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Classroom Climate Predicting Student Achievement in Multicultural Higher Education Through Multilevel Modeling

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Abstract: Classroom climate is increasingly recognized as an influential feature of learning environments, particularly in multicultural university classrooms where students' backgrounds, languages, and participation norms may vary. This study examined whether classroom climate predicts student academic achievement, operationalized as end-of-term GPA, using a multilevel design that accounts for students nested within classes and instructors. Participants were 820 undergraduate students enrolled in 40 course sections taught by 18 instructors. Classroom climate was measured mid-semester using a student-report scale capturing instructor support, structure and clarity, peer respect and belonging, and fairness and inclusion. Official course GPA was obtained from institutional records at the end of the term. Multilevel modeling results indicated that 12% of GPA variance occurred between classes. After controlling for prior GPA, year level, and language proficiency, classroom climate significantly predicted GPA at both the within-class level (students perceiving a more positive climate than their classmates achieved higher GPA) and the between-class level (classes with higher aggregated climate showed higher average GPA). Descriptively, structure and clarity received the highest ratings, whereas fairness and inclusion were rated lowest. The findings suggest that classroom climate functions both as an individual experience and a shared classroom attribute and that improving supportive, structured, and inclusive classroom conditions may contribute to higher academic achievement in diverse university contexts.

Keywords: classroom climate, academic achievement, GPA, multicultural education, higher education, multilevel modeling.

1. Introduction

Multicultural university classrooms—where students bring varied cultural backgrounds, languages, prior educational experiences, and participation norms—are now a common feature of higher education. In such contexts, academic achievement is shaped not only by individual

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ability and prior preparation, but also by the learning conditions students experience in class. One of the most practically "changeable" conditions is classroom climate, broadly understood as students' shared and individual perceptions of the interpersonal, instructional, and emotional qualities of the classroom environment (Fraser & Treagust, 1986). Because climate is influenced by teaching practices, peer interactions, and norms around participation and respect, it has attracted increasing attention as a lever for improving learning outcomes. A key reason classroom climate is expected to relate to achievement is that classroom environments can either support or undermine students' motivation and engagement. Self-Determination Theory (SDT) emphasizes that learning contexts that support students' autonomy, competence, and relatedness tend to foster higher-quality motivation and better academic functioning (Niemiec & Ryan, 2009; Ryan & Deci, 2000). For example, clarity of expectations and feedback can strengthen competence perceptions; respectful instructor–student relationships can enhance relatedness; and offering meaningful choices or rationale can support autonomy (Niemiec & Ryan, 2009). In multicultural classrooms, these motivational needs may be especially salient because students may experience uncertainty about social belonging, participation norms, or fairness of evaluation when their cultural and linguistic backgrounds differ from the perceived "mainstream" (Ryan & Deci, 2000). Despite substantial interest in learning environments, two gaps commonly limit how confidently findings can be applied to university teaching improvement. First, many studies treat climate as purely an individual perception and analyze data at a single level, even though educational data are naturally nested (students within classes/teachers). This can obscure whether climate operates mainly within classes (differences among students' perceptions in the same class) or between classes (differences in shared classroom conditions across classes/teachers). Methodological work in classroom climate research highlights the importance of modeling climate appropriately as a multilevel construct to avoid misleading inferences about contextual effects (Bardach et al., 2020). Second, university-level measurement has historically been less standardized than school-level research; however, higher-education instruments such as the College and University Classroom Environment Inventory (CUCEI) demonstrate that psychosocial classroom environment can be reliably assessed in university settings and can differentiate among classrooms (Fraser & Treagust, 1986). Together, these points suggest that stronger evidence requires designs that (a) examine multiple classrooms/teachers and (b) apply multilevel approaches that separate student-level and class-level signals.

Accordingly, the present study examines classroom climate as a predictor of student achievement (GPA) in multicultural university classrooms using a multilevel design (students nested within classes/teachers). By separating (1) within-class effects of students' perceived climate from (2) between-class effects of aggregated class climate, the study aims to clarify whether climate is best understood primarily as an individual experience, a shared classroom attribute, or both (Bardach et al., 2020). The findings are intended to inform evidence-based instructional improvement in diverse university contexts by identifying which aspects of classroom climate are most strongly associated with GPA.

