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Analyzing Students' Classroom Emotional Climate Toward Science Learning in Junior High School

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ABSTRACT

This research aims to analyze students' classroom emotional climate towards science learning in junior high school. This research uses survey methods, which are included in quantitative research. The instrument was adapted from the Classroom Assessment Scoring System (CLASS) and developed to measure classroom emotional climate based on student perspectives. It included open-ended question columns given to junior high school students in West Bandung Regency, West Java, Indonesia. The participants involved in this research were 80 students, divided into 32 male students and 48 female students aged 12 – 16 years. The research results explain that the classroom emotional climate of junior high school students in Bandung Regency is relatively high because these results are dominated by 43.75% of students. Likewise, the calculation results for each dimension. Meanwhile, other findings show no significant difference between the classroom emotional climate of male and female students in West Bandung Regency, dominated by classroom emotional climate in the high category, namely 56% for male students and 52% for female students. This research can be used to describe the classroom emotional climate of junior high school students in Indonesia.

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1. INTRODUCTION

To engage student participation in Science, Technology, Engineering, and Mathematics (STEM) subjects, schools are encouraged to introduce students to STEM through projects that integrate each of the disciplines within STEM. Because there is still little research that discusses the emotional climate in the learning environment in STEM classrooms (Fraser *et al.*, 2020) developed and validated the Classroom Emotional Climate (CEC) questionnaire.

The quality of classroom emotional climate is defined as social and emotional interactions between students, their peers, and teachers (Reyes *et al.*, 2012). Social and emotional interactions between teachers and students and between students greatly influence engagement and learning and consistently predict students' attitudes toward learning. Studying STEM and careers in STEM has been proven to influence student learning outcomes (Fraser *et al.*, 2020). The social and emotional atmosphere in which learning occurs can also influence students' motivation to engage in learning in that classroom environment, attitudes toward STEM, and desire to continue studying STEM subjects (Parpala *et al.*, 2013). Teachers in classes with a positive classroom emotional climate: show concern for students; understand student needs; listen to students' points of view and consider them; avoid sarcasm or harsh discipline; express interest and respect for students and foster cooperation between students; and being aware of students' emotional and academic needs. One of the instruments to determine the quality of classroom emotional climate is the Classroom Assessment Scoring System (CLASS) is an observation tool for grades K-3 that focuses on three domains, namely emotional support, classroom organization, and support for learning through instruction.

The Classroom Emotional Climate (CEC) questionnaire (Fraser *et al.*, 2020) was developed and validated specifically to investigate students' perceptions of integrated STEM classrooms. Seven scales make up the CEC questionnaire: Concern, Control, Clarity, Challenge, Motivation, Consolidation, and Collaboration. We hypothesized that a positive classroom emotional climate in an integrated STEM classroom would also predict students' attitudes toward STEM and willingness to pursue a STEM pathway based on the positive correlations between each of the CEC scales and students' attitudes toward STEM.

Following the Classroom Assessment Scoring System (CLASS) protocol, the Tripod student survey (Tripod 7 C) was developed to measure the classroom emotional climate of the class based on the student's perspective. The 7 C dimensions of the Tripod are explained in other reports.

Care defines how much the teacher cares about the environment where students feel safe and comfortable; cover is how strongly the teacher encourages students to express themselves and the student's points of view; captivating is how interesting and relevant the class is; clarify is recognizing when students do not understand and providing alternative teaching methods; consolidate is in helping students to organize their knowledge and prepare for future learning; challenge defines is the teacher has high expectations for results and encourages deeper thinking; control is how well the teacher ensures that the environment is conducive to students focusing on the task.

This research has previously been carried out on students in Australia during the COVID-19 pandemic and post-pandemic situations. Still, this time, the identification of classroom emotional climate was researched for junior high school students in the West Bandung Regency area, West Java, Indonesia. Based on data on student attendance at school, the low motivation of students to go to school is interesting to find out how students' classroom emotional climate in junior high school students in the West Bandung Regency area. The

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distribution of the CEC questionnaire to junior high school students in West Bandung Regency was then used to identify their classroom emotional climate. The results of this identification in the future can become material for reflection and evaluation for parties in need. This research can answer the following questions:

(i) How is students' classroom emotional climate toward science learning in junior high school?
(ii) Are there differences in classroom emotional climate regarding science learning for junior high school students based on gender?

2. METHODS

2.1. Research Design

The type of research used is quantitative, using a survey method using online Google Forms media. The data collection technique in this research was carried out using a survey method, namely distributing instruments such as a Likert scale questionnaire and an open question column about the Classroom Emotional Climate felt by students towards science learning. The quantitative method is a process of finding knowledge using data in the form of numbers to analyze information about what you want to know. The survey method obtains data from certain natural (not artificial) places. Still, research carries out treatments in data collection, for example, by distributing questionnaires, tests, structured interviews, and so on. Surveys are distributed using Google Forms, a tool in Google Drive that allows for the creation of online survey forms.

