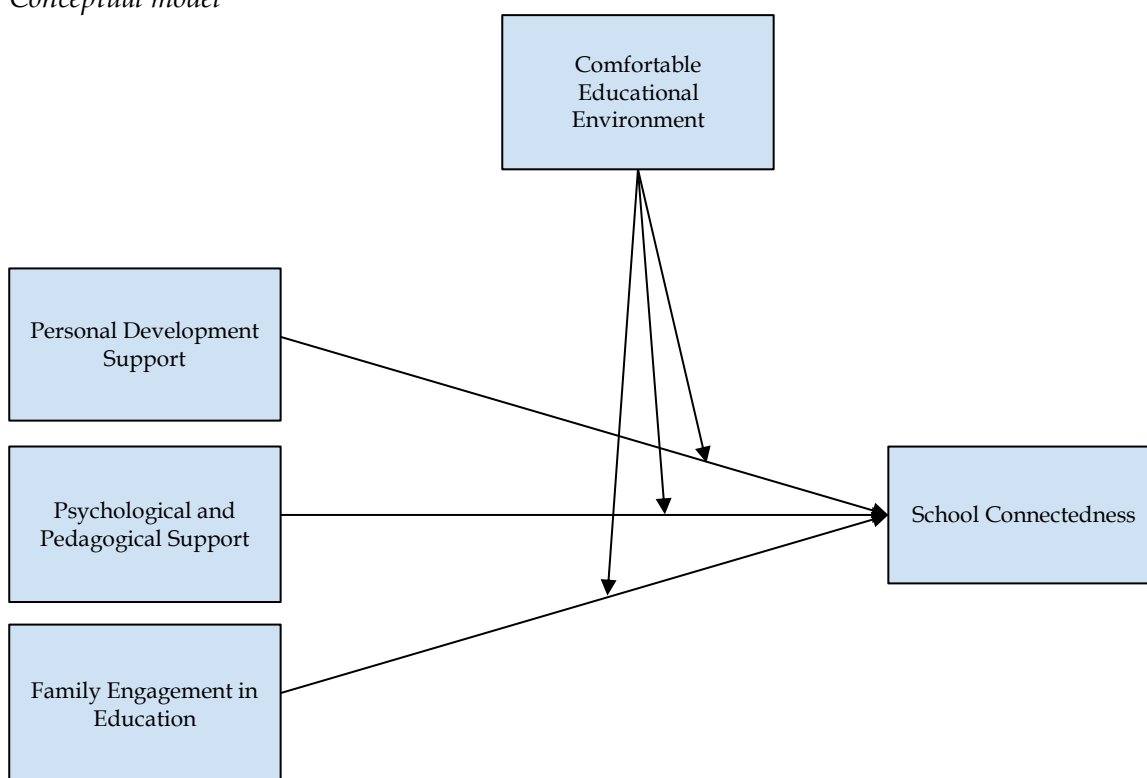
Personal development support represents structured school initiatives aimed at fostering students' autonomy, interpersonal awareness, and engagement (Ecclestone, 2012; Piñeiro-Cossio et

al., 2021). Psychological-pedagogical support captures emotionally responsive teaching practices and access to institutional psychological resources that address students' relational and emotional needs (Holopainen et al., 2012; Salavera et al., 2024). Family engagement in education reflects collaborative involvement between families and schools that reinforces relational continuity across contexts (Hanson et al., 2016). Although conceptually related, these constructs represent distinct mechanisms through which students' connectedness to school may develop.

A central feature of the model is the positioning of the comfortable educational environment as a moderating contextual condition. The comfortable educational environment reflects students' perceptions of psychological safety, emotional comfort, and inclusive institutional norms - core characteristics of positive school climate that are consistently linked to school connectedness (Celia et al., 2024; Peng & Paterson, 2025). Rather than conceptualizing environmental comfort as a direct predictor alone, the model treats it as a contextual factor that shapes how relational supports influence students' perceptions of belonging and connectedness.

Accordingly, the model proposes that the strength of the relationships between each support mechanism and school connectedness varies depending on the level of environmental comfort. In highly comfortable educational environments, where relational warmth and safety are embedded in everyday practices, the incremental contribution of specific support mechanisms may be less pronounced. In contrast, in less comfortable educational environments, structured supports may play a more substantial role in fostering students' connection to school. Figure 1 presents the conceptual model guiding the empirical analysis.

