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Development of the Mongolian school climate inventory

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ABSTRACT

The school climate is an essential aspect of educational practices and policies. This study aims to investigate Mongolian secondary school teachers' perceptions of school climate and develop a measurement tool. The study involved 686 randomly selected teachers, and research data were collected online from the Mongolian National Educational Evaluation Centre. Statistical analysis was conducted using SPSS-21 software. This study was conducted in three phases: item generation, a pilot study, and a main study. Firstly, 77 items were developed on a 5-point Likert scale based on a literature review. Before the main survey, a pilot test was carried out with 200 teachers from the southern province of the country. Finally, an exploratory factor analysis (EFA) with Promax rotation was used to explore the content validity of the survey. Cronbach's alpha was applied to assess the reliability of each factor. The statistical analysis revealed a 14-factor structure based on the data. The reliability analysis results indicated that internal consistency for all factors is at an acceptable level. The study's overall results suggest that the proposed inventory is a validated measurement tool to examine teachers' perceptions of the school climate in Mongolian secondary schools.

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1. INTRODUCTION

The school climate plays a crucial role in determining student learning and achievement. However, there is limited research on school climate in Mongolia, and it is not yet recognized at the national level how aspects of school climate are essential for evaluating education quality. Currently, there are no tools available to measure the aspects of school climate, nor any attempts to adapt suitable ones developed in other countries. Moreover, the review of literature of articles published in peer-reviewed journals that considered the school climate from the perspectives of Mongolian students shows only a study by Enkhtur *et al.* [1], where the authors identified similarities and differences between Mongolian student experiences and Western-based school climate. To address this gap, we aim to develop a school climate measurement tool called the Mongolian school climate inventory (MoSCI). Therefore, the main objective is threefold. The first objective is to create items that represent the school climate as perceived by teachers, collect data, evaluate pilot tests, and examine whether the data are suitable for exploratory factor analysis (EFA). The second objective is to explore factor solutions. The third objective is to assess the reliability of each factor. The primary research questions to achieve the goals of this study are as:

- Are the data suitable for EFA?
- How many factors do items extract, and what do the factors mean?
- Is the internal consistency good for each component?

As a result of this study, we propose a new measurement model for a school climate as perceived by teachers of secondary schools in Mongolia, which makes the innovativeness of the study. This also can be used as a main tool for policy makers and implementators of the country for evaluating the institutional climate of a school through teachers' perceptions and for supporting further intervention for overall school improvement nationwide. As we mentioned before, there are still no tools to measure the aspects of school climate in the country.

The concept of school climate was first recognized more than 100 years ago. Perry [2] described how students are affected by the quality of their environment and highlighted the crucial influence of school culture or climate on students' outcomes. Yet, school climate did not enter the realm of empirical research until the early 1960s when Halpin and Croft [3] developed the organizational climate descriptive questionnaire and began systematically studying the effects of school organizational climate on student learning and development. Over the last several decades, researchers and educators have realized that the initial conceptualization of school climate was overly simplistic and now recognize it as a multidimensional construct [4].

School climate refers to the various characteristics of a school, such as cultural, contextual, perceptual, and behavioral factors [5]. Although there is no widely accepted definition for school climate, it is generally understood as the quality and character of school life. This is based on the patterns of people's experiences of school life and reflects the norms, goals, values, interpersonal relationships, teaching and learning practices, and organizational structures [6]. Multiple domains and dimensions of the school climate can be explained from the viewpoint of various theoretical foundations. For example, the risk and resilience model [7]–[9], attachment theory [10], [11], social control theory [12], and social cognitive theory [13]–[15].

The risk and resilience model focuses on identifying the factors present in a child's environment that promote positive development and reduce negative outcomes when they face risk [7], [8]. School is a crucial setting for considering these factors. Risk factors such as growing up in poverty or facing discrimination can increase the likelihood of negative outcomes for children. Resilience, on the other hand, refers to the accumulation of assets, such as positive relationships with teachers and challenging instruction, which can help children overcome adversity [16], [17]. Positive student development depends on the unique combination of a student's individual qualities and their school environment [18], [19].

Attachment theory refers to the emotional connection that exists between an infant and their mother [20], [21]. This connection helps the child become more independent and confident with consistent emotional support and a safe environment [22]. One of the first opportunities to form attachments outside the family unit is during the transition to school, when children can bond with peers and teachers [10], [11]. Because attachment theory emphasizes the importance of building strong social bonds, it is especially applicable to the school community, as the quality and frequency of relationships within the school environment can significantly influence a child's development.