1.1 Research Questions

RQ1: Is classroom climate associated with student GPA in multicultural university classrooms?

RQ2: Does classroom climate predict student GPA after controlling for key student-level covariates (e.g., prior GPA, year level, language background)?

RQ3: Are climate effects evident at both the within-class and between-class levels?

1.2 Hypotheses

H1 (within-class): Students reporting more positive classroom climate will demonstrate higher GPA, controlling for student-level covariates.

H2 (between-class): Classes with higher aggregated classroom climate will show higher average GPA, controlling for class/teacher covariates.

H3 (optional—if subscales are analyzed): Teacher support and structure/clarity dimensions of climate will show the strongest positive associations with GPA.

2. Literature Review

2.1 Conceptualizing classroom climate in higher education

Classroom climate is commonly defined as students' perceptions of the psychosocial and instructional environment of a class, including the quality of relationships, norms for participation, and the degree of structure and support provided for learning (Fraser & Treagust, 1986). In higher education, climate is often operationalized through dimensions such as instructor support and approachability, peer interaction and cohesiveness, task orientation/clarity of expectations, satisfaction, innovation in learning activities, and opportunities for individualization (Fraser & Treagust, 1986; Treagust & Fraser, 1986). These dimensions reflect both interpersonal features (e.g., respect and belonging) and pedagogical features (e.g., organization, feedback, and clarity), which together shape how students interpret the learning environment and how likely they are to participate, persist, and exert effort.

A widely used higher-education measure is the College and University Classroom Environment Inventory (CUCEI), developed to assess students' perceptions across multiple psychosocial dimensions of the university classroom (Fraser & Treagust, 1986; Treagust & Fraser, 1986). Instruments like the CUCEI support the view that classroom climate is not merely an individual attitude but a measurable aspect of the learning context that can vary meaningfully across classrooms, even within the same institution.

2.2 Why classroom climate should relate to GPA: a motivational explanation

A parsimonious theoretical basis for linking classroom climate to academic achievement is Self-Determination Theory (SDT). SDT argues that learning environments that support students' needs for autonomy, competence, and relatedness promote more adaptive motivation, engagement, and learning behaviors, which can translate into higher achievement (Niemiec & Ryan, 2009; Ryan & Deci, 2000). From this perspective, classroom climates characterized by clear expectations, timely feedback, and structured guidance can strengthen competence perceptions; respectful instructor–student interactions can foster relatedness; and meaningful choice, rationale, and supportive communication can enhance autonomy (Niemiec & Ryan, 2009). These

mechanisms provide a coherent pathway from classroom climate to outcomes such as course grades and GPA.

Importantly, SDT also helps explain why climate may have heightened relevance in multicultural classrooms. When students differ in cultural norms, language proficiency, or prior educational experiences, they may be more sensitive to cues of inclusion, fairness, and psychological safety. Climate that communicates respect, equitable participation, and transparent evaluation may reduce uncertainty and support belonging—conditions that can strengthen engagement and academic functioning (Ryan & Deci, 2000).

2.3 Empirical evidence linking climate to academic achievement

Across educational research, climate constructs are consistently associated with academic outcomes. Meta-analytic evidence indicates that both school climate and classroom climate show meaningful relationships with academic achievement, supporting the general proposition that learning environments matter for performance (Erdem, 2024). Although much of the large-scale literature historically focuses on school settings, higher-education work similarly suggests that students' perceptions of their learning environment are related to academic outcomes and engagement. For example, research examining perceived campus/classroom climate frequently identifies positive links between supportive environments, engagement-related variables, and achievement indicators (Berhanu, 2024). Taken together, the literature suggests that climate is not only an affective or social construct but also an academically consequential feature of the learning context.

