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Article

The Interplay of School Environment and Academic Self-Beliefs in Predicting Learning Engagement Among Chinese Students

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Abstract: This study explores Chinese students' learning engagement, encompassing behavioral, cognitive, and emotional aspects, and its intricate relationships with school atmosphere, academic self-efficacy, and academic emotions—an area that remains significantly under-researched in contemporary educational psychology. A positive school climate, which is fundamentally characterized by harmonious teacher-student and peer relationships, a highly positive campus culture, and democratic teaching management practices, is hypothesized to substantially promote overall learning engagement. Furthermore, academic self-efficacy is proposed as a critical factor moderating and mediating this complex relationship. To empirically investigate these dynamics, a quantitative research design was employed, utilizing a structured questionnaire administered to a randomly cluster-sampled cohort of 379 Chinese students across various educational levels. Advanced structural equation modeling techniques were rigorously applied to analyze the collected data concerning the four key variables and to systematically test the proposed theoretical hypotheses. The expected contributions of this comprehensive investigation include robust empirical evidence demonstrating the significant role of a positive school climate in directly improving student learning engagement. Practical implications derived from the findings strongly advocate for educational stakeholders to actively foster a positive school atmosphere, enhance effective teacher-student communication channels, and implement targeted interventions aimed at boosting students' academic self-efficacy. Ultimately, this study aims to inform ongoing initiatives for Chinese educational quality improvement and to lay a solid, evidence-based foundation for future longitudinal research exploring the grade-specific and subject-specific impacts of school climate on academic outcomes.

Keywords: learning engagement; school climate; academic self-efficacy; academic emotions; structural equation modeling

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1. Introduction

In the field of educational research within China, the concept of students' learning engagement has consistently been identified as a pivotal factor influencing academic success. Academic achievement is not solely determined by intellectual capabilities or the adoption of effective learning strategies. Instead, a growing body of research emphasizes the importance of external and internal factors, such as the learning environment and students' psychological states, in shaping their engagement levels [1–3]. Among these, the school climate has emerged as a critical environmental factor, encompassing elements such as teacher-student relationships, peer interactions, and the overall sense of safety and

support within the school setting. A positive school climate fosters an environment where students feel valued and motivated, which in turn enhances their willingness to actively participate in learning activities. Furthermore, psychological constructs like academic emotions and academic self-efficacy play significant roles in mediating the relationship between school climate and learning engagement. Academic emotions, which include feelings such as enjoyment, anxiety, and pride related to learning tasks, directly influence students' motivation and persistence. Similarly, academic self-efficacy, defined as students' belief in their ability to succeed in academic tasks, serves as a powerful predictor of their engagement and performance. This study aims to delve deeper into the mechanisms through which a positive school climate impacts students' learning engagement, with a particular focus on the mediating effects of academic emotions and self-efficacy [4–6]. By understanding these dynamics within the Chinese educational context, this research seeks to provide actionable insights for educators and policymakers to create more supportive and effective learning environments that promote sustained academic engagement and success.

2. Problem Statement

Against the backdrop of global educational reform, the influence of a positive school climate on student academic performance has garnered significant attention. Learning engagement, encompassing behavioral, emotional, and cognitive dimensions, is widely recognized as a critical mediator in this relationship. A positive school climate, characterized by supportive interpersonal relationships, a sense of security, and inclusiveness, plays a pivotal role in fostering higher levels of learning engagement. However, there remains a notable gap in research concerning the specific dynamics of this relationship within the Chinese educational context. Chinese students often encounter challenges related to low learning engagement, which can be attributed to factors such as insufficient external motivational support, limited strategies for coping with academic setbacks, and overly monotonous teaching methods. These challenges not only result in suboptimal academic performance but also contribute to the development of negative emotions, including academic burnout and anxiety, thereby perpetuating a detrimental cycle of disengagement and underachievement. A positive school climate, coupled with high academic self-efficacy and constructive academic emotions, has the potential to enhance learning engagement across multiple dimensions [7–9]. These elements work synergistically to create an environment conducive to active participation and sustained effort in academic tasks. While existing studies have explored the interplay among these variables, many are constrained by cross-sectional research designs and a lack of consideration for cultural nuances, making it difficult to establish causal relationships or identify unique characteristics within the Chinese context. This study aims to address these gaps by focusing on the Chinese educational environment to examine how a positive school climate influences students' learning engagement. Particular emphasis is placed on analyzing the mediating roles of academic emotions and academic self-efficacy to elucidate the underlying mechanisms. By doing so, the research seeks to provide valuable insights for educational policymakers and practitioners, offering evidence-based recommendations for fostering positive school environments that promote student engagement and academic success. This investigation is expected to contribute to the broader understanding of how culturally specific factors shape the relationship between school climate and learning engagement, ultimately supporting the development of more effective educational strategies tailored to the needs of Chinese students.