As applied to school climate research, social control theory emphasizes the importance of quality academic climates to inspire greater commitment and involvement in educational activities. It also focuses on the quality of the safety and community domains to strengthen students' attachment to the school and belief in the school's moral code. Thus, a strong bond with the school community encourages conformity to conventional norms and decreases the likelihood of deviant behavior.

According to the social cognitive theory, the school environment can significantly impact teaching practices, which, in turn, affect the development of students. Motivation is a key component of this theory, defined as behavior to achieve specific goals [14]. In this theoretical framework, the school climate impacts student development through the quality of interactions in the academic, community, and safety domains, by instilling high academic expectations, facilitating supportive teacher-student relationships, and maintaining an environment where students feel emotionally safe and secure in taking academic risks. The theory suggests that learning occurs in a social context with a dynamic and reciprocal interaction of the person, environment, and behavior.

Although there is ongoing debate regarding the specific elements that contribute to a positive school climate, many researchers have identified four major aspects: quality of teaching and learning, school community and relationships, school organization, and the institutional and structural features of the school environment. Moreover, it is widely acknowledged that the school climate is a multifaceted construct that includes safety, academic dimension, community, and institutional environment. Wang and Degol [4] identified four domains and 13 dimensions of school climate. These domains are academic (teaching and learning, leadership, and professional development), community (quality of relationships, connectedness, respect for diversity, and partnerships), safety (social and emotional safety, physical safety, discipline, and order), and institutional environment (environmental adequacy, structural organization, and availability of

resources). Previous research on school climate assessments has shown that safety, relationships, and institutional structures are the most commonly researched domains [4], [23].

The academic domain of school climate focuses on how learning and teaching are promoted in the school and is defined using three dimensions: leadership; teaching and learning; and professional development climate [24]. Community refers to the quality of interactions between and among school members. The community domain of school climate is defined as having four dimensions: quality of interpersonal relationships, connectedness, respect for diversity, and community partnerships. Quality of interpersonal relationships refers to the consistency, frequency, and nature of the relationships that take place within the school: student-teacher relationships, relationships among students, and relationships among staff members [19], [25].

School safety refers to the physical and emotional security provided by a school and formed by its members, along with the degree of order and discipline present [26]–[28]. The safety domain of school climate is most commonly defined in three dimensions: physical safety, emotional safety, and order and discipline. The institutional environment component of school climate refers to the adequacy of the school setting, the maintenance and infrastructure of the building, and the accessibility and allocation of educational resources. Characteristics of the structural organization that have been linked to perceptions of school climate include school size [29], [30], class size [31]. The availability of resources indicates the accessibility teachers and students have to the technology, tools, and resources that augment instruction [32].

2. RESEARCH METHOD

2.1. Research sample

This study used data collected during the national educational quality assessment organized in Mongolia in October 2022. According to the 2022 report from the National Statistics Office, 23,290 teachers are working in secondary schools. The study included 686 randomly sampled teachers from public and private schools nationwide. The sample size taken from the population of 23,290 teachers with a 99% confidence level and 5% error margin [33] is 648, which is less than the size of our sample. Mongolia is divided into 21 provinces (named "*aimag*"), and the capital (named "*niislel*") Ulaanbaatar. Secondary subdivisions outside Ulaanbaatar are referred to as "*soum*". *Soums* are further subdivided into bags. The sample distribution includes participants from the Ulaanbaatar, *aimags*, *soums*, and bags, with 300 from Ulaanbaatar, 247 from the *aimags*, 135 from the *soums*, and four from the bags. The characteristics of the participants are shown in Table 1 (by age and experience).

More than 80% of all teachers in Mongolia are female. In our study, 87% (n=601) of respondents were female. According to Table 1, 5.98% (n=41) of respondents have worked for less than 1 year, 19.24% (n=132) have worked between 1-5 years. Additionally, 21.28% (n=146) have worked for 6-10 years, 19.68% (n=135) for 11-15 years, 15.45% (n=106) for 16-20 years, 11.08% (n=76) for 21-25 years, and 7.29% (n=50) for 26 years or more.

Table 1. Characteristics of the sample (by age and experience)

Experience	Up to 1	1-5	6-10	11-15	16-20	21-25	26 and above	Total
Male	7	21	22	21	6	3	5	85
Female	34	111	124	114	100	73	45	601
Total	41	132	146	135	106	76	50	686

2.2. Data collection method and data analysis

Based on a literature review, 77 items were generated on a 5-point Likert scale. After preparing the initial draft with all the selected items, a panel of experts checked and approved them. The items were then further narrowed down and simplified. The research data were collected online from the Mongolian National Educational Evaluation Centre, and statistical analysis was performed using SPSS-21 software. Before conducting the main survey, a pilot test was performed involving 200 teachers or respondents from the southern province of the country to examine the reliability of the entire scale. Cronbach's alpha was used to determine the items' internal consistency. The Cronbach's alpha for the perceptions of the school climate scale was .96, within an acceptable range.