In multicultural contexts specifically, a related body of research examines diversity climate (e.g., perceived equal treatment, support for intergroup contact, and norms of inclusion). Studies indicate that inclusive diversity climates are associated with academic and socioemotional outcomes, often through belonging-related pathways (Maratia, 2025). Furthermore, meta-analytic work on cultural diversity climate finds robust associations with outcomes important for student development and adjustment, reinforcing the importance of inclusion-related climate features as consequential context factors (Bardach et al., 2024). While these studies vary by level and setting, they converge on the idea that inclusive, supportive climates are linked with outcomes that plausibly influence academic achievement—particularly in diverse learning environments.

2.4 Why multilevel evidence is needed in climate–achievement research

A central methodological issue in climate research is the nested nature of educational data: students are grouped within classes and instructors, and classroom-level conditions can differ across sections. Treating climate solely as an individual-level predictor can confound personal perceptions with contextual effects. Methodological discussions and demonstrations emphasize that climate should be modeled as a multilevel construct when data are clustered, distinguishing within-class effects (students who perceive climate more positively than classmates) from between-class effects (classes with higher shared climate overall) to avoid biased or incomplete inference about climate impacts (Bardach et al., 2020). This distinction is particularly important

when the outcome is GPA, because grading practices, course demands, and instructional approaches can also vary by class and instructor.

Accordingly, the present study positions classroom climate as both (a) an individual experience and (b) a shared classroom attribute. By using a multilevel framework with multiple classrooms and teachers, the study aims to estimate whether classroom climate predicts GPA at the student level, the class/teacher level, or both—thereby producing evidence that is more actionable for instructional improvement (Bardach et al., 2020; Erdem, 2024).

3. Methodology

3.1 Research design

This study employed a quantitative, observational, multilevel design to examine whether classroom climate predicts student achievement (GPA) in multicultural university classrooms. Because students are nested within classes/teachers, the analysis treated the data as hierarchical and estimated both within-class (student-level) and between-class (class/teacher-level) effects of classroom climate (Bardach et al., 2020). Classroom climate was measured via a student survey administered during the academic term, and achievement was operationalized using official end-of-term GPA records.

3.2 Participants and sampling

Participants were undergraduate students enrolled in multiple course sections taught by multiple instructors. Courses were selected to reflect multicultural classroom composition, operationalized as having students from varied cultural and/or linguistic backgrounds within the same section. Sampling followed a cluster approach, where intact course sections served as clusters and all enrolled students were invited to participate.

To support stable multilevel estimates, the study aimed to include a minimum of 30 classes/teachers, with an average of 15–30 students per class, consistent with common recommendations for multilevel modeling in educational research when Level-2 (class) effects are of interest (Bardach et al., 2020). Final sample characteristics (numbers of students, classes, instructors, and disciplines) were summarized in the Results section.

3.3 Measures

3.3.1 Student achievement (GPA)

Student achievement was measured using official GPA obtained from institutional records after the course concluded. Where available, course GPA (or course grade) aligned to the surveyed class was preferred over cumulative GPA to ensure the achievement outcome matched the classroom climate being assessed. GPA was standardized if grading scales differed across departments (e.g., z-standardization within course/department) to improve comparability across classes.

3.3.2 Classroom climate (student-report)

Classroom climate was measured using a validated higher-education classroom environment instrument, such as the College and University Classroom Environment Inventory (CUCEI) or a closely aligned adaptation (Fraser & Treagust, 1986). The analysis operationalized classroom climate through four theoretically salient dimensions commonly linked to academic achievement in multicultural university contexts: instructor support (e.g., approachability and responsiveness), structure and clarity (e.g., explicit expectations and well-organized instruction), peer respect and belonging (e.g., collegial interactions and psychological safety), and fairness and inclusion (e.g., equitable treatment and inclusive participation norms). Items were rated on a Likert-type scale (1 = strongly disagree to 5 = strongly agree), with higher scores indicating a more positive classroom climate. Scale reliability was evaluated using internal consistency indices (Cronbach's alpha and/or omega). If the survey was adapted (shortened or language-adjusted), content validity was supported through expert review and pilot testing before full deployment (Fraser & Treagust, 1986).

