



CONSENSUS CLASSROOM CLIMATE INVENTORY: SCALE DEVELOPMENT AND VALIDATION

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Abstract

Science education is a key area of research, largely due to its inherent complexity and challenges. Various teaching methods have been developed to address these difficulties, which include the consensus classroom climate. However, no standardized tool has been created to evaluate the consensus within a classroom. This study aimed to develop and validate the Consensus Classroom Climate Inventory (CCCI), an instrument designed to measure the consensus climate of a classroom. The research was conducted in two phases: (1) initial item pool development based on an extensive literature review and (2) expert panel review for content validation. The resulting 29-item scale was pilot-tested with 120 freshmen students from a state university. Exploratory factor analysis using SMART-PLS yielded four distinct factors: Student Agency, Collaborative Learning Environment, Inclusive and Flexible Learning, and Student Autonomy. The final scale consisted of 23 items. Confirmatory factor analysis demonstrated strong factor loadings (>0.8) for all items, indicating good construct validity. Model fit indices suggested a generally good fit, though some indices indicated room for improvement. Reliability analysis revealed high internal consistency across all factors. The CCCI shows promise as a reliable and valid tool for assessing consensus classroom climate, though further refinement is recommended to enhance model fit. This instrument can assist educators in evaluating the consensus climate of Science classrooms and help educators enhance teaching to improve students' Science learning.

Keywords: consensus classroom climate, factor analysis, scale development, reliability test, validity test

Introduction

Science is important for every student to learn throughout his life. In fact, most of the basic life skills can be learned through Science. However, Science has the reputation of being so abstract and difficult that most students find it difficult to learn. As a matter of fact, Science education has long been a challenge for Filipino students, as highlighted by recent PISA results wherein the Philippines was among the low-performing countries in Science (Avvisati, F., & Ilizaliturri, 2022). To tackle this issue, researchers have conducted various studies. A growing body of research has underscored the importance of a positive classroom environment to maximize student learning which includes student engagement, teacher support and innovation, cooperation, classroom organization and management, classroom culture, and teacher's professional development (Ma & Wei, 2022; Tosuncuoglu, 2018; Wang et al., 2020; Yu & Jiang, 2022). Central to this effort is the notion that students thrive with positive and supportive interactions with their educators (Coristine et al., 2022). All of these are encapsulated in a consensus classroom climate (CCC). This refers to a learning environment with general agreement or shared understanding among students and the teacher. It typically involves open communication (MacDougall, 2013), mutual respect (Briggs & Reid, 2001), and collaboration (Adejimi, 2023). In a consensus classroom, students may work together to

solve problems, make decisions, or establish common goals, creating a positive and cooperative atmosphere for learning (Sartor & Young Brown, 2004). In education, a conventional classroom focuses on teachers, and students are not often included in classroom interaction. As part of the democratization of education, a consensus classroom climate serves as the middle ground between teacher-centered education and student-centered education.

Recent research by Adejimi et al. (2023) has demonstrated that consensus and cooperative reflective journal writing substantially enhanced students' performance in biology compared to a control group. This improvement is attributed to improved communication, responsibility, trust, relationship maintenance, mutual encouragement, and shared goals. Additionally, Allen et al. (2022) found that peer learning and consensus-building with clickers significantly improved students' performance on biology assessments. The initial student ability had a stronger impact on success, suggesting the method's effectiveness in facilitating learning.

Literature Review

Consensus is defined as "group solidarity in sentiment and belief, unanimity, general agreement," a term introduced into the English language in 1843, originating from the Latin words "cum" and "sentire," which suggests thinking or feeling together. As described by Sartor and Brown (2004), the consensus process underpins the effort to reach unanimity or broad agreement among a group. Positioned along a spectrum from autocratic decision-making to more participative approaches like "decision by majority rule" and "decision by consensus," consensus serves as a decision rule that is integral to democratic processes, particularly in the United States (Nielsen & Miller, 1992; Sager & Gastil, 1999).