Next, an EFA with Promax rotation was conducted to assess the content validity of the survey. This was achieved by measuring the Kaiser-Meyer-Olkin (KMO) test of sample adequacy and Bartlett's test for sphericity to investigate the appropriateness of the data. Since the data did not follow a normal distribution, we chose the extraction method with principal components. Cronbach's alpha was used to assess the reliability of each factor.

3. RESULTS AND DISCUSSION

The concept of measurement validity encompasses four main types: content validity, criterion validity, convergence validity, and discriminant validity. Content validity focuses on ensuring that the items used to represent a scale effectively assess the entire theoretical range of the construct. Content validity can be established by using various methods, such as conducting an EFA on initial data to determine the number of underlying dimensions, their relationships, and how the items are related to these dimensions. Our research aimed to assess the content reliability of the school climate questionnaire for Mongolian teachers. We performed an EFA analysis to achieve this, and the results are presented.

The KMO measure of sample adequacy was .934, which indicates that factor analysis can be conducted on the data and that there is a sufficient number of items for each factor [34]. The Bartlett sphericity test was significant (Chi square=30544.42, df=2926, $p<.05$), which means that the correlation matrix was not an identity matrix. The communalities for all items, as shown in Table 2, met the requirement (greater than .5) for a valid EFA.

Table 2. Communalities

Item	Initial	Extraction	Item	Initial	Extraction
6:1	1.000	.666	9:7	1.000	.583
6:2	1.000	.745	9:8	1.000	.693
6:3	1.000	.704	9:9	1.000	.619
6:4	1.000	.705	9:10	1.000	.569
6:5	1.000	.697	9:11	1.000	.616
6:6	1.000	.710	9:12	1.000	.598
6:9	1.000	.713	9:13	1.000	.580
6:10	1.000	.740	9:4	1.000	.628
6:11	1.000	.560	9:15	1.000	.604
6:12	1.000	.734	9:16	1.000	.570
6:13	1.000	.731	9:17	1.000	.686
6:16	1.000	.543	9:18	1.000	.727
7:1	1.000	.665	9:19	1.000	.728
7:2	1.000	.671	9:20	1.000	.646
7:3	1.000	.610	10:1	1.000	.626
7:4	1.000	.510	10:2	1.000	.639
7:6	1.000	.508	10:3	1.000	.648
7:7	1.000	.601	10:4	1.000	.572
7:8	1.000	.691	10:5	1.000	.609
7:9	1.000	.593	10:6	1.000	.612
7:10	1.000	.646	10:7	1.000	.671
7:11	1.000	.617	10:8	1.000	.690
7:12	1.000	.711	10:9	1.000	.702
7:13	1.000	.702	10:10	1.000	.753
7:14	1.000	.647	10:11	1.000	.584
7:15	1.000	.714	10:12	1.000	.571
7:16	1.000	.668	13:1	1.000	.690
8:1	1.000	.770	13:2	1.000	.576
8:2	1.000	.767	13:3	1.000	.658
8:3	1.000	.697	13:4	1.000	.726
8:4	1.000	.774	13:5	1.000	.592
8:5	1.000	.773	14:1	1.000	.554
8:6	1.000	.745	14:2	1.000	.591
9:1	1.000	.556	14:3	1.000	.500
9:2	1.000	.529	14:4	1.000	.559
9:3	1.000	.575	14:5	1.000	.574
9:4	1.000	.593	14:6	1.000	.539
9:5	1.000	.571	7:5	1.000	.664
9:6	1.000	.602			

Extraction method: principal component analysis

Table 3 shows the 14 components extracted from the item scale and component loadings. When the eigenvalue of the factors is greater than 1, it can be considered an independent factor [35]. Based on the factor analysis results, 75 items were extracted into 14 factors, representing 63.86% of the variance of the original items. A factor loading greater than .4 indicates that the experimental variables can measure the factor [36]. Table 4 indicates that the assessment of the 14-factor structure revealed that all items were strongly loaded on the fourteen components above .4, which is an acceptable range. Two items (6:16 and 7:4) with low fit were removed.