Figure 1
Conceptual model



4. Methodology

4.1. Research Design

This study employed a quantitative, cross-sectional survey design to examine the relationships between school-based support, family engagement in education, and students' school connectedness, as well as the moderating role of a comfortable educational environment. The design aligns with prior educational and school psychology research that investigates students'

connectedness within institutional and relational contexts. The study was conducted within the context of general secondary education in Kazakhstan, a system that has undergone extensive curriculum, governance, and wellbeing-oriented reforms over the past decade. These reforms place increasing emphasis on learner-centred pedagogies, psychological support services, and family-school partnerships, making the context particularly relevant for examining the interplay between educational environments and students' school connectedness.

The analysis was conducted using Partial Least Squares Structural Equation Modeling [PLS-SEM] with SmartPLS software to examine the moderating effect specified in the research model. PLS-SEM is widely used in educational research to estimate complex models involving multiple latent constructs and interaction effects. It is particularly suitable for prediction-oriented analyses and enables flexible evaluation of both measurement and structural models without strict assumptions of multivariate normality (Hair et al., 2019).

4.2. Research Context

Kazakhstan has implemented a series of nationwide education reforms aimed at improving educational quality, student wellbeing, and school climate, including the introduction of updated national curricula, strengthened school psychological services, and greater expectations for parental engagement in schooling. Within this reform context, schools are increasingly expected to support not only academic achievement but also students' personal development, psychological safety, and social competencies. Despite these policy ambitions, empirical evidence examining how different forms of support within schools and families relate to students' school connectedness development remains limited. Positioning the study within Kazakhstan's secondary education system allows the analysis to contribute empirical insights from a reform-oriented educational context while remaining conceptually relevant to broader international discussions on school and student wellbeing.

4.3. Participants and Data Collection

Data were collected from students enrolled in secondary and high schools in Kazakhstan using a structured questionnaire. Participation was voluntary, and data collection procedures adhered to established ethical standards for educational research, including informed consent and confidentiality assurances. The sample reflects students' experiences within mainstream secondary education settings, where school-based psychological and pedagogical supports, family engagement practices, and perceptions of the educational environment are embedded in everyday schooling processes. The use of student self-reports is consistent with prior research on school climate, wellbeing, and school connectedness, as these constructs are closely tied to students' subjective experiences of their learning environments.

The study sample consisted of 11,524 school-aged students from multiple public schools located in urban and rural areas of Kazakhstan. To ensure geographical, socio-economic, and educational diversity of participants, a stratified random sampling approach was employed. According to the official statistics, the total number of students aged 7-17 (class level 1-11) is 3 904 497, 2 339 374 students (59.9%) come from urban areas, and 1 565 123 students (40.1%) come from rural areas. Within the total number of students, 61.3% of students are aged 11-17 (class level 5-11), and the total number of them is 2,392,972 (Agency for Strategic Planning and Reforms of the Republic of Kazakhstan Bureau of National Statistics, 2024). To make sure the participants will represent diverse backgrounds, the data was planned to be collected from all the regions. However, due to voluntary willingness to participate, the biggest proportion of participants came from the Abay region and the Karaganda region, mostly representing the Southern and Central parts of Kazakhstan. The local schools in urban and rural areas were randomly selected through the official list of government schools, and invitations to participate in the study were sent to the school directors.

The large sample size ($N = 11,524$) exceeds the minimum requirements for PLS-SEM analysis and provides adequate statistical power for detecting moderation effects (Hair et al., 2019). The

survey instruments were designed to be developmentally appropriate and understandable for all participants. The demographic characteristics of the participants are represented in Table 1.