In the classroom, student-centered decision-making emphasizes collective will and individual student voices, extending decision-making power from the teacher to the entire class. Sartor and Young Brown (2004) advocate for each class to develop its unique consensus method, fostering community, trust, and a shared vision among students. This process begins with smaller decisions, like prioritizing homework assignments and setting assessment criteria, and extends to formal classroom meetings where students actively participate in grading, discuss crucial topics, and reach consensus through voting or the use of colored cards symbolizing various levels of agreement (Sartor & Young Brown, 2004). Another approach involves teachers sharing syllabus creation with students, empowering them to influence classroom policies and expectations through consensus, transforming the syllabus into a living, negotiated document that adapts to evolving needs and preferences, and creating a sense of ownership and accountability among students (Blinne, 2013).

Collaborative learning and problem-solving are integral to education, with consensus-building playing a crucial role. In Japanese elementary schools, the concept of "neriage" during mathematical inquiry lessons engages students in consensus-building discussions, exploring various problem-solving strategies and collaboratively determining the most rational and efficient solutions (Shimizu, 1999). Similarly, MacDougall (2013) underscored the importance of student-to-student+ dialogue in science education, promoting a focus question, communication, and consensus-building process to facilitate productive dialogue. Consensus discussions need not require unanimous agreement; they instead promote togetherness and mutual negotiation (Hartnett, 2012). By incorporating elements such as shared power, informed commitment, and effective facilitation, consensus decision-making creates a dynamic, democratic, and egalitarian learning community where students actively participate in shaping their learning environment and contribute to decision-making (Adejimi, 2023; Briggs & Reid, 2001).

Classrooms can benefit from a shift towards consensus-based decision-making. This approach empowers students by giving them a voice in shaping their learning environment. Teachers and students work together to make choices about everything from classroom rules

to the syllabus (Blinne, 2013; Sartor & Young Brown, 2004). Discussions and negotiations are key to reaching agreements considering everyone's perspectives (Briggs & Reid, 2001). This fosters a sense of community, trust, and ownership among students (Sartor & Young Brown, 2004).

Research suggests that consensus-building can lead to a more positive and productive learning environment (Fetalvero, 2017; Fetalvero & Bagarinao, 2017). Students become active participants, taking responsibility for their learning and challenging the status quo (Freire, 1998; Hooks, 1994). The flexible and adaptable approach allows each class to develop its unique consensus method (Sartor & Young Brown, 2004). For it to work effectively, there needs to be a supportive environment with clear goals and strong facilitation (Briggs & Reid, 2001).

However, a scale to measure the consensus of a classroom remains lacking. Measuring a classroom's consensus helps teachers evaluate the impact of consensus on learning outcomes and explore potential correlations with areas yet to be examined. Additionally, an inventory helps teachers identify which part of the consensus classroom they need to improve, thus maximizing the student's learning. The aim of this study was to create and validate an inventory of the consensus classroom climate, particularly in Science classrooms.

Research Methodology

Theoretical Framework

This study is anchored on the Self-Determination Theory. According to this theory, the source of motivation may come from within (intrinsic) or outside (extrinsic) (Ryan & Deci, 2000). This theory suggests that humans are driven by three core needs: autonomy (feeling in control), competence (feeling capable), and relatedness (feeling connected). These core needs fuel our motivation. This theory suggests that a classroom environment should foster these three core needs to enhance student motivation. This aligns with the consensus classroom climate. According to Reeve (2012), student agency is another component of student engagement that aligns with competence that should be added. Also, student autonomy improves student motivation through active participation in learning. A collaborative learning environment and inclusive and flexible learning are related to relatedness. Students are more motivated when they feel that they belong and can contribute to the group (Chiu, 2021; Kusurkar et al., 2011; Ryan & Deci, 2017).

Participants

Using Raosoft sample size calculator (Zaidi et al., 2021), 120 students were used as a sample of the study from a total of 174 first year students who were enrolled in the Science, Technology, and Society (STS) subject in the academic year 2023-2024. Students who submitted their intent to participate in the survey were chosen through convenience sampling (Emerson, 2021). Further, the sample size was also recommended in the study of Hair et al. (2009). The university's ethics review was considered before the actual data gathering. The researchers also sought approval from the university president and college dean before gathering data. Also, informed consents were sent to the participants before they responded to the survey.