3. Research Questions

The overall level of students' learning engagement, encompassing behavioral, emotional, and cognitive dimensions, is a critical area of investigation within the current Chinese educational context. Understanding these dimensions provides valuable insights into how students interact with their learning environment, how they emotionally connect

with their studies, and how effectively they process and apply knowledge. Behavioral engagement refers to students' participation in academic tasks, including attendance, effort, and persistence. Emotional engagement involves students' feelings of interest, enthusiasm, and attachment to their learning experiences. Cognitive engagement pertains to the depth of students' investment in understanding and mastering complex concepts. By examining these dimensions collectively, researchers aim to identify patterns and factors that influence students' overall engagement levels, which can inform strategies to enhance educational outcomes in China.

A positive school climate, characterized by interpersonal, teaching, and administrative climates, is hypothesized to significantly influence students' learning engagement. The interpersonal climate involves the quality of relationships among students, teachers, and staff, fostering a sense of belonging and mutual respect. The teaching climate pertains to the instructional practices, teacher support, and the overall academic atmosphere that encourages active learning and intellectual curiosity. The administrative climate includes the policies, leadership, and organizational structures that create a stable and supportive environment for education. Investigating the impact of these components on learning engagement allows researchers to determine how the broader school environment contributes to students' academic success and personal development. This understanding can guide the implementation of targeted interventions to cultivate a more conducive learning atmosphere.

Academic self-efficacy, defined as students' belief in their ability to successfully complete academic tasks, is proposed to play a mediating role between positive school climate and learning engagement. Self-efficacy influences students' motivation, resilience, and approach to challenges, making it a pivotal factor in their academic journey. When students perceive their school climate as supportive and encouraging, their confidence in their abilities is likely to increase, which in turn enhances their engagement in learning activities. This mediating relationship underscores the importance of fostering both a positive school environment and strong self-efficacy to optimize educational outcomes. By exploring this dynamic, researchers can identify strategies to empower students and create conditions that promote sustained academic involvement.

Positive academic emotions, such as enjoyment, hope, and pride, are also hypothesized to mediate the relationship between positive school climate and students' learning engagement. These emotions play a crucial role in shaping students' attitudes toward learning and their ability to persist in the face of challenges. A supportive school climate can nurture these positive emotions by providing students with a sense of security, encouragement, and recognition. In turn, these emotions enhance students' willingness to engage deeply with their studies, fostering a cycle of motivation and achievement. Understanding this mediating effect allows educators and policymakers to design interventions that not only improve the school climate but also actively cultivate positive emotional experiences for students, thereby boosting their overall engagement and academic performance.

The interpersonal climate within the broader school climate may exert a stronger impact on students' learning engagement compared to the teaching and administrative climates. This hypothesis suggests that the quality of relationships among students, teachers, and staff is a particularly influential factor in shaping students' academic experiences. Positive interpersonal interactions can foster trust, collaboration, and a sense of belonging, which are essential for sustained engagement. Furthermore, this effect may be mediated by positive academic emotions and academic self-efficacy, highlighting the interconnected nature of these variables. By examining the relative influence of interpersonal climate and its mediating factors, researchers can identify key areas for intervention to enhance students' engagement. This nuanced understanding can inform the development of targeted strategies to strengthen interpersonal relationships within schools, thereby creating a more supportive and engaging educational environment.