Table 3. Total variance explained

Comp	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings
	Total	% of variance	Cumulative (%)	Total	% of variance	Cumulative (%)	Total
1	17.25	22.401	22.401	17.249	22.401	22.401	12.604
2	6.927	8.997	31.397	6.927	8.997	31.397	8.396
3	4.349	5.648	37.045	4.349	5.648	37.045	11.513
4	3.446	4.476	41.521	3.446	4.476	41.521	8.391
5	3.065	3.981	45.502	3.065	3.981	45.502	4.227
6	2.475	3.215	48.717	2.475	3.215	48.717	9.902
7	2.195	2.851	51.568	2.195	2.851	51.568	9.691
8	1.814	2.356	53.924	1.814	2.356	53.924	5.621
9	1.570	2.039	55.963	1.570	2.039	55.963	4.439
10	1.407	1.828	57.790	1.407	1.828	57.790	4.417
11	1.373	1.782	59.573	1.373	1.782	59.573	2.282
12	1.205	1.565	61.138	1.205	1.565	61.138	3.304
13	1.084	1.408	62.545	1.084	1.408	62.545	3.794
14	1.013	1.315	63.861	1.013	1.315	63.861	2.043

Table 4. Pattern matrix

Item	Components					Item	Components								
	1	2	3	4	5		6	7	8	9	10	11	12	13	14
6:1	.78					9:2	.69								
6:2	.87					9:5	.62								
6:3	.79					9:7	.72								
6:4	.87					9:8	.76								
6:5	.86					9:11	.81								
6:6	.89					9:15	.65								
6:9	.86					7:1		.88							
6:10	.82					7:2		.89							
6:11	.70					7:3		.72							
6:12	.83					7:5		.49							
6:13	.84					7:6		.47							
6:16			removed			7:8		.47							
10:4		.48				13:1			.80						
10:5		.65				13:2			.63						
10:6		.64				13:3			.71						
10:7		.78				13:4			.78						
10:8		.83				13:5			.76						
10:9		.83				14:1				.59					
10:10		.87				14:2				.67					
10:11		.71				14:5				.76					
10:12		.59				9:10					.76				
7:7			.49			9:12					.74				
7:9			.41			9:13					.62				
7:10			.53			9:3						.71			
7:11			.54			9:6						.70			
7:12			.86			9:9						.70			
7:13			.84			14:3							.62		
7:14			.80			14:4							.53		
7:15			.85			14:6							.65		
7:16			.74			10:1								.77	
8:1				.88		10:2								.58	
8:2				.85		10:3								.71	
8:3				.78		9:1									.58
8:4				.87		9:4									.73
8:5				.86		9:14									.48
8:6				.83		7:4					removed				
9:16					.54										
9:17					.78										
9:18					.85										
9:19					.85										
9:20					.72										

The 14 extracted factors were labeled as: F1 (professional development and support), F2 (teacher-student-student interactions in class), F3 (compliance with school rules), F4 (teacher commitment to the job), F5 (lack of effective communication in class), F6 (learner-centered teaching practices), F7 (teacher commitment to curriculum implementation), F8 (homework strategies), F9 (assessment strategies 1), F10 (lack of resources in class), F11(lack of times for interaction and feedback), F12 (assessment strategies 2),

F13 (direct instructional model based teaching practices), and F14 (teacher-centered teaching practices). The results indicate the alignment of the school climate domains identified by Wang and Degol [4], which include academic, safety, and institutional environment. Specifically, factors F1, F2, F6, F8, F9, F12, F13, and F14 represent dimensions of the academic domain, factors F7, F10, and F11 correspond to dimensions of the institutional environment, while factors F3, F4, and F5 correspond to dimensions of the safety domain.

The detailed explanations of the 14 factors by the three school climate domains follow. First, explain the factors that characterize the academic domain (F1, F2, F6, F8, F9, F12, F13, and F14). The F1 factor with the highest variation is named "professional development and support" (eigenvalue=17.25, accounting for 22.4% of variance) and it consists of 11 items (factor coefficients ranging from .70 to .89) representing practices that promote a climate for professional development and support of teachers from school leadership. For example, the principal and managers of our school provide me with opportunities to grow professionally, and our principal and managers support continuous professional development for teachers. This result is consistent with McGiboney conclusion [37]. The study considered the daily operation of a school to be the accurate measure of a school's climate and level of influence by the school leader. The school's daily operations predict teachers' perception of school climate more than the opinions or theories of principals' leadership. In other words, a school's leader may perceive the school climate as positive, but the proof is in the elements of the school climate that students and teachers experience. For example, a leadership decision that develops and supports programs, activities, or practices that encourage teachers and students to interact more often is related to school climate [37].