2.2. Participants

The type of research used is quantitative, using a survey method using online Google Forms media. The data collection technique in this research was carried out using a survey method, namely distributing instruments such as a Likert scale questionnaire and an open question column about the Classroom Emotional Climate felt by students towards science learning. The quantitative method is a process of finding knowledge using data in the form of numbers to analyze information about what you want to know. The survey method obtains data from certain natural (not artificial) places. Still, research carries out treatments in data collection, for example, by distributing questionnaires, tests, structured interviews, and so on. Surveys are distributed using Google Forms, a tool in Google Drive that allows for the creation of online survey forms (see **Table 1**).

Table 1. Population and student gender.

Grade	Gender	Number	%
7	Male	23	28.75
	Female	23	28.75
	Total	46	57.50
8	Male	2	2.50
	Female	7	8.75
	Total	9	11.25
9	Male	7	8.75
	Female	18	22.50
	Total	25	31.25

2.3 Research Instrument

Emotions are a form of expression from within humans that can influence their ability to control themselves, which later impacts attitudes towards their surroundings, including

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students' processes and learning outcomes. Indicators of emotionality toward learning include the following (Fraser et al., 2020):

(i) Control,
(ii) Clarity of material,
(iii) Challenge,
(iv) Motivation,
(v) Consolidation,
(vi) Collaboration, and
(vii) Attitude.

The instrument used in the research is the Classroom Emotional Climate (CEC) instrument (Fraser et al., 2020) and has 7 dimensions. Each dimension has 6 statements with a Likert scale of 1 to 5, a value of 1 representing strongly disagree and 5 for strongly agree.

2.4. Data Analysis

In the classroom instrument for students' emotional climate towards science learning, seven dimensions of statements are part of the emotional state itself. Each dimension in this instrument has six statements with five Likert scale levels (strongly disagree, disagree, doubtful, agree, and strongly agree). The data obtained was processed using Microsoft Excel with the SUM formula to add up all the answers for each individual. From all the SUM results obtained, the mean is then found using the AVERAGE formula and the standard deviation using the STDEV formula. Furthermore, it can identify the tendency for students' high or low emotional levels in science learning in this study to be based on 4 categories with the following calculations in **Table 2**.

Table 2. Categorization of tendencies.

Category	Calculations
Very high	$X > (M + 1\ SD)$
High	$(M + 1SD) > X \geq M$
Low	$M > X \geq (M - 1\ SD)$
Very low	$X < (M - 1\ SD)$

This is done for all dimensions and repeated to identify each dimension. Then, it was carried out again for each gender and each dimension to identify whether or not classroom emotional climate was significant in gender differences.

3. RESULTS AND DISCUSSION

3.1. Finding related to Research Question 1: "How is the students' classroom emotional climate in junior high school?"

This research aims to identify the classroom emotional climate of junior high school students in Bandung Regency towards science learning. Based on the results of descriptive analysis of the data that has been obtained, in general, the emotional level of junior high school students in Bandung Regency towards science learning in a pandemic situation is relatively high. This is a positive thing, considering that teachers have a very important role in the continuity and management of the class. So, the emotional level also depends on the teacher's ability to bring students' attention and behavior in academic activities, as well as provide feedback to students so that they can understand the material at a deeper level. This is not only in classroom management but also in emotional support for students, such as caring, attentiveness, and respect shown by teachers, which also influence students' emotions (Pianta & Hamre, 2009). Therefore, this high emotional level cannot be separated

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from good classroom management by the teachers concerned. Data obtained in **Table 3** shows the frequency distribution table of the tendency of emotional variable data for junior high school students in West Bandung Regency toward science learning.

Table 3. Results of distribution of classroom emotional climate tendencies of West Bandung Regency Middle School students towards science learning

Category	Class Interval	f	Percentage
Very high	X > 196.38	10	12.5
High	196.38 ≥ X > 166.56	35	43.75
Low	166.56> X ≥ 136.74	26	32.5
Very low	X < 136.74	9	11.25
Total		**80**	**100.00**

Table 3 shows the results of the distribution of trends in classroom emotional climate variable data for junior high school students in West Bandung Regency towards science learning (**Figure 1**).