Scale Development

To develop the consensus classroom climate inventory, two phases were conducted:

Phase I

To create the Consensus Classroom Climate Inventory (CCCI), an extensive literature review was conducted to identify key dimensions of consensus classroom climate. These elements informed the development of an initial pool of 25 potential scale items. These scale items generally describe what consensus in a science classroom is. At first, the general points of the consensus classroom are studied through the literature review. After that, indicators for each point were developed. For example, literature suggests that a consensus classroom is a democratic classroom that lets the voices of the students be heard, thus the developed indicator “I have the opportunity to suggest topics or projects for the Science class curriculum.” This is done until 25 potential scale items were developed which were sent to experts for review.

Phase II

A panel of educational experts reviewed the item pool: three secondary school educators, one tertiary education educator, and one consensus classroom expert, a science teacher. These experts were chosen due to their expertise in science education and the consensus classroom climate to solicit better comments to develop the scale. This combination of experience from secondary and tertiary levels and expertise in science content and teaching methods ensured a thorough evaluation of the item pool. Items were revised and added based on expert judgments, in which from an initial pool of 25 items, 4 items were added resulting in 29 items.

Exploratory Factor Analysis

The resulting scale was pilot-tested with 120 respondents. From this, four (4) unique factors were extracted. Also, items with factor loadings of .45 and below were discarded. From the initial 29 items, 23 items were included in the final questionnaire. The factor loadings are shown in Table 2.

Confirmatory Factor Analysis

From a population of 1,214 first-year students from other campuses of Romblon State University, a sample of 293 was calculated using the Raosoft sample size calculator and was chosen through convenience sampling. The responses of these samples were needed to confirm whether the indicators truly measure what they intend to measure.

Research Results

The researcher first determined whether the data collected were appropriate for factor analysis. To test this, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test were conducted for the exploratory factor analysis of the consensus classroom climate inventory

Table 1
Kaiser-Meyer-Olkin Measure (KMO) and Barlett's Test

KMO of Sampling Adequacy		.952
Bartlett's Test of Sphericity	χ^2	3576
	df	406
	p value	< .001

The results presented in Table 1 provide crucial insights into the appropriateness of the data for factor analysis, a fundamental step in validating the test instrument. Specifically, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy of .952, which is well above the recommended threshold of .5, indicates an excellent level of sampling adequacy for conducting factor analysis. This high KMO value suggests that the correlations among the variables are sufficiently strong, supporting the suitability of the data for identifying underlying factors.

Additionally, Bartlett's Test of Sphericity yielded a *p*-value of < .001, which is significantly below the alpha level of .05. This result confirms that the correlation matrix is not an identity matrix and that there are significant correlations among the variables. Essentially, this test indicates that the variables share enough common variance to justify the extraction of factors.

These preliminary tests are critical because they validate that the dataset is appropriate for factor analysis, ensuring that the subsequent extraction of factors will yield meaningful and interpretable results. Without these validations, the factor analysis might lead to unreliable or misleading outcomes, thereby compromising the validity of the test instrument.

Table 2
Indicators for Each Identified Factor with Corresponding Factor Loadings

Factor 1: Student Agency	Factor Loadings	Cronbach's alpha	Literature
25. I actively participate in peer discussions, providing feedback to enhance learning.	.697	.942	Blinne (2013) Hooks (1994), Freire (1998), Sartor & Young Brown (2004) -
29. I actively participate in decision-making regarding class rules	.602		
22. I am encouraged to deepen my understanding by engaging in independent research to seek answers to my questions.	.601		
28. I collectively suggest to others the sequence of topics to be covered during the semester.	.579		
15. I have the opportunity to participate in selecting course materials and textbooks.	.563		
24. Class decisions about the pace of learning are open to discussion among class members	.531		
19. The mode of assessments is freely discussed among class members	.527		
Factor 2 Collaborative Learning Environment			