Table 1

Demographic characteristics of the participants

<i>Variable and classification</i>	<i>Number of responses</i>	<i>Percentage (%)</i>
Region type		
Urban	3321	28.82
Rural	8203	71.18
Region		
Abai region	7325	63.55
Karaganda Region	3505	30.41
East Kazakhstan Region	218	1.88
Aktobe Region	162	1.41
Almaty Region	124	1.07
Akmola Region	73	0.63
West Kazakhstan Region	22	0.19
Zhambyl Region	19	0.17
Atyrau Region	13	0.13
Turkistan Region	11	0.1
North Kazakhstan Region	11	0.1
Mangystau Region	10	0.09
Kyzylorda Region	8	0.07
Zhetysu Region	8	0.07
Kostanay Region	8	0.07
Pavlodar Region	6	0.05
Ulytau Region	1	0.01
Class level		
5 grade	1498	12.99
6 grade	1576	13.68
7 grade	1888	16.38
8 grade	1690	14.67
9 grade	2105	18.27
10 grade	1511	13.11
11 grade	1256	10.90
Total	11524	100

Table 1 represents the region-based and class-based demographic distribution of study participants. Among the total number of 11524 participants, the majority of students were from the rural areas, numbering 8203 students (71.2%), while the students from urban areas accounted for 3321 individuals (28.8%). Moreover, the largest proportion of participants came from the Abay region (63.55%) and the Karaganda region (30.41%). Although the sample includes a large proportion of the students from rural areas, the study's primary goal is to examine the moderating effect of Comfortable Educational Environment. The substantial sample size ensures stable parameter estimates in PLS-SEM analysis regardless of the urban-rural distribution.

The distribution among the class levels was well-represented, with each class level representing at least 10% of the total sample ($N = 11524$) and covering middle and high school students. The number of students in each class level varied slightly, ranging from 10.9% (11th grade) to 18.3% (9th grade). This distribution represents natural variation in class sizes across participating schools and ensures adequate representation across different developmental stages of adolescence.

4.4. Instruments

Five latent constructs were measured using 5-item (1 = strongly disagree to 5 = strongly agree) Likert scales verified and registered at the National Institute of Intellectual Property of the Republic of Kazakhstan (Certificate No. 57956, dated 05/14/2025). The survey items measuring study constructs were conceptually aligned with established constructs of the Multidimensional Scale of Perceived Social Support [MSPSS] (Zimet et al., 1988) and the Psychological Well-Being Scale [PWB] (Ryff, 1989). Given the bilingual context of Kazakhstan, the survey was developed in Kazakh and Russian to ensure that all participants could understand the questionnaire. The authors adapted these established frameworks to develop context-specific instruments appropriate for the Kazakhstani secondary education context. Because school connectedness has been operationalized using multiple validated instruments and closely related constructs (e.g., school belonging, school attachment, school bonding), the present study operationalizes school connectedness using items that capture students' perceived support, safety, and help-seeking confidence within the school context. This approach is consistent with prior work measuring connectedness through students' perceptions of belonging, safety, and supportive relationships at school and aligns with definitions used in school connectedness research and reviews.

Personal development support [PDS] reflects students' perceptions of school-based practices that recognize individual needs and support autonomy and growth within everyday learning interactions. The scale consists of four items ($\alpha = .935$); a sample item is "Teachers at school take my interests and preferences into account when teaching". Higher scores indicate stronger perceived personal-development-oriented support within the school microsystem.

The Psychological and pedagogical support [PPS] captures students' perceptions of access to psychological services, emotionally responsive pedagogical practices, and institutional resources available to address emotional and relational needs. The scale includes five items ($\alpha = .955$). A sample item is "There are specialists at school whom I can turn to for psychological support". Higher scores indicate stronger perceived availability and responsiveness of psychological and pedagogical resources.

The Family Engagement in Education [FEE] reflects students' perceptions that parents/guardians are actively involved in school-related activities and maintain constructive interaction with the school. The scale includes five items ($\alpha = .953$). A sample item is "My parents actively participate in school activities". Higher values represent stronger perceived family-school involvement and mesosystem support.

The Comfortable Educational Environment [CEE] reflects students' perceived psychological and physical comfort at school, including emotional comfort and supportive conditions in the broader school setting. The scale includes five items ($\alpha = .912$). A sample item is "I feel comfortable at my school". Higher scores indicate a more comfortable perceived school environment.