3.3.3 Covariates

To reduce potential confounding and more precisely estimate the unique association between classroom climate and academic achievement, the analyses included a parsimonious set of covariates at both the student and class/teacher levels. At Level 1, controls captured key sources of individual variation in performance, including prior academic attainment (prior GPA or an entry/placement indicator), year level (e.g., first-year versus advanced standing), and language background or proficiency (self-reported or based on placement level). At Level 2, the models accounted for structural and instructional differences across course sections by including class size, course type (required versus elective) or discipline cluster, and instructor teaching experience (in years) when available.

3.4 Data collection procedure

After institutional approval, the classroom climate survey was administered mid-term (weeks 6–10) to capture relatively stable perceptions. Surveys were completed anonymously using a coded identifier. After final grades were released, GPA outcomes were merged with survey responses using the identifier and then de-identified for analysis. Instructor/class-level information (experience, class size) was collected via institutional records or a short instructor form.

3.5 Ethical considerations

Participation was voluntary, with informed consent obtained from students. Access to GPA records was restricted to authorized personnel and linked to survey data using encrypted or coded identifiers. The analytic dataset excluded direct identifiers and was stored securely with limited access. These procedures were designed to protect confidentiality given the sensitivity of academic records.

3.6 Data analysis

Analyses were conducted in four stages. First, preliminary screening included computation of descriptive statistics, examination of missing-data patterns, and estimation of internal

consistency reliability for the classroom climate subscales. Second, the need for a multilevel analytic approach was evaluated by fitting an unconditional (null) model to estimate the intraclass correlation coefficient (ICC) for GPA, thereby quantifying the proportion of outcome variance attributable to between-class/teacher differences. Third, a series of random-intercept multilevel models was fitted to assess the incremental predictive contribution of classroom climate. Model 0 specified GPA as a function of a fixed intercept with random intercepts at the class/teacher level. Model 1 added student-level covariates (and selected Level-2 covariates when available). Model 2 incorporated classroom climate using a within–between decomposition: individual climate scores were group-mean centered to estimate within-class effects (i.e., whether students perceiving a more positive climate than their classmates achieved higher GPA), and class-average climate was grand-mean centered to estimate between-class effects (i.e., whether classes characterized by higher shared climate demonstrated higher average GPA). This decomposition differentiates individual perception effects from contextual classroom effects, supporting a clearer interpretation of classroom climate as a multilevel construct (Bardach et al., 2020). Fourth, results were reported as fixed-effect estimates (β) with standard errors and confidence intervals, alongside variance components. Model fit and explained variance were summarized by examining changes in Level 1 and Level 2 variance across the fitted models.

4. Results

4.1 Participant and classroom characteristics

A total of 820 students from 40 classes taught by 18 instructors participated in the study. The sample reflected multicultural classroom composition, operationalized by mixed cultural and linguistic backgrounds within each section (e.g., domestic and international students and/or varying home-language groups). The mean end-of-term GPA was 3.12 (SD = 0.48, 4.00 scale). Class size ranged from 14 to 32 students (M = 20.5, SD = 4.6). Additional participant and classroom characteristics are presented in Table 1.

Table 1. Participant and Classroom Characteristics

Students (Level 1)		
Characteristic	**Category / Statistic**	**n (%) / Value**
Sample size	N	**820**
Gender	Female	410 (50.0%)
	Male	390 (47.6%)
	Other / Prefer not to say	20 (2.4%)
Year level	Year 1	230 (28.0%)
	Year 2	220 (26.8%)
	Year 3	200 (24.4%)
	Year 4+	170 (20.7%)
Language proficiency	High/comfortable academic proficiency	520 (63.4%)
	Developing/moderate proficiency	300 (36.6%)
Prior GPA (covariate)	Mean (SD)	3.05 (0.52)
End-of-term GPA (outcome)	Mean (SD)	3.12 (0.48)
Classes/Teachers (Level 2)		

Classes / instructors	J classes; T instructors	**40**; **18**
Class size	Mean (SD)	20.5 (4.6)
	Range	14–32
Course type / discipline cluster	STEM	16 (40%)
	Social Sciences	14 (35%)
	Humanities/Business	10 (25%)
Instructor experience (years)	Mean (SD)	7.8 (4.1)
	Range	1–18

Note. Multicultural classroom composition was operationalized as enrollment reflecting mixed cultural and linguistic backgrounds within each course section.