13. I frequently collaborate in groups to solve complex Science problems.	.670		Sartor & Young Brown (2004) - MacDougall (2013) -
11. My Science teacher seeks my input on instructional techniques.	.648		
12. The format and structure of assignments are open to debate among class members.	.618	.949	
18. I take the initiative in organizing study groups or collaborative study sessions with fellow students	.558		
10. My Science teacher adapts their approach based on my feedback.	.552		
26. I play an active role in proposing real-world applications of scientific concepts discussed in class.	.533		
2. Decisions about teaching methods and materials are collaboratively made between my Science teacher and class members.	.533		
16. The Science class incorporates small group consensus activities that cater to different learning preferences.	.507		
Factor 3 Inclusive and Flexible Learning			
6. Group assignments and projects are common in our science class.	.753		Briggs & Reid (2001) -
4. Science class discussions embrace diverse perspectives, allowing class members to express different viewpoints or experiences.	.672	.896	Kaner et al. (2014) -
8. I actively participate in adapting the curriculum content to evolving needs throughout the semester.	.596		
7. I have opportunities to present my findings, research, or project work to the class, showcasing my active involvement in the learning process.	.582		
1. The Science curriculum includes activities requiring working with my peers to achieve common learning objectives.	.532		
Factor 4 Student Autonomy			
20. I actively participate in hands-on experiments and laboratory activities, contributing to data collection and analysis.	.719		Sartor & Young Brown (2004) -
23. I partake in setting the agenda for the classroom setting.	.613	.892	Blinne (2013)
14. I actively participate in decision-making regarding the mode of learning taking cognizance of each and every learning preference	.527		

Exploratory Factor Analysis was used to identify four (4) factors of consensus classroom as indicated by the literature review. Table 2 shows each factor and the items under each identified factor. Generative AI was used to name each factor. Three (3) AIs were consulted on the proper term to be named as indicated by the items under it. These AI were: Claude, ChatGPT, Gemini, and Blackbox.ai. After this, it was analyzed which of the term/s suggested was appropriate by returning to the literature. Table 2 shows the literature tackling the specific name used for each factor. Finally, the following are used: (1) Student Agency, (2) Collaborative Learning Environment, (3) Inclusive and Flexible Learning, and (4) Student Autonomy.

For example, in Factor 1, the following items have higher factor loadings: 25. I actively participate in peer discussions, providing feedback to enhance learning; 29. I actively participate in decision-making regarding class rules; 22. I am encouraged to deepen my understanding by engaging in independent research to seek answers to my questions; 28. I collectively suggest to others the sequence of topics to be covered during the semester; 15. I have the opportunity to participate in selecting course materials and textbooks; 24. Class decisions about the pace of learning are open to discussion among class members; and 19. The mode of assessment is freely discussed among class members. The AIs were then consulted on what concept was being discussed by the different items. Claude suggested “Student Active Engagement and Voice,” ChatGPT suggested “Student Participation and Engagement,” Gemini suggested “Student Agency and Collaboration in Learning,” and Blackbox.ai suggested “Student Learning and Engagement.”. All of the terms given by the different AIs were somewhat similar, which only means that the items indeed reflect the same concept.

The same process is also used for other factors. The second factor was the collaborative learning environment, which is composed of eight (8) indicators, which all describe how students collaborate with their peers through group activities and with their teachers through adapting and changing the classroom methods and techniques. The indicators include: 13. I frequently collaborate in groups to solve complex Science problems; 11. My Science teacher seeks my input on instructional techniques; 12. The format and structure of assignments are open to debate among class members; 18. I take the initiative in organizing study groups or collaborative study sessions with fellow students; 10. My Science teacher adapts their approach based on my feedback; 26. I play an active role in proposing real-world applications of scientific concepts discussed in class.; 2. Decisions about teaching methods and materials are collaboratively made between my Science teacher and class members; and 16. The Science class incorporates small group consensus activities that cater to different learning preferences.