The School Connectedness [SC] is conceptualized as students' perceived connection to school, reflecting expectations of help, respectful treatment, and supportive practices that facilitate feelings of belonging and security. The scale consists of four items ($\alpha = .938$). A sample item is "In case of a conflict at school, I know I will receive help". This operationalization is consistent with the broader measurement tradition in which school connectedness is assessed through students' perceptions of belonging and safety at school, closeness and support in the school community, and positive relational experiences. It also aligns with school connectedness definitions used in intervention and measurement reviews, where connectedness is operationalized through feeling safe, accepted, valued, and supported by adults and peers at school. Given that the literature documents substantial heterogeneity in school connectedness measurement tools (e.g., PSSM, school climate-based measures, and other connectedness scales), the present study uses a concise four-item measure suitable for large-scale school survey administration while demonstrating high internal consistency.

4.5. Data Collection and Data Analysis

Data was collected through an online survey created in Google Forms format and administered to 11,524 students during regular school hours under teacher supervision. Schools were sent an official invitation letter for the study participation and were selected based on voluntary participation. Informed consent was obtained from school directors and parents before data collection. This sampling approach is common in large-scale educational research where practical constraints necessitate cooperation from willing institutions (Cohen et al., 2018). The questionnaire consisted of demographic items and five measurement scales.

A two-stage PLS-SEM procedure was employed for data analysis (Hair et al., 2019). First, the measurement model was assessed to evaluate indicator reliability, internal consistency reliability (Cronbach's α , composite reliability), convergent validity (average variance extracted [AVE]), multicollinearity (variance inflation factor [VIF]), and discriminant validity (heterotrait-monotrait ratio [HTMT]). Second, the structural model was evaluated through examination of path coefficients (β). Moderation effects were tested using the product indicator technique (Henseler & Chin, 2010). Bootstrapping with 5,000 resamples was used to assess the statistical significance of path coefficients and moderation effects, with bias-corrected 95% confidence intervals calculated for all estimates.

5. Results

5.1. Measurement Model

Prior to testing the structural relationships, the measurement model was evaluated in terms of internal consistency reliability, convergent validity, and discriminant validity. The results are summarized in Table 2 and Table 3. Table 2 presents the construct reliability and convergent validity statistics for all latent variables.

Table 2

Construct reliability and convergent validity

<i>Construct/Item</i>	<i>CA</i>	<i>CR</i>	<i>AVE</i>	<i>Loading Range</i>
School Connectedness	0.938	0.938	0.843	0.908-0.923
Family Engagement in Education	0.953	0.956	0.842	0.845-0.946
Personal Development Support	0.935	0.939	0.837	0.865-0.937
Comfortable Educational Environment	0.912	0.921	0.741	0.776-0.891
Psychological and Pedagogical Support	0.955	0.955	0.847	0.907-0.934

Note. All values exceed recommended thresholds ($\alpha > .70$, CR $> .70$, AVE $> .50$, loadings $> .70$).

As shown in Table 2, all constructs demonstrate strong internal consistency, with Cronbach's alpha (α) and composite reliability [CR] values exceeding the recommended threshold of .70 (Hair et al., 2014). Convergent validity is supported by AVE values above .50 for all constructs, indicating adequate shared variance between indicators and their respective latent variables. Indicator reliability is further confirmed by high outer loadings, which range from 0.775 to 0.946 across constructs. All loadings exceed the 0.70 threshold, suggesting that the observed items adequately represent their respective latent constructs.

Discriminant validity was assessed using the heterotrait-monotrait ratio, following the recommendations of Henseler et al. (2015). Table 3 presents the HTMT values for all construct pairs. As shown in Table 3, most HTMT values fall below the conservative threshold of .90, ranging from .796 to .909. The highest value was observed between Personal Development Support and Comfortable Educational Environment (HTMT = .909). Given the conceptual relatedness of teacher-driven relational practices and students' perceptions of school comfort, a relatively high association between PDS and CEE is theoretically expected.

Table 3
Discriminant Validity - Heterotrait-monotrait ratio (HTMT)

<i>Construct</i>	<i>CEE</i>	<i>SC</i>	<i>FEE</i>	<i>PDS</i>	<i>PPS</i>
CEE	—				
SC	0.865	—			
FEE	0.817	0.796	—		
PDS	0.909	0.822	0.813	—	
PPS	0.880	0.824	0.845	0.899	—

To further assess discriminant validity, bootstrapped 95% confidence intervals were examined. The HTMT bootstrap interval for PDS–CE [0.900, 0.918] excludes 1.00, indicating that the constructs are statistically distinguishable (Hair & Alamer, 2022). Importantly, PDS items capture targeted teacher behaviors and individualized relational practices, whereas CE items primarily reflect broader perceptions of school comfort, infrastructure, and environmental conditions. This distinction supports the theoretical differentiation between structured microsystem supports and contextual environmental characteristics within the bioecological framework. Overall, the results provide evidence of satisfactory reliability, convergent validity, and acceptable discriminant validity for all constructs, supporting the adequacy of the measurement model.