Supportive teaching practices, diverse opportunities for knowledge construction, a conducive learning atmosphere [13], [14] and specific instructional activities such as teacher interactions with students, assessment practices, and providing feedback [19], [25], [37], [38] are all essential factors in the academic domain, particularly in teaching and learning. Factors identified in this research are consistent with the results of previous research. One notable factor (F2) named teacher-student-student interactions in class (eigen value=6.93, accounting for 9% of variance) comprises nine items (factor coefficients ranging from .50 to .87) that represent the interactions and practices between teachers and students (i.e., the teacher creates opportunities and an environment for effective and active communication between teacher-student and student-student). For example, "I provide opportunities for students to practice asking questions and explaining to others," and "I provide opportunities for students to illustrate their ideas and solutions." The F6 factor named learner-centered teaching practices (eigen value=2.48, 3.22% of variance) includes six items (factor coefficients ranging from .62 to .81). For example, "I pay attention to the discussion among students and provide opportunities for students to learn from their mistakes." The F13 factor named "direct instructional model-based teaching practices" (eigenvalue=1.08, accounting for 1.41% of variance) includes three items (factor coefficients ranging from .58 to .77). For example, first, "I explain the contents to the students." The F14 factor, named teacher-centered teaching practices (eigenvalue=1.01, accounting for 1.32% of variance), consisted of three items (factor coefficients ranging from .48 to .73). For example, "I provide teacher-centered teaching in most classes." The F8 factor named homework strategies (eigenvalue=1.81, accounting for 2.36% of variance) consists of five items (factor coefficients ranging from .63 to .80). For example, I always check students' homework and give feedback. The F9 factor named assessment strategies 1 (eigenvalue=1.57, accounting for 2.04% of variance) includes three items (factor coefficients ranging from .59 to .76). And the F12 factor named assessment strategies 2 (eigenvalue=1.21, accounting for 1.57% of variance) consists of three items (factor coefficients ranging from .53 to .65). These items represent teacher evaluation and assessment practices (i.e., using various assessment strategies for student learning; concrete feedback is given to students on learning).

Previous research suggests the importance of numerous factors within the institutional environment domain of school climate. Key aspects include the adequacy of the school setting, the maintenance and infrastructure of the building, the accessibility and allocation of educational resources [32], school size [29], [30], and class size [31]. Our findings align with the theoretical framework in this area. For example, the F10 factor refers to the availability of resources, while the F11 factor pertains to school size or class size. The F7 factor named "teacher commitment for curriculum implementation" (eigenvalue=2.20, accounting for 2.85% of variance) comprises five items (factor coefficients ranging from .47 to .89). The F10 factor named lack of resources in class (eigenvalue=1.57, accounting for 2.04% of variance) comprises three items (factor coefficients ranging from .42 to .76) representing a poor supply of textbooks, learning materials, substances, and reagents. The F11 factor named "lack of time for interaction and feedback" (eigenvalue=1.21, accounting for 1.57% of variance) consists of three items (factor coefficients ranging from .70 to .71) representing the lack of time for teachers to discuss and provide feedback one-to-one with their students about issues related to their progress.

Safety is a critical aspect of the school climate, and our results identified three key factors in this area. One of these is the F3 factor named "compliance with school rules" (eigenvalue=4.35, accounting for 5.65% of variance), which covers nine items (factor coefficients ranging from .41 to .86). For example, "how

well do students follow your school rules?" The F4 factor named "teacher commitment for the job" (eigenvalue=3.45, accounting for 4.48% of variance) includes gender items (factor coefficients ranging from .78 to .88). For example, "I will do my job as a teacher consistently and continuously." The F5 factor named "causes of lack of effective communication in class" (eigenvalue=3.07, accounting for 3.98% of variance) comprises five items (factor coefficients ranging from .54 to .85). For example, a lack of food and nutrients for students makes teaching and learning difficult, and a lack of student interest makes teaching and learning difficult.

The data was analyzed to assess reliability using the Cronbach's alpha coefficient for each factor. The results of the EFA and the reliability analysis are summarized in Table 5. The results of the reliability analysis indicated that the internal consistency for all factors is at an acceptable level. Specially, the internal consistency of factors F1, F2, F3, and F4 was excellent ($\alpha \geq .9$), while the one for factors F5, F6, F7, F8, F9, F10, and F13 was good ($.9 > \alpha \geq .7$).

Through the use of EFA with Promax rotation, a 14-factor structure was identified based on the data. The scale encompasses key elements of the school climate domains, including the academic, safety, and institutional environment. As this study aimed to develop and validate a scale to measure perceptions about the school climate of Mongolian secondary school teachers, we conclude that the aim is achieved. This study is significant, as it suggests certain valid and robust instruments in the field of school climate for addressing issues and problems in Mongolian educational practices and policies. We note that since this study examined only the validity of the content, the question of the validity of other types will be treated in our future studies.