4. Research Procedure

During the research preparation stage, the researcher conducted a systematic review of domestic and international literature to clarify the theoretical connotations and operational definitions of key variables, including school climate, positive emotions, academic self-efficacy, and learning engagement. Based on this foundation, the overall research model and hypotheses were constructed. Quantitative research methods and structural equation modeling were selected as the primary analytical tools, ensuring a robust methodological framework for subsequent research design and data analysis [10–12]. The researcher also completed a preliminary design of the research protocol, assessing its feasibility, ethical compliance, and implementation conditions. To ensure the reliability and validity of measurement instruments, mature scales validated in prior studies were prioritized, with revisions made to enhance their contextual applicability for Chinese senior high school students. A small-scale pretest was conducted to refine the questionnaire, addressing ambiguities and improving clarity. In the data analysis stage, descriptive statistical analysis, analysis of variance (ANOVA), and structural equation modeling (SEM) were employed sequentially. Descriptive statistics provided an overview of the research variables, while ANOVA examined differences across demographic groups. SEM was used to test hypotheses and analyze direct and mediating effects among variables. The principle of "measurement model first, structural model later" was strictly adhered to, ensuring the reliability and validity of instruments before testing theoretical paths. In interpreting results, the researcher integrated statistical findings with the theoretical framework, focusing on how positive school climate influences learning engagement through positive academic emotions and self-efficacy. Comparisons with existing studies were made to identify consistencies and differences, with contextualized interpretations provided to align findings with the Chinese educational context. This comprehensive approach not only validated the hypotheses but also laid the groundwork for practical recommendations and educational implications [13, 14] (As shown in Figure 1).

Figure 1. Research Procedure

5. Sample Demographic Overview

A total of 420 samples were initially collected for this study. Following a meticulous screening process, invalid samples were excluded. These invalid samples included responses that were left blank, those completed in an unrealistically short amount of time,

and answers that displayed repetitive or routine patterns, which could indicate a lack of genuine engagement. After this rigorous filtering, 379 valid samples were retained, resulting in an effective recovery rate of 90.23%. This high recovery rate underscores the reliability of the data collection process and ensures that the subsequent analysis is based on a robust dataset. To gain a comprehensive understanding of the participants' backgrounds, demographic data were analyzed using SPSS 24.0 software. This analysis involved examining various attributes of the respondents, such as age, gender, educational background, occupation, and other relevant demographic factors. The detailed results of this demographic analysis are presented in Table 1. By providing a clear demographic profile, Table 1 serves as a foundational reference for interpreting the study's findings and understanding the diversity of the sample population. Such demographic insights are crucial for contextualizing the results and ensuring that the conclusions drawn are representative of the broader population under study. This approach enhances the overall validity and applicability of the research outcomes.

Table 1. Demographic Profile of Respondents

Variable	Choice	N	Percentage
grade	grade 7	145	37.5%
	grade 8	121	30.7%
	grade 9	112	28.8%
gender	male	187	48.6%
	female	190	51.4%
Family residence location	Urban area	185	48.1%
	Rural area	193	51.9%
academic performance	Very poor	52	13.7%
	Poor	70	18.5%
	Below average	61	16.1%
	Average	67	17.7%
	Good	73	19.3%
	Excellent	56	14.8%
Father's highest education level	Primary school	5	1.3%
	Middle school	73	19.3%
	High school	76	20.1%
	Vocational college, associate degree	55	14.5%
	Bachelor's degree	121	31.9%
	Master's degre	39	10.3%
	Doctoral degree	10	2.6%
Mother's highest education	Primary school	15	4.0%
	Middle school	85	22.4%
	High school	106	28.0%
	Vocational college, associate degree	88	23.2%
	Bachelor's degree	70	18.5%
	Master's degre	8	2.1%
	Doctoral degree	8	2.0%
family's economic status	Very difficult	85	21.7%
	Somewhat difficult	75	19.1%
	Average	66	16.7%
	Relatively wealthy	71	18.0%
	Very wealthy	77	19.6%

6. Common Method

Bias can arise in questionnaire survey methods due to various constraints, leading to systematic errors. These errors occur when all statistical variables are collected from the same respondent or completed within the same time period, potentially introducing common method bias. To address this issue, two primary approaches are utilized: procedural control and statistical control. Procedural control involves designing the survey process to minimize bias, while statistical control employs analytical techniques to detect and mitigate its effects. In this study, Harman's single-factor test was employed to assess the presence of common method variance. This test is a widely recognized statistical approach for evaluating whether the data are significantly influenced by such bias.