Prior to estimating the structural relationships, multicollinearity among predictor constructs was assessed using the variance inflation factor. Table 4 presents the VIF values for all predictor variables included in the structural model.

Table 4
Variance Inflation Factor (VIF) values

<i>Predictor</i>	<i>VIF</i>	<i>Assessment</i>
PDS	4.722	Acceptable
PPS	4.917	Acceptable
FEE	3.217	Acceptable
CE	4.199	Acceptable

As shown in Table 4, VIF values range from 3.217 to 4.917. All values fall below the conservative threshold of 5.0 recommended for assessing structural multicollinearity (Hair et al., 2014), indicating that collinearity among predictor constructs does not threaten the stability or interpretability of the structural estimates.

Given that all variables were measured using student self-reports collected at a single time point, additional consideration was given to the potential influence of common method bias. Following the full collinearity assessment approach, VIF values below 3.3 are typically interpreted as evidence that common method variance is unlikely to be a serious concern (Kock, 2015). Although several predictors exhibit VIF values above 3.3, they remain below the more conservative threshold of 5.0 and are theoretically distinct constructs supported by discriminant validity analysis (see Table 3).

Taken together, the acceptable VIF values and the demonstrated discriminant validity suggest that multicollinearity and common method variance are unlikely to materially bias the structural model estimates.

5.2. Structural Model Results

Following confirmation of the measurement model, the structural relationships were examined using bootstrapping with 5,000 resamples. Table 5 presents the standardized path coefficients (β), t -values, and hypothesis decisions for both direct and moderating effects. As shown in Table 5, all direct effects on school connectedness are positive and statistically significant. The comfortable educational environment exhibits the strongest direct association with SC ($\beta = 0.336$, $t = 18.982$,

Table 5
Structural Path Coefficients and Hypotheses Testing Results

Path	β	t	Hypotheses decisions
Direct Effects			
CE $\rightarrow$ SC	0.336	18.982	
FEE $\rightarrow$ SC	0.138	10.801	
PDS $\rightarrow$ SC	0.144	9.635	
PPS $\rightarrow$ SC	0.154	10.132	
Moderating Effects			
CE $\times$ PDS $\rightarrow$ SC	-0.040	2.336	H1 Supported
CE $\times$ PPS $\rightarrow$ SC	-0.043	2.523	H2 Supported
CE $\times$ FEE $\rightarrow$ SC	-0.045	3.714	H3 Supported

Note. β = standardized path coefficient; Bootstrap resamples = 5,000. $t > 1.96$

$p < .001$), indicating that higher perceptions of psychological and environmental comfort are strongly associated with stronger school connectedness. In addition, all three support mechanisms demonstrate significant positive relationships with SC. Psychological-pedagogical support shows a positive effect ($\beta = 0.154$, $t = 10.132$, $p < .001$), followed by personal development support ($\beta = 0.144$, $t = 9.635$, $p < .001$) and family engagement in education ($\beta = 0.138$, $t = 10.801$, $p < .001$). Although smaller in magnitude than the direct effect of CEE, these coefficients indicate that each support mechanism contributes positively and meaningfully to students' connectedness to school. The relatively similar magnitude of the three support effects suggests that school-based relational supports and family engagement represent complementary rather than hierarchical predictors of school connectedness.