Table 5. The factor solutions for the MoSCI

Factor code	Initial eigenvalues			Number of items	Ranges of factor coefficients	Reliability coefficients
	Total	% of variance	Cumulative (%)			
F1	17.25	22.40	22.40	11	.70-.89	.95
F2	6.93	9.00	31.40	9	.48-.87	.90
F3	4.35	5.65	37.05	9	.41-.86	.91
F4	3.45	4.48	41.53	6	.78-.88	.92
F5	3.07	3.98	45.51	5	.54-.85	.86
F6	2.48	3.22	48.73	6	.62-.81	.83
F7	2.20	2.85	51.58	6	.47-.89	.84
F8	1.81	2.36	53.94	5	.63-.80	.83
F9	1.57	2.04	55.98	3	.59-.76	.73
F10	1.41	1.83	57.81	3	.62-.76	.70
F11	1.37	1.78	59.59	3	.70-.71	.63
F12	1.21	1.57	61.16	3	.53-.65	.60
F13	1.08	1.41	62.57	3	.58-.77	.74
F14	1.01	1.32	63.89	3	.48-.73	.60

4. CONCLUSION

The study focused on developing a tool to measure school climate called the MoSCI. The study's conclusions are as: first, the findings showed relationships among the experimental variables, and the number of items for each factor is sufficient. Second, the study found that the proposed items determined 14 independent factors. Specifically, these factors are related to the perceived school climate of teachers and represent professional development and support (F1), teacher-student-student interactions in class (F2), compliance with school rules (F3), teacher commitment to the job (F4), lack of effective communication in class (F5), learner-centered teaching practices (F6), teacher commitment to curriculum implementation (F7), homework strategies (F8), assessment strategies (F9 and F12), lack of resources in class (F10), lack of times for interaction and feedback (F11), direct instructional model-based teaching practices (F13), and teacher-centered teaching practices (F14). The factor with the highest variation is "professional development and support". Factors F6, F10, and F13 are related to teaching strategies, while F2, F5, and F11 are more related to teacher-student-student interaction. However, factors F8, F9, and F12 represented teachers' evaluation and feedback strategies, while factors F4 and F7 represented the teachers' commitment. Third, the internal consistency of all factors is good.

The results indicate the alignment of identified school climate domains, including academic, safety, and institutional environment. Specifically, factors F1, F2, F6, F8, F9, F12, F13, and F14 represent dimensions of the academic domain, factors F7, F10, and F11 correspond to dimensions of the institutional environment, while factors F3, F4, and F5 correspond to dimensions of the safety domain. The study's overall results suggest that the proposed MoSCI inventory is a validated measurement tool to examine teachers' perceptions of the school climate in Mongolian secondary schools.

This study is innovative in developing a new measurement model for a school climate as perceived by teachers of secondary schools in Mongolia. MoSCI can be a valuable tool for evaluating the institutional climate of a school through teachers' perceptions and for supporting further intervention for overall school improvement nationwide. In this study, we developed items that represent the school climate by teachers and presented the results of studying only the factor structure. The study used only EFA to identify the factor structure. This approach has its limitations. Therefore, further research is needed to explore the consistency across different populations of the MoSCI and the structural validity of the model with CFA. Additionally, it is necessary to study the impact of the school climate on student learning, achievement, and behavior, as well as the relationships between the school climate and other variables of effective schooling.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Davaanyam Tumenbayar	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	✓
Amartuvshin Amarzaya	✓	✓				✓		✓	✓	✓	✓	✓	✓	✓
Lkhagvasuren Ganbat						✓	✓	✓		✓				
Sandag Gendenjamts					✓		✓	✓		✓				
Navchaa Tserendorj	✓		✓	✓			✓			✓	✓			✓

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare that the research was carried out without any commercial or financial affiliations that could be seen as a possible conflict of interest.

DATA AVAILABILITY

The data that support the findings of this study are available on request from the Education Evaluation Center of Mongolia through corresponding [AA], or other authors. The data, which contain information that could compromise the privacy of research participants, are not publicly available due to certain restrictions.