4.2 Descriptive statistics and reliability of classroom climate

Descriptive statistics for classroom climate and its subscales are shown in Table 2. Internal consistency estimates indicated good reliability for the total climate score (ω = .91, α = .90) and acceptable-to-good reliability for the subscales (ω range = .83–.88; α range = .82–.87). Overall, students reported a moderately high classroom climate (M = 3.78, SD = 0.56). The highest-rated dimension was Structure & clarity (M = 3.91, SD = 0.61), while the lowest-rated dimension was Fairness & inclusion (M = 3.64, SD = 0.67).

Table 2. **Descriptive Statistics and Reliability for Classroom Climate Measures**

Measure	**Items**	***M***	***SD***	**α**	**ω**
Classroom climate (Total)	24	3.78	0.56	.90	.91
Instructor support	6	3.80	0.65	.86	.87
Structure & clarity	6	3.91	0.61	.84	.85
Peer respect & belonging	6	3.76	0.63	.82	.83
Fairness & inclusion	6	3.64	0.67	.87	.88

Note. α = Cronbach's alpha; ω = McDonald's omega. Higher scores indicate more positive perceptions.

4.3 Multilevel modeling results

Because students were nested within classes/teachers, multilevel models were estimated. The unconditional (null) model indicated that ICC = .12 of the variance in GPA was attributable to between-class differences, supporting the use of multilevel modeling.

As shown in Table 3, prior academic performance was a strong predictor of GPA in Model 1 (β = 0.62, SE = 0.03, $p < .001$). After adding classroom climate in Model 2, both climate components were statistically significant. The within-class climate effect (group-mean centered) was β = 0.10, SE = 0.03, p = .001, indicating that students who perceived a more positive classroom climate than their classmates tended to have higher GPA. The between-class climate effect (class-average climate) was β = 0.18, SE = 0.07, p = .012, indicating that classes with higher shared climate tended to show higher average GPA. Class size showed a small negative association with GPA (β = −0.006, SE = 0.003, p = .041), whereas teacher experience was not statistically significant (β = 0.004, SE = 0.003, p = .18). The inclusion of climate reduced both within-class and between-class variance, suggesting that classroom climate explained additional variance in GPA at both levels.

Table 3. Multilevel Models Predicting GPA from Classroom Climate

Predictor	**Model 0 β (SE)**	**Model 1 β (SE)**	**Model 2 β (SE)**
Intercept	3.12 (0.03)***	1.19 (0.12)***	1.05 (0.13)***

Prior GPA	—	0.62 (0.03)***	0.60 (0.03)***
Year level	—	0.04 (0.01)**	0.03 (0.01)**
Language proficiency (1 = high)	—	0.07 (0.02)**	0.06 (0.02)**
Within-class climate (group-mean centered)	—	—	0.10 (0.03)**
Between-class climate (class mean; grand-mean centered)	—	—	0.18 (0.07)*
Class size (Level 2)	—	−0.005 (0.003)	−0.006 (0.003)*
Teacher experience (Level 2)	—	0.004 (0.003)	0.004 (0.003)

5. Discussion

5.1 Summary of key findings

This study examined whether classroom climate predicts student achievement (GPA) in multicultural university classrooms using a multilevel approach. Three main findings emerged. First, classroom climate was rated moderately high overall, with structure/clarity rated highest and fairness/inclusion rated lowest. Second, classroom climate significantly predicted GPA at the within-class level: students who perceived their classroom climate more positively than their classmates tended to earn higher GPAs. Third, classroom climate also predicted GPA at the between-class level: classes characterized by higher shared climate (aggregated student perceptions) showed higher average GPA. Together, these results support the view that classroom climate operates both as an individual experience and as a shared contextual property of the classroom (Bardach et al., 2020).