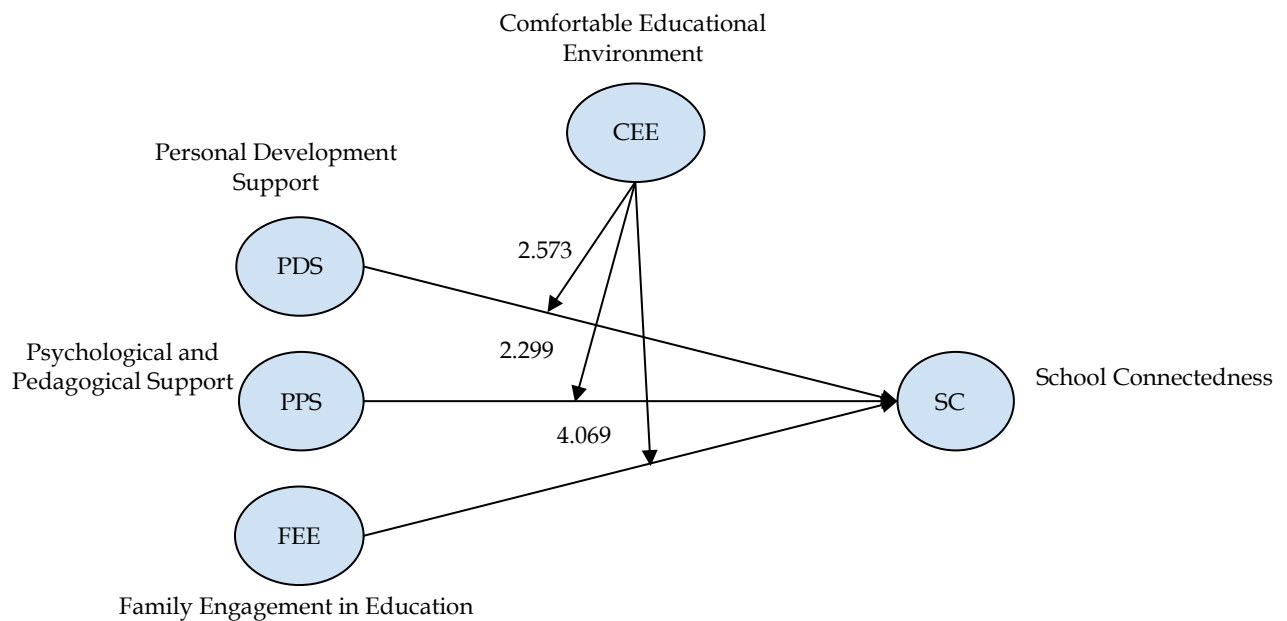
To examine whether environmental educational comfort conditions the relationships between support mechanisms and school connectedness, three interaction terms were included in the model. As reported in Table 5, all interaction effects are negative and statistically significant. Specifically, CEE negatively moderates the relationship between FEE and SC ($\beta = -0.045$, $t = 3.714$, $p < .001$), between PPS and SC ($\beta = -0.043$, $t = 2.523$, $p = .012$), and between PDS and SC ($\beta = -0.040$, $t = 2.336$, $p = .020$). These results indicate that the positive associations between each support mechanism and school connectedness become weaker as students' perceptions of environmental comfort increase.

Importantly, the magnitude of these interaction effects is relatively small, suggesting attenuation rather than reversal of relationships. In other words, support mechanisms remain positively associated with school connectedness across levels of environmental comfort; however, their incremental contribution is reduced in contexts perceived as highly comfortable.

This pattern is consistent with the bioecological principle that contextual conditions shape the operation of proximal processes. Rather than implying functional substitution or causal displacement, the findings indicate that the strength of relational supports varies across environmental conditions.

Figure 2 illustrates the structural model, including standardized direct effects and interaction paths. As shown in Figure 2, the direct effect of CEE on SC is visibly stronger than the individual support paths, while the interaction paths display small but statistically significant negative coefficients. The graphical representation reinforces the interpretation that environmental comfort operates both as a direct predictor and as a contextual moderator. These negative moderating effects indicate that CEE acts as a buffering mechanism rather than an enhancing mechanism. In other words, when students already perceive their school environment as highly comfortable, the additional benefits of support systems on social interaction development are attenuated. This pattern suggests a potential ceiling effect, where students in comfortable environments may have already achieved optimal levels of social interaction development, rendering additional support

Figure 2
PLS-SEM Analysis Results



less impactful. Alternatively, this finding may reflect a compensatory mechanism, wherein support systems are most critical and effective when environmental comfort is low, but become less necessary when comfort is already high.

As a result, while all direct effects were positive and significant as expected, the hypothesized moderation effects were negative, indicating that the relationships between support systems and social interaction development are weaker at higher levels of CE.