REFERENCES

[1] O. Enkhtur, D. H. Gruman, and M. Munkhbat, "'Put students' dreams first': Student perspectives on secondary school climate improvement in Mongolia," *School Psychology International*, vol. 44, no. 5, pp. 533–552, Oct. 2023, doi: 10.1177/01430343221147268.
[2] A. C. Perry, *The management of a city school*. New York: Macmillan, 1908.
[3] A. W. Halpin and D. B. Croft, *The Organizational Climate of Schools*. Chicago: Midwest Administration Center of the University of Chicago, 1963.
[4] M.-T. Wang and J. L. Degol, "School climate: A review of the construct, measurement, and impact on student outcomes," *Educational Psychology Review*, vol. 28, no. 2, pp. 315–352, Jun. 2016, doi: 10.1007/s10648-015-9319-1.
[5] C. P. Bradshaw, J. Cohen, D. L. Espelage, and M. Nation, "Addressing School Safety Through Comprehensive School Climate Approaches," *School Psychology Review*, vol. 50, no. 2–3, pp. 221–236, Jul. 2021, doi: 10.1080/2372966X.2021.1926321.

[6] J. Cohen, E. M. Mccabe, N. M. Michelli, and T. Pickeral, "School Climate: Research, Policy, Practice, and Teacher Education," *Teachers College Record: The Voice of Scholarship in Education*, vol. 111, no. 1, pp. 180–213, Jan. 2009, doi: 10.1177/016146810911100108.

[7] M. Rutter, "Implications of Resilience Concepts for Scientific Understanding," *Annals of the New York Academy of Sciences*, vol. 1094, no. 1, pp. 1–12, Dec. 2006, doi: 10.1196/annals.1376.002.

[8] M. A. Zimmerman and R. Arunkumar, "Resiliency Research: Implications for Schools and Policy," *Social Policy Report*, vol. 8, no. 4, pp. 1–20, Dec. 1994, doi: 10.1002/j.2379-3988.1994.tb00032.x.

[9] J. Chang and T. N. Le, "Multiculturalism as a dimension of school climate: The impact on the academic achievement of Asian American and Hispanic youth," *Cultural Diversity & Ethnic Minority Psychology*, vol. 16, no. 4, pp. 485–492, Oct. 2010, doi: 10.1037/a0020654.

[10] S. H. Birch and G. W. Ladd, "The teacher-child relationship and children's early school adjustment," *Journal of School Psychology*, vol. 35, no. 1, pp. 61–79, Mar. 1997, doi: 10.1016/S0022-4405(96)00029-5.

[11] B. K. Hamre and R. C. Pianta, "Early Teacher–Child Relationships and the Trajectory of Children's School Outcomes through Eighth Grade," *Child Development*, vol. 72, no. 2, pp. 625–638, Mar. 2001, doi: 10.1111/1467-8624.00301.

[12] R. Agnew, "Why Do They Do it? An Examination of the Intervening Mechanisms between 'Social Control' Variables and Delinquency," *Journal of Research in Crime and Delinquency*, vol. 30, no. 3, pp. 245–266, Aug. 1993, doi: 10.1177/0022427893030003001.

[13] A. Bandura, W. H. Freeman, and R. Lightsey, "Self-Efficacy: The Exercise of Control," *Journal of Cognitive Psychotherapy*, vol. 13, no. 2, pp. 158–166, Jan. 1999, doi: 10.1891/0889-8391.13.2.158.

[14] D. Schunk, J. Meece, and P. Pintrich, *Motivation in education: theory, research, and applications*, 10th ed. Boston, MA: Pearson, 2020.

[15] J. L. Meece, E. M. Anderman, and L. H. Anderman, "Classroom Goal Structure, Student Motivation, and Academic Achievement," *Annual Review of Psychology*, vol. 57, no. 1, pp. 487–503, Jan. 2006, doi: 10.1146/annurev.psych.56.091103.070258.

[16] J. E. Brooks, "Strengthening Resilience in Children and Youths: Maximizing Opportunities through the Schools," *Children & Schools*, vol. 28, no. 2, pp. 69–76, Apr. 2006, doi: 10.1093/cs/28.2.69.

[17] M. W. Fraser, M. J. Galinsky, and J. M. Richman, "Risk, protection, and resilience: Toward a conceptual framework for social work practice," *Social Work Research*, vol. 23, no. 3, pp. 131–143, Sep. 1999, doi: 10.1093/swr/23.3.131.

[18] G. L. Bowen, R. A. Rose, J. D. Powers, and E. J. Glennie, "The Joint Effects of Neighborhoods, Schools, Peers, and Families on Changes in the School Success of Middle School Students*," *Family Relations*, vol. 57, no. 4, pp. 504–516, Oct. 2008, doi: 10.1111/j.1741-3729.2008.00518.x.

[19] L. M. Hopson and E. Lee, "Mitigating the effect of family poverty on academic and behavioral outcomes: The role of school climate in middle and high school," *Children and Youth Services Review*, vol. 33, no. 11, pp. 2221–2229, Nov. 2011, doi: 10.1016/j.childyouth.2011.07.006.