The third factor is inclusive and flexible learning, which is composed of five (5) indicators, which all describe the nature of the classroom in which diverse learners are included and the curriculum is adapted based on the evolving needs of the students. The indicators include 6. Group assignments and projects are common in our science class; 4. Science class discussions embrace diverse perspectives, allowing class members to express different viewpoints or experiences; 8. I actively participate in adapting the curriculum content to evolving needs throughout the semester; 7. I have opportunities to present my findings, research, or project work to the class, showcasing my active involvement in the learning process; and 1. The Science curriculum includes activities requiring working with my peers to achieve common learning objectives.

The last factor is student autonomy which has three (3) indicators that focus on the individuality of the student. The indicators are: 20. I actively participate in hands-on experiments and laboratory activities, contributing to data collection and analysis; 23. I partake in setting the agenda for the classroom setting; and 14. I actively participate in decision-making regarding the mode of learning, taking cognizance of each and every learning preference.

As shown in the table, only those items with factor loadings of .50 and above were retained.

Confirmatory Factor Analysis of the CCI

After the conduct of the exploratory factor analysis, which was useful in eliminating items and grouping the remaining valid items based on factor loadings, confirmatory factor analysis was the final test. In Figure 1, it presents a confirmatory factor analysis of the consensus classroom climate construct. After the pilot testing, the research confirmed whether each indicator accurately measures its corresponding factor. The figure displays the factor loadings

for each observed variable (questionnaire items) on their respective latent factors (Student Agency, Student Autonomy, Collaborative Learning Environment, and Inclusive and Flexible Learning).

All factor loadings are above .8, which ranges from .84-.91. Specifically, for Student Agency, each indicator has factor loading of .852, .838, .830, .869, .853, .858, and .852, respectively. For Student Autonomy, each indicator has factor loadings of .864, .841, and .908, respectively. For the Collaborative Learning Environment, each indicator has factor loadings of .868, .842, .912, .885, .919, .861, .814, and .894, respectively. Lastly, for Inclusive and Flexible Learning, each indicator has factor loadings of .888, .891, .872, .875, and .907, respectively. This indicates a strong association between the variables and their respective factors. Cronbach's alpha supports the data, indicating strong internal consistency among the items for each factor. The Cronbach's alpha values for the factors are .942, .949, .896, and .892, respectively, all of which demonstrate high internal consistency. This suggests that the instruments' results and measurement of the perceived implementation of consensus classroom climate are reliable. The instrument measures what it intends to measure.

Figure 1
Confirmatory Analysis of Consensus Classroom Climate Inventory

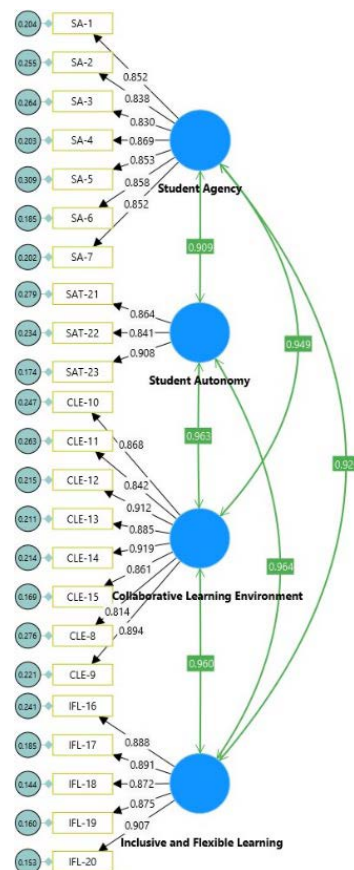


Table 3
Model Fit Indices of the Consensus Classroom Climate Inventory

	Estimated model	Accepted Value	Remarks
<i>p</i> -value	<.000	Lower than 5	Good Fit
Chi Square (χ^2)/ <i>df</i>	3.549		
RMSEA	.093		
RMSEA LOW 90% CI	.086	Lower than .08	Reasonable Fit
RMSEA HIGH 90% CI	.100		
GFI	.799	Above .90	Mediocre Fit
AGFI	.752	Above .90	Mediocre Fit
PGFI	.648	Above .90	Poor Fit
SRMR	.029	Below .05	Very Good Fit
NFI	.913	Above .90	Good Fit
TLI	.927	Above .90	Very Good Fit
CFI	.936	Above .90	Very Good Fit

Indices for various models were also computed to determine the fit of the scale developed. The values are shown in Table 3. The chi-square to degrees of freedom ratio (χ^2/df) of 3.549 indicates a good fit, despite the low *p*-value, which can be attributed to the high degrees of freedom. The Root Mean Square Error of Approximation (RMSEA) of .093, with a 90% confidence interval ranging from .086 to .100, suggests a reasonable fit for the model.