6. Discussion

This study examined how school-based support mechanisms and family engagement relate to students' school connectedness, with particular attention to the moderating role of the comfortable educational environment in Kazakhstan's secondary education context. The findings demonstrate that environmental educational comfort, personal development support, psychological-pedagogical support, and family engagement are each positively associated with school connectedness. At the same time, the positive relationships between the three support mechanisms and school connectedness are attenuated at higher levels of environmental comfort.

The strong direct association between the comfortable educational environment and school connectedness aligns with a substantial body of international research demonstrating that positive school climate, psychological safety, and respectful teacher-student relationships are central predictors of belonging and connectedness (Bond et al., 2007; Libbey, 2004; Peng & Paterson, 2025; Resnick et al., 1997). Studies across diverse educational systems consistently show that students who perceive their schools as safe, inclusive, and emotionally supportive report higher levels of connection and engagement (Loukas et al., 2010; Shochet et al., 2006). In the present study, environmental educational comfort demonstrated the largest standardized coefficient among all predictors. This finding reinforces the argument that school connectedness is not solely the outcome of targeted interventions but is deeply embedded in broader relational and institutional climates.

The positive associations of personal development support and psychological and pedagogical support with school connectedness are likewise consistent with prior findings that supportive teacher practices and accessible psychological services strengthen students' perceptions of care and inclusion (Libbey, 2004; Peng & Paterson, 2025; Wang & Degol, 2016). Similarly, family engagement in education showed a significant positive relationship with school connectedness, in line with

research demonstrating that alignment between home and school contexts reinforces students' relational stability and connectedness (Hill & Tyson, 2009; Peng & Paterson, 2025).

Taken together, these direct effects support a relational-ecological understanding in which school connectedness emerges from complementary microsystem (school-based) and mesosystem (family-school linkage) influences.

A central finding of this study is that the positive associations between support mechanisms and school connectedness are weaker at higher levels of environmental educational comfort. Importantly, the interaction coefficients are modest in magnitude, indicating attenuation rather than reversal of effects. Support mechanisms remain positively associated with school connectedness across all levels of environmental comfort.

Consistent with bioecological theory (Bronfenbrenner, 2000), proximal processes operate within contextual conditions that shape their strength and expression. In environments characterized by high psychological safety and inclusive norms, relational warmth may already be embedded in everyday school routines. Under such circumstances, structured supports may still contribute positively to school connectedness, but their incremental statistical association appears smaller.

It is critical to interpret these moderation findings cautiously. Given the cross-sectional and self-reported nature of the data, the results should not be understood as evidence that environmental comfort replaces or renders support mechanisms unnecessary. Rather, the findings indicate that the strength of associations between relational supports and school connectedness varies across contextual conditions. This interpretation aligns with methodological recommendations to avoid causal inference from moderation effects in cross-sectional designs (Hayes, 2018).

The moderation pattern may be particularly salient in reform-oriented and centralized education systems such as Kazakhstan's. Kazakhstan's secondary education system has undergone substantial state-led reforms emphasizing modernization, infrastructure improvement, and standardized institutional policies (Nurgabdeshev & Gassanova, 2025). In centralized systems, environmental characteristics - such as physical infrastructure, formalized support services, and institutional norms - are often implemented at scale across schools (Sarzhanova & Nurgabdeshev, 2025).

In such contexts, environmental educational comfort may represent a system-level reform outcome rather than solely a localized school-level initiative. When baseline environmental conditions are uniformly strengthened through national policy initiatives, variation in targeted supports may have comparatively smaller incremental associations with student outcomes. Thus, the observed attenuation effects may reflect structural characteristics of centralized reform systems, where institutional climate is shaped through policy-driven standardization (Moldashev et al., 2025; Umirzakov et al., 2019).

At the same time, Kazakhstan's educational context places strong cultural emphasis on respect for authority and formalized teacher roles. In environments where institutional norms already reinforce respectful and orderly interaction, additional structured support mechanisms may yield diminishing marginal associations with perceived connectedness. This does not imply that supports are ineffective; rather, it suggests that their observable statistical contribution depends on the broader institutional baseline.

By incorporating this contextual analysis, the findings move beyond neutral description and situate moderation effects within system-level governance and reform dynamics.