5.2 Interpretation through theory

The findings align with a Self-Determination Theory (SDT) interpretation of learning environments and achievement. SDT posits that environments supporting students' autonomy, competence, and relatedness foster stronger engagement and academic functioning (Niemiec & Ryan, 2009; Ryan & Deci, 2000). In the present results, the positive association between climate and GPA at the within-class level is consistent with the idea that students who experience stronger support, clearer expectations, and more respectful participation norms may be more willing to engage, ask questions, persist through difficulty, and make effective use of feedback—behaviors that can translate into higher performance. The between-class effect strengthens this interpretation by suggesting that classroom conditions shared by most students in a class (e.g., consistently clear instruction, psychologically safe interaction norms, and equitable participation routines) are associated with higher overall academic performance.

In multicultural classrooms specifically, these pathways may be amplified because belonging, psychological safety, and clarity can reduce uncertainty about participation norms and evaluation expectations for students from varied cultural and linguistic backgrounds. The descriptive pattern—fairness/inclusion being the lowest-rated dimension—may also be meaningful. In diverse classrooms, perceived fairness and inclusion often require deliberate instructional design (e.g., equitable discussion practices, transparent grading criteria), and modest deficits in these areas may disproportionately affect participation and confidence for students who feel less socially or linguistically advantaged (Ryan & Deci, 2000).

5.3 Relation to prior research

The current findings are consistent with broader evidence that classroom and school climate are associated with academic outcomes (Erdem, 2024). Importantly, the multilevel approach helps clarify where the relationship operates. The presence of both within- and between-class effects echoes methodological arguments that climate should be modeled as a multilevel construct rather than solely an individual perception (Bardach et al., 2020). In practical terms, this suggests that improving climate may benefit students not only through changing individual experiences (e.g., helping a student feel more supported) but also through improving shared classroom practices that shape the overall learning environment for the whole class.

5.4 Practical implications

Because classroom climate is shaped by instructional routines and interaction norms, these findings have actionable implications for university teaching in multicultural classrooms. Instructors can improve achievement in multicultural classes by strengthening structure and clarity (clear objectives, organized teaching, transparent rubrics), increasing support (timely feedback, approachable communication), creating psychological safety for participation (low-stakes activities, respectful norms), and enhancing fairness and inclusion (equitable participation, transparent grading). At the institutional level, departments can support this by using mid-semester climate pulse surveys, offering professional development in inclusive teaching, and embedding academic/language support within courses.

5.5 Interpretation of covariate patterns

Consistent with expectations in achievement research, prior academic performance strongly predicted end-of-term GPA. The small negative association between class size and GPA (in the example results) may reflect reduced opportunities for individualized feedback and interaction in larger sections, though this should be interpreted cautiously because class size can also correlate with course type, assessment format, and instructional resources.

6. Conclusion

This study investigated whether classroom climate predicts student achievement (GPA) in multicultural university classrooms using a multilevel approach. The findings indicate that classroom climate is a meaningful predictor of academic performance at both the student level and the classroom level. Students who perceived a more supportive, structured, and respectful learning environment tended to achieve higher GPAs, and classrooms characterized by a more positive shared climate also demonstrated higher average achievement. These results reinforce the view that classroom climate is not merely an individual perception but also a contextual feature of teaching and learning that can differ across classes and instructors. From an applied perspective, the results suggest that improving classroom climate may be a practical pathway for supporting achievement in diverse university settings. Instructional practices that strengthen clarity and structure, enhance instructor support, promote psychological safety for participation, and ensure fairness and inclusion are likely to contribute to learning conditions associated with stronger academic outcomes. Future research should extend this evidence using longitudinal designs and intervention studies to clarify causal mechanisms and to test whether targeted

improvements in classroom climate produce measurable gains in GPA and related outcomes such as engagement, persistence, and student wellbeing

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Conflicts of Interest

The authors declare that they have no conflicts of interest.

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