The methodology involved conducting an exploratory factor analysis on all measurement items of the latent variables simultaneously. The key criterion for determining the presence of common method bias is the explanatory power of the first unrotated factor, which represents the factor with the strongest explanatory power. If this factor's explanatory power exceeds 50%, it indicates a significant common method variance. Conversely, if it remains below this threshold, the data are considered free from severe bias. In this study, the analysis was performed using SPSS 24.0, and the variance explanation rate of the first factor was calculated to be 30.416%. This value is well below the 50% threshold, demonstrating that the data are not significantly affected by common method bias [15].

The results of this analysis are summarized in Table 2, which provides detailed information on the initial eigenvalues and the extraction sums of squared loadings for each principal component. These metrics include the total variance explained, the percentage of variance, and the cumulative percentage. The findings suggest that the measurements of the statistical variables in the sample are both reliable and valid. Furthermore, the absence of significant common method bias ensures that the research results are robust and not distorted by systematic errors introduced during data collection. This rigorous approach to evaluating and addressing potential biases enhances the credibility and reliability of the study's conclusions.

Table 2. Common Method Bias

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	29.416	33.961	33.961	29.416	33.961	33.961
2	4.010	4.758	39.719	4.010	4.758	39.719
3	4.003	4.038	44.757	4.003	4.038	44.757
4	3.006	4.004	48.971	3.006	4.004	48.971
5	2.612	3.033	52.204	2.612	3.033	52.204
6	2.464	2.862	55.265	2.464	2.862	55.265
7	1.655	2.147	57.512	1.655	2.147	57.512
8	1.401	1.640	59.352	1.401	1.640	59.352
9	1.114	1.411	60.863	1.114	1.411	60.863

Note: This table presents the initial eigenvalues and the extraction sums of squared loadings for each principal component, including total variance explained, percentage of variance, and cumulative percentage.

7. Measurement Model Reliability Test

The table provides a detailed analysis of the Cronbach's alpha reliability coefficients for each scale utilized in the study. These coefficients are critical indicators of internal consistency reliability, reflecting the degree to which items within a scale measure the same construct. Among the scales, the Interpersonal Environment scale exhibits the highest reliability with a Cronbach's alpha coefficient of 0.953, signifying exceptional internal consistency [16]. Similarly, the Educational Environment and Self-efficacy scales both demonstrate remarkably high reliability, each with a Cronbach's alpha coefficient of 0.949. These values underscore the robustness of the measurement tools employed for these constructs. Other scales also exhibit strong reliability, with coefficients exceeding 0.85. Specifically, the Academic Emotion scale achieves a coefficient of 0.931, while Learning Engagement and Learning Ability scales yield coefficients of 0.932 and 0.939, respectively. The Learning Behavior scale follows closely with a coefficient of 0.928, and the Administrative Environment scale demonstrates a reliability coefficient of 0.901. Furthermore, the vigor, focus, and dedication dimensions exhibit reliability coefficients of 0.885, 0.886, and 0.862, respectively. These findings collectively affirm the high reliability of the measurement items across all dimensions. Table 3 illustrates that all Cronbach's alpha coefficients in this study surpass the widely accepted threshold of 0.70, which is generally regarded as the minimum standard for acceptable reliability. Values above 0.80 are indicative of good reliability, and those exceeding 0.90 reflect excellent reliability. This consistency ensures that the scales are well-suited for accurately capturing the constructs they are intended to measure, thereby enhancing the validity of the study's findings. The reliability analysis presented in Table 3 is a testament to the methodological rigor applied in the development and validation of the measurement instruments, ensuring their applicability in academic research and practical settings.

Table 3. Reliability Analysis of Each Dimension

Variable	Cronbach's alpha
Interpersonal environment	0.853
administrative environment	0.801
educational environment	0.849
Academic emotion	0.831
Learning ability	0.839
Learning behavior	0.828
Self-efficacy	0.849
vigor	0.805
dedication	0.802
focus	0.806
learning engagement	0.832

Note: This table presents the internal consistency reliability coefficients (Cronbach's α) for each dimension of the scale. A Cronbach's α value above 0.70 generally indicates acceptable reliability, while values above 0.80 indicate good reliability.