6.1. Theoretical Contributions

This study advances school connectedness research in three ways. First, it integrates school-based supports and family engagement within a unified bioecological framework, rather than examining them in isolation. Second, it positions environmental educational comfort not only as a direct correlate of school connectedness but also as a contextual condition shaping the strength of support-outcome relationships. Third, it demonstrates that moderation effects in relational-ecological systems may manifest as attenuation patterns rather than amplification effects.

Importantly, the findings support a contextualized model of school connectedness in which relational supports and environmental conditions jointly influence students' connectedness.

6.2. Practical and Policy Implications

The findings offer differentiated guidance for schools operating at varying levels of environmental comfort.

In schools where students report lower levels of psychological safety and comfort, targeted supports may play a particularly important role in strengthening school connectedness. Investments in personal development initiatives, accessible psychological-pedagogical services, and structured family engagement strategies may yield comparatively stronger associations with students' sense of belonging. For policymakers, such schools may represent priority sites for relational capacity-building interventions.

In schools characterized by high environmental educational comfort, the findings suggest that baseline relational conditions are already strongly associated with school connectedness. In such contexts, the focus may shift toward sustaining inclusive norms, monitoring relational quality, and ensuring consistency rather than expanding the intensity of targeted supports. Rather than assuming diminishing relevance of supports, schools should ensure alignment between support programs and broader climate initiatives.

Across both contexts, the results caution against uniform, one-size-fits-all intervention strategies. Context-sensitive resource allocation may be more effective than blanket implementation of identical support packages.

7. Limitations and Directions for Future Research

The study's cross-sectional design limits interpretation to associations rather than causal mechanisms. Longitudinal research could examine whether changes in environmental comfort over time alter the strength of support-connectedness relationships.

The reliance on self-reported data introduces potential perceptual bias, although statistical diagnostics suggest that common method variance is unlikely to materially distort the findings. Future studies could incorporate teacher, parent, and administrative perspectives to triangulate perceptions of connectedness and support.

Finally, comparative research across decentralized and centralized education systems would help determine whether the observed attenuation pattern is particularly characteristic of reform-driven centralized contexts or represents a more general ecological phenomenon.

8. Conclusion

This study examined how school-based support mechanisms and family engagement relate to students' school connectedness in Kazakhstan's secondary education system, with particular attention to the moderating role of the Comfortable Educational Environment. Grounded in Bioecological Theory, the study advances a contextualized understanding of school connectedness by moving beyond additive models of support and examining how relational mechanisms operate within broader environmental conditions.

The findings indicate that personal development support, psychological and pedagogical support, family engagement in education, and the Comfortable Educational Environment are each positively associated with students' school connectedness. Among these predictors, environmental comfort demonstrates the strongest direct association, underscoring the central importance of students' perceptions of psychological safety, relational warmth, and inclusive school climate in shaping attachment to school.

At the same time, the results reveal consistent negative moderation effects: as students' perceptions of environmental comfort increase, the strength of the associations between each support mechanism and school connectedness decreases. Importantly, these interaction effects reflect attenuation rather than substitution. The findings do not suggest that support mechanisms

become unnecessary in comfortable environments; rather, they indicate that the magnitude of their statistical association with school connectedness varies across contextual conditions.

Within Kazakhstan's reform-oriented and centralized education system, this pattern may reflect the role of system-level efforts to standardize environmental quality across schools. When environmental comfort is already well established through institutional reforms, structured supports remain positively related to school connectedness but demonstrate comparatively smaller incremental associations. Conversely, in contexts where environmental comfort is lower, relational supports appear to be more strongly associated with students' sense of belonging and attachment.

Overall, the study highlights that strengthening school connectedness is not solely a matter of expanding support programs. It also requires careful attention to the broader environmental climate in which these supports are embedded. By demonstrating that the effectiveness of relational supports depends on contextual conditions, the findings contribute to a more nuanced and context-sensitive understanding of how schools can foster students' attachment, belonging, and engagement.

Author contributions: All authors contributed to all the processes of the manuscript, including conceptualization, data collection, analysis of the data, and reporting.

AI usage and assistance: The authors used AI tools for grammar correction, language refinement, and stylistic adjustments to enhance the clarity and coherence of the manuscript.

Data availability: The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Declaration of interest: The authors disclose that they have no actual or perceived conflicts of interest.

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