[20] J. Bowlby, *Attachment: Attachment and loss*, 2nd ed. New York: Basic Books, 1983.

[21] M. S. Ainsworth, "Attachments beyond infancy," *American Psychologist*, vol. 44, no. 4, pp. 709–716, 1989, doi: 10.1037/0003-066X.44.4.709.

[22] R. C. Pianta and B. K. Hamre, "Conceptualization, Measurement, and Improvement of Classroom Processes: Standardized Observation Can Leverage Capacity," *Educational Researcher*, vol. 38, no. 2, pp. 109–119, Mar. 2009, doi: 10.3102/0013189X09332374.

[23] L. Molinari and V. Grazia, "Students' school climate perceptions: do engagement and burnout matter?" *Learning Environments Research*, vol. 26, no. 1, pp. 1–18, Apr. 2023, doi: 10.1007/s10984-021-09384-9.

[24] A. Thapa, J. Cohen, S. Guffey, and A. Higgins-D'Alessandro, "A Review of School Climate Research," *Review of Educational Research*, vol. 83, no. 3, pp. 357–385, Sep. 2013, doi: 10.3102/0034654313483907.

[25] S. Barth, Roland, "Improving Relationships Within the Schoolhouse," *Educational Leadership*, vol. 63, no. 6, pp. 8–13, 2006.

[26] J. F. Devine and J. Cohen, *Making your school safe: strategies to protect children and promote learning*. New York: Teachers College Press, 2007.

[27] G. M. Morrison, M. J. Furlong, and R. L. Morrison, "School Violence to School Safety: Reframing the Issue for School Psychologists," *School Psychology Review*, vol. 23, no. 2, pp. 236–256, Jun. 1994, doi: 10.1080/02796015.1994.12085709.

[28] D. Wilson, "The Interface of School Climate and School Connectedness and Relationships with Aggression and Victimization," *Journal of School Health*, vol. 74, no. 7, pp. 293–299, Sep. 2004, doi: 10.1111/j.1746-1561.2004.tb08286.x.

[29] G. L. Bowen, N. K. Bowen, and J. M. Richman, "School Size and Middle School Students' Perceptions of the School Environment," *Children & Schools*, vol. 22, no. 2, pp. 69–82, Apr. 2000, doi: 10.1093/cs/22.2.69.

[30] K. Leithwood and D. Jantzi, "A Review of Empirical Evidence About School Size Effects: A Policy Perspective," *Review of Educational Research*, vol. 79, no. 1, pp. 464–490, Mar. 2009, doi: 10.3102/0034654308326158.

[31] J. D. Finn and C. M. Achilles, "Tennessee's Class Size Study: Findings, Implications, Misconceptions," *Educational Evaluation and Policy Analysis*, vol. 21, no. 2, pp. 97–109, Jun. 1999, doi: 10.3102/01623737021002097.

[32] J. Oakes and M. Saunders, "Education's Most Basic Tools: Access to Textbooks and Instructional Materials in California's Public Schools," *Teachers College Record: The Voice of Scholarship in Education*, vol. 106, no. 10, pp. 1967–1988, Oct. 2004, doi: 10.1177/016146810410601004.

[33] D. S. Moore, G. P. McCabe, and B. A. Craig, *Introduction to the Practice of Statistics*, 10th ed. New York: WH Freeman, 2021.

[34] B. G. Tabachnick and L. S. Fidell, *Using Multivariate Statistics*, 7th ed. Boston, MA: Pearson, 2021.

[35] H. F. Kaiser, "The Application of Electronic Computers to Factor Analysis," *Educational and Psychological Measurement*, vol. 20, no. 1, pp. 141–151, Apr. 1960, doi: 10.1177/001316446002000116.

[36] A. G. Yong and S. Pearce, "A Beginner's Guide to Factor Analysis: Focusing on Exploratory Factor Analysis," *Tutorials in Quantitative Methods for Psychology*, vol. 9, no. 2, pp. 79–94, Oct. 2013, doi: 10.20982/tqmp.09.2.p079.

[37] G. W. McGiboney, *The psychology of school climate*, 2nd ed. Newcastle upon Tyne: Cambridge Scholars Publishing, 2023.

[38] R. Crosnoe, S. Cavanagh, and G. H. Elder, "Adolescent Friendships as Academic Resources: The Intersection of Friendship, Race, and School Disadvantage," *Sociological Perspectives*, vol. 46, no. 3, pp. 331–352, 2003, doi: 10.1525/sop.2003.46.3.331.

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