Cronbach's alpha coefficients are widely recognized as a standard measure for assessing the internal consistency reliability of scales [17]. This metric evaluates the extent to which items within a scale are interrelated, thereby providing a quantitative measure of the scale's reliability. In this study, the Cronbach's alpha coefficients for all dimensions are presented in Table 3, offering a comprehensive overview of the reliability of the measurement instruments. The coefficients demonstrate that all scales meet or exceed the threshold of 0.70, which is generally considered the minimum acceptable level for reliability. Moreover, several scales exhibit coefficients above 0.90, indicating excellent reliability. These findings highlight the robustness of the scales and their suitability for

accurately measuring the intended constructs. The reliability analysis underscores the importance of employing well-validated measurement tools in research, as high reliability enhances the credibility and reproducibility of the study's results. Table 3 serves as a critical reference point for understanding the reliability of the scales used in this study, ensuring that the measurement items are consistent and reliable indicators of the constructs they aim to assess.

8. Structural Model

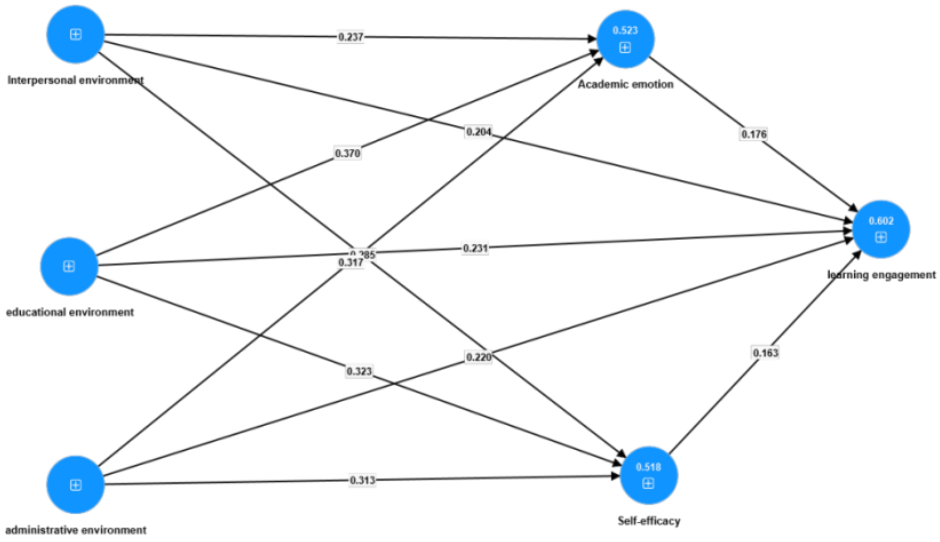

Figure 2. Structural Model

The hypothesized model diagram was utilized to evaluate potential multicollinearity issues within the proposed research framework. To achieve this, the variance inflation factor (VIF) for each variable was calculated. The analysis revealed that the VIF value between Academic Emotion and Learning Engagement was 2.132, while the VIF value between Self-efficacy and Learning Engagement was 2.109. Additionally, the VIF values between Interpersonal Environment and both Academic Emotion and Self-efficacy were 1.397. Similarly, the VIF values between Educational Environment and both Academic Emotion and Self-efficacy were 1.352, and the VIF values between Administrative Environment and both Academic Emotion and Self-efficacy were 1.256. Furthermore, the VIF value between Interpersonal Environment and Learning Engagement was 1.652, the VIF value between Administrative Environment and Learning Engagement was 1.624, and the VIF value between Educational Environment and Learning Engagement was 1.801. These results indicate that all VIF values were significantly below the commonly accepted threshold of 5, suggesting that multicollinearity among the research variables was not a concern. This finding ensures the reliability of the regression analysis conducted in this study. Table 4 provides a detailed summary of the direct, indirect, and total effects among the constructs, further supporting the robustness of the model. With the basic assumptions of regression analysis satisfied, the study proceeded to conduct path analysis and hypothesis testing to explore the relationships among the variables in greater depth. This comprehensive approach ensures that the structural model is both statistically sound and capable of yielding meaningful insights into the dynamics of Academic Emotion, Self-efficacy, Learning Engagement, and the various environmental factors. The results of this analysis contribute to a deeper understanding of the interplay between these constructs, offering valuable implications for educational research and practice [8, 13]. By addressing potential multicollinearity issues and validating the model's assumptions, the study establishes a solid foundation for interpreting the findings and drawing conclusions based on the proposed hypotheses.