The Goodness of Fit Index (GFI) value of .799 falls below the threshold for a good fit, which is typically considered above .90, and an excellent fit above .95. Similarly, the Adjusted Goodness of Fit Index (AGFI) value of .752 also falls below the acceptable threshold, where values above .90 indicate a good fit, and those above .80 are sometimes considered acceptable.

The Parsimony Goodness of Fit Index (PGFI) value of .648 places the model in the poor fit category, as values above .90 suggest a good fit, .80-.90 is considered mediocre, and below .80 indicates poor fit. In contrast, the Standardized Root Mean Square Residual (SRMR) value of .029 indicates a very good fit, as values below .05 are considered very good, values between .05 and .10 are acceptable, and values above .10 indicate a mediocre or poor fit.

The Normed Fit Index (NFI) value falls within the good fit range, with values above .90 suggesting a good fit and those above 0.95 considered excellent. The Tucker-Lewis Index (TLI) value is very close to the excellent fit range, as values above .90 indicate a reasonable fit, and those above .95 are excellent. Lastly, the Comparative Fit Index (CFI) value is well within the range for a good fit, with values above .90 (or even .95 in some fields) suggesting a good fit.

Overall, the strong positive values from CFI, TLI, SRMR, and NFI suggest that the model captures the data well. While GFI, AGFI, and PGFI are lower, the overall picture leans towards a good fit.

Table 4
Construct Reliability and Validity of the Consensus Classroom Climate Inventory

Factors	Cronbach's alpha	Composite reliability (rho_c)	Average variance extracted (AVE)	Remarks
Collaborative Learning and Environment	.964	.964	.771	High Level
Inclusive and Flexible Learning	.957	.957	.818	High Level
Student Agency	.956	.956	.758	Moderate Level
Student Autonomy	.907	.909	.768	Moderate Level

Also, Construct reliability and validity were computed, and the values are presented in Table 4. For collaborative learning and environment, Cronbach's Alpha is .964, a very high value exceeding the commonly recommended threshold of .7. This indicates that the items in the scale are highly consistent in measuring the same underlying construct. The Composite Reliability is also .964, further strengthening the scale's internal consistency. The Average Variance Extracted (AVE) is .771, suggesting that the underlying construct captures a substantial portion of the variance in the items (approximately 77%), indicating strong convergent validity. In simpler terms, the items effectively measure what they are intended to measure.

For inclusive and flexible learning, Cronbach's Alpha is .957, which is also a very high value above the threshold of .7. The Composite Reliability is .957, further affirming the strong internal consistency of the scale. The AVE is .818, indicating that the underlying construct captures about 82% of the variance in the items, demonstrating strong convergent validity. This means the items are accurately measuring the intended construct.

For student agency, Cronbach's Alpha and Composite Reliability are both .956, indicating very high internal consistency. The AVE is .758, which is moderate. An AVE of .758 suggests that the underlying construct captures approximately 76% of the variance in the items. While this is not as high as in the previous cases, it still indicates a good level of convergent validity, meaning the items are reasonably measuring what they are intended to measure.

For student autonomy, Cronbach's Alpha is .907, and Composite Reliability is .909, indicating good internal consistency. The AVE is .768, which is also moderate. An AVE of .768 suggests that the underlying construct captures approximately 77% of the variance in the items, indicating a good level of convergent validity. This means the items are adequately measuring the intended construct.