Table 4. Direct, Indirect, and Total Effects among Constructs

	Academic emotion	Self-efficacy	learning engagement
Academic emotion			2.032
Interpersonal environment	1.386	1.386	1.643
Self-efficacy			2.009
administrative environment	1.234	1.236	1.602
educational environment	1.332	1.322	1.601

9. Conclusion

This study provides a comprehensive summary of its main findings, theoretical contributions, practical implications, and limitations. By examining the intricate relationships among school climate, positive emotions, academic self-efficacy, and learning engagement, it uncovers the underlying mechanisms that drive students' learning engagement within the context of China's basic education system. The findings offer valuable insights into how environmental factors and psychological constructs interact to influence student behavior, thereby contributing to the broader understanding of educational psychology. Moreover, the study emphasizes the importance of fostering a supportive school climate to enhance students' emotional well-being and academic confidence, which are critical for sustained engagement in learning activities. These insights are not only relevant for theoretical advancements but also hold significant practical value for educators and policymakers aiming to optimize educational environments and promote student development.

First, the study empirically validates both the direct and indirect effects of three distinct dimensions of school climate—interpersonal, teaching, and institutional—on learning engagement. This nuanced analysis deepens the localized application of theoretical frameworks by demonstrating how these dimensions collectively and individually contribute to student outcomes. The dual mediating role of positive emotions and academic self-efficacy is particularly noteworthy, as it elucidates the complex environment-psychology-behavior chain. This chain highlights how external environmental factors influence internal psychological states, which in turn drive observable behaviors such as learning engagement. By enriching the theoretical interpretation of learning engagement, the study provides a robust foundation for future research aimed at exploring similar mechanisms in diverse educational contexts.

Second, the findings underscore the pivotal role of interpersonal and teaching climates in fostering learning motivation and engagement. These dimensions are shown to be particularly influential in shaping students' attitudes and behaviors, thereby reinforcing the importance of nurturing positive relationships and effective teaching practices within schools. Furthermore, the study's exploration of the three-dimensional structure of learning engagement—comprising behavioral, emotional, and cognitive components—offers a novel theoretical perspective. This comprehensive framework not only enhances the understanding of student engagement but also provides actionable insights for designing interventions that address multiple facets of student development simultaneously.

In addition to its theoretical contributions, the study offers practical recommendations for educators and policymakers. These suggestions focus on optimizing the school environment and empowering students psychologically to achieve high-quality education outcomes. For instance, schools are encouraged to create a supportive and inclusive climate that fosters positive interpersonal interactions and effective teaching practices. Simultaneously, targeted interventions aimed at enhancing students' emotional resilience and academic self-efficacy are proposed as strategies to sustain high levels of learning engagement. By addressing both environmental and psychological factors, these recommendations aim to create a holistic approach to educational improvement that benefits all stakeholders.

Finally, the study acknowledges its limitations, which include constraints related to sample size, methodological approaches, and the generalizability of findings. The relatively narrow sample scope may limit the applicability of the results to broader populations, while the reliance on specific quantitative methods may overlook nuanced qualitative insights. To address these issues, future research is encouraged to expand the sample size to include more diverse student populations and to integrate qualitative methodologies alongside quantitative analyses. Such an approach would provide a more comprehensive understanding of the factors influencing learning engagement and allow for the development of more tailored and effective educational interventions. Additionally, exploring longitudinal designs could offer deeper insights into the dynamic and evolving nature of the relationships among school climate, psychological factors, and learning engagement over time.

In conclusion, this study presents a localized theoretical model and empirical evidence that elucidate the relationships among school climate, positive emotions, academic self-efficacy, and learning engagement. By doing so, it lays a solid foundation for advancing basic education reform and supporting adolescent development. The findings not only contribute to the academic discourse on educational psychology but also provide actionable insights for practitioners and policymakers. These contributions are expected to inform future efforts aimed at creating more effective and inclusive educational environments that promote holistic student development and long-term academic success.

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