Discussion

The assessment of classroom climate is a multifaceted endeavor that demands methodological rigor and theoretical grounding. Prior research has extensively documented the critical dimensions of classroom climate, notably student agency, collaborative learning, inclusivity, and student autonomy. Student agency, which encompasses students' sense of being heard and valued, is well-supported in the literature. The foundational work of Hooks (1994), Freire (1998), and Sartor and Young Brown (2004) underscores the importance of democratic practices in education that empower students and foster meaningful engagement. These

scholars argue that such practices enhance student motivation and participation, aligning with contemporary theories of student-centered learning.

Similarly, collaborative learning environments are emphasized in the literature as crucial for developing effective interpersonal and problem-solving skills among students. Sartor and Young Brown (2004) and MacDougall (2013) highlighted that fostering peer interactions and collaborative dialogue can significantly enhance students' ability to work in teams—skills increasingly valued in both academic and professional contexts. Furthermore, the importance of designing inclusive and flexible learning experiences is well-documented. Briggs and Reid (2001) and Kaner (2014) advocate for integrating diverse perspectives and adapting teaching methods to accommodate various learning styles, thereby promoting equity and broadening students' educational experiences.

Student autonomy is another key dimension supported by Sartor and Young Brown (2004) and Blinne (2013), who argued for the necessity of balancing instructional guidance with opportunities for independent decision-making. This approach helps reduce power struggles and promotes self-determination, contributing to a more democratic and supportive classroom environment.

Consensus classroom climate may have been used by various educators in their respective classrooms, none the less, there is no instrument that accounts for this important variable in a classroom setting. Therefore, this study advances the existing body of knowledge by providing a robust, empirically validated instrument for assessing classroom climate through a rigorous methodological framework. Utilizing both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), this research identifies four pivotal factors—student agency, collaborative learning and environment, inclusive and flexible learning, and student autonomy. These factors are grounded in established theoretical constructs and empirically validated, as evidenced by factor loadings ranging from .84 to .91 (Brown & Moore, 2012). This methodological rigor ensures that the instrument accurately reflects the intended constructs and provides a reliable measure of classroom climate.

The implications of these findings are significant for both theoretical understanding and practical application. By empirically validating these factors, the research underscores the importance of integrating these dimensions into educational practice. For instance, the emphasis on student agency aligns with contemporary educational theories advocating for democratic practices, offering practical benefits such as enhanced student engagement and improved academic outcomes (Freire, 1998; Hooks, 1994). Similarly, the focus on collaborative learning, inclusivity, and autonomy provides actionable insights for educators, enabling the creation of more effective and supportive learning environments (Briggs & Reid, 2001; MacDougall, 2013).

Moreover, the study highlights areas for ongoing refinement of the instrument, suggesting that while the instrument performs well, further evaluation and adjustment are necessary to enhance its precision and applicability. This ongoing refinement ensures that the instrument remains relevant and useful across diverse educational contexts. The integration of theoretical insights with empirical validation not only strengthens the instrument's validity but also its potential impact on both research and practical applications in education. Thus, this study contributes significantly to advancing understanding of classroom climate and offers a valuable tool for educators seeking to improve educational practices and classroom dynamics.

Conclusions and Implications

This study developed and validated the CCCI, an instrument designed to measure the consensus climate of a classroom, particularly in a science classroom. Initial item pool development was conducted based on an extensive literature review while content validation was

done by expert panel. The scale was pilot-tested for exploratory and confirmatory factor analyses among University students taking up Science, Technology and Society course, respectively. Four factors were extracted—student agency, collaborative learning and environment, inclusive and flexible learning, and student autonomy. The successful identification and validation of these factors underscore the instrument's robustness and its potential to provide meaningful insights into various dimensions of classroom climate.

The development and validation of the classroom climate assessment instrument reveal significant insights into its efficacy and implications for educational practice. The high Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and the significant Bartlett's Test of Sphericity affirm that the data is suitable for factor analysis. This methodological rigor ensures that the instrument's factors—student agency, collaborative learning and environment, inclusive and flexible learning, and student autonomy—are well-supported both theoretically and empirically. The successful identification and validation of these factors underscore the instrument's robustness and its potential to provide meaningful insights into various dimensions of classroom climate.

The factor of student agency highlights the importance of students feeling valued and involved in their learning environment, aligning with contemporary educational theories advocating for democratic classroom practices. This finding suggests that educators should actively engage students in decision-making processes, thereby enhancing their motivation and ownership of their learning. Such practices not only foster a sense of empowerment but also contribute to increased student engagement and improved academic outcomes.

Similarly, the factors of collaborative learning and environment, inclusive and flexible learning, and student autonomy provide actionable implications for classroom practice. Encouraging collaboration and peer interaction can enhance students' teamwork skills. Designing flexible and inclusive learning experiences ensures that diverse perspectives are integrated, and various learning needs are met. Moreover, fostering student autonomy empowers students to take ownership of their learning while maintaining a supportive classroom environment.

In a larger sense, the validated instrument offers a valuable tool for educators to assess and improve classroom dynamics, providing a foundation for targeted interventions and enhancements in educational practice.

Declaration of Interest

The authors declare no competing interest.

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Appendix A CONSENSUS CLASSROOM CLIMATE INVENTORY

Part I. Personal Profile

Name (optional): _____

Sex (Assigned at birth): () F () M

Age (in years as of last birthday): _____

College (check the box of your college):

- () College of Arts and Sciences
() College of Education
() College of Engineering
() College of Business and Accountancy
() College of Agriculture, Fisheries and Forestry
() Institute of Information Technology

Bachelor's Degree Program: _____

Part II. For each statement, please rate your agreement on a scale from 1 to 5, the scale is indicated below for your reference. Choose the rating that best reflects your experiences and perceptions by encircling the scale.

(5) Strongly Agree (4) Agree (3) Neither Agree nor Disagree (2) Disagree (1) Strong Disagree

Student Agency	Scale				
25. I actively participate in peer discussions, providing feedback to enhance learning.	5	4	3	2	1
29. I actively participate in decision-making regarding class rules	5	4	3	2	1
22. I am encouraged to deepen my understanding by engaging in independent research to seek answers to my questions.	5	4	3	2	1
28. I collectively suggest to others the sequence of topics to be covered during the semester.	5	4	3	2	1
15. I have the opportunity to participate in selecting course materials and textbooks.	5	4	3	2	1
24. Class decisions about the pace of learning are open to discussion among class members	5	4	3	2	1
19. The mode of assessments is freely discussed among class members	5	4	3	2	1
Collaborative Learning Environment					
13. I frequently collaborate in groups to solve complex Science problems.	5	4	3	2	1
11. My Science teacher seeks my input on instructional techniques.	5	4	3	2	1
12. The format and structure of assignments are open to debate among class members.	5	4	3	2	1
18. I take the initiative in organizing study groups or collaborative study sessions with fellow students	5	4	3	2	1
10. My Science teacher adapts their approach based on my feedback.	5	4	3	2	1

26. I play an active role in proposing real-world applications of scientific concepts discussed in class.	5	4	3	2	1
2. Decisions about teaching methods and materials are collaboratively made between my Science teacher and class members.	5	4	3	2	1
16. The Science class incorporates small group consensus activities that cater to different learning preferences.	5	4	3	2	1
Inclusive and Flexible Learning					
6. Group assignments and projects are common in our science class.	5	4	3	2	1
4. Science class discussions embrace diverse perspectives, allowing class members to express different viewpoints or experiences.	5	4	3	2	1
8. I actively participate in adapting the curriculum content to evolving needs throughout the semester.	5	4	3	2	1
7. I have opportunities to present my findings, research, or project work to the class, showcasing my active involvement in the learning process.	5	4	3	2	1
1. The Science curriculum includes activities requiring working with my peers to achieve common learning objectives.	5	4	3	2	1
Student Autonomy					
20. I actively participate in hands-on experiments and laboratory activities, contributing to data collection and analysis.	5	4	3	2	1
23. I partake in setting the agenda for the classroom setting.	5	4	3	2	1
14. I actively participate in decision-making regarding the mode of learning, taking cognizance of each and every learning preference	5	4	3	2	1

Note: The items were classified according to factors. The suggested item placements, indicated by item numbers, may be followed when conducting the inventory.

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