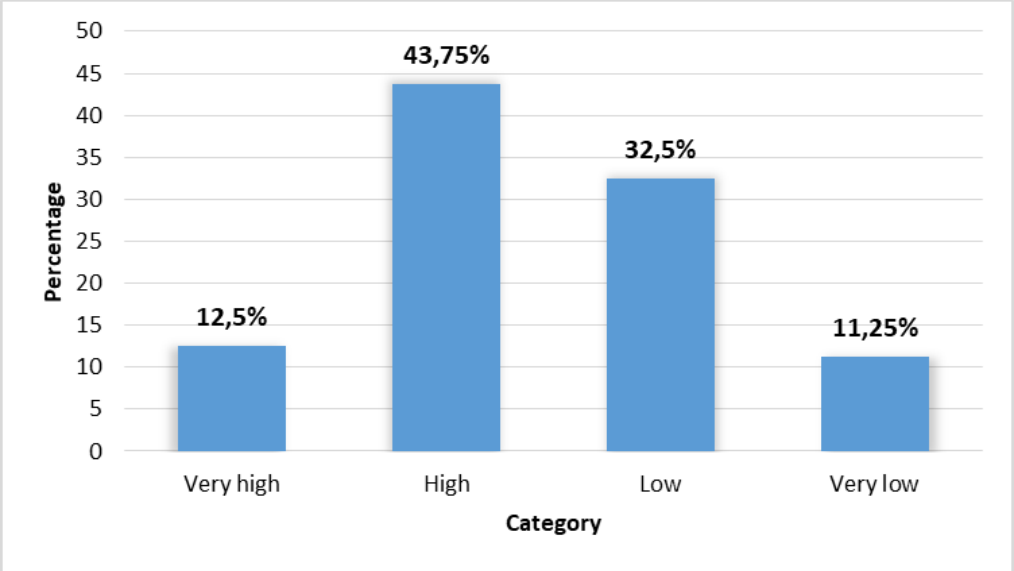

Figure 1. Percentage of classroom emotional climate categorization of junior high school students in West Bandung Regency toward science learning.

Based on **Figure 1**, which shows data calculations that junior high school students in West Bandung Regency regarding science learning have a very good/high emotional level of 12% of students, a good/high emotional level of 44%, bad/low emotional level of 35%, and very bad/low as much as 11%. Furthermore, from the categorization of the distribution of these tendencies, the emotions of junior high school students in West Bandung Regency towards science learning are relatively high.

In the classroom instrument for students' emotional climate towards science learning, 6 dimensions are aspects of students' emotions. Based on data from samples processed using Microsoft Excel, identifying tendencies towards high or low levels of students' emotional aspects is based on 4 categories with the same calculations as before. So, the frequency distribution can be described in **Table 4** and the histogram in **Figure 2**.

From **Figure 2**, all dimensions have a high category categorization. This is related to the results of the frequency distribution categorization of emotional variable data for junior high school students in West Bandung, Indonesia:

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(i) Control. In the control dimension, statements relate to students' self-control during class, such as listening, participating, and paying attention with a focus on explanations from the teacher, as well as the level of students in respecting and following the learning flow. The high results in the control dimension are positive from the emotional part of junior high school students in West Bandung Regency towards science learning. Understanding students' level of respect for their teachers can enable one to predict potential behavior and related perceptions that may influence the learning process. Some researchers have also explored the cognitions associated with efforts to predict learner behavior that is often associated with respect (Egger & Powers, 2003).

(ii) Clarity. Building positive relationships with students is something that is needed when the learning process occurs. Regarding the dimension of material clarity, related things are the services provided by teachers to students during learning, such as ensuring understanding of the material, providing explanations that are easy to understand, explaining difficult things well, and allowing questions to be asked. When students like their teacher, these students enjoy the time spent with the teacher and want to please the teacher by doing what the teacher asks. This is proven by many students' answers in the open-question column that liked their science teacher (Downing & Mitchem, 2005).

(iii) Challenge. The statement on the challenge dimension is in the form of how the teacher encourages students to mobilize their full abilities in critical, logical thinking, doing assignments, and correcting mistakes in science learning. Developing students' critical thinking is currently considered one of education's main goals (Qing *et al.*, 2010). The high category results in the challenge dimension mean that the teacher concerned has involved students in providing the best in science learning.

(iv) Motivation. In the motivation dimension, the statement submitted is about how the teacher makes learning interesting through the questions asked in class and the assignments given to students. Several studies have investigated various constructs of motivation that are used as predictors of students' academic achievement beyond cognitive abilities and previous achievements. Where the results show that most motivational constructs predict academic achievement beyond intelligence and that students' self-concept abilities and task values are more important. Stronger in predicting their achievement than achievement goals and motives (Steinmayr *et al.*, 2019).

(v) Consolidation. To have a good learning flow, consolidation is needed, which aims to form a stronger entity. In the consolidation dimension of the instrument, there are statements about the assistance provided by the teacher to direct students to remember and follow the planned learning flow. The high results in the consolidation dimension indicate that junior high school science learning activities in Bandung Regency already have good consolidation.

(vi) Collaboration. Based on a survey conducted by Johnson in educational research, compared to competitive and individualistic efforts, collaborative cooperation shows several advantages: higher achievement and greater productivity, more caring, supportive, and committed relationships, as well as; better psychological health, social competence and self-esteem (Laal & Ghodsi, 2012). The high level of collaboration results obtained from research data is one of the dimensions or aspects that supports the high classroom emotional climate of junior high school students in West Bandung Regency towards science learning.

(vii) Attitude. In the form of students' views on science learning, such as interest in participating because learning is related to students' majors and interests and students' confidence level in passing science learning. High results indicate that the science learning

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presented by the teacher is related to students' future interests. Because a person's representation of their expected future self can influence current motivation and behavior (Peetz *et al.*, 2009).

Table 4. Result of distribution of classroom emotional climate tendencies of West Bandung Regency Middle School students towards science learning in each dimension.

Dimension	Very high	High	Low	Very low	Total
Control	15	33	22	10	80
Clarity	11	39	20	10	80
Challenge	9	37	20	14	80
Motivation	18	26	24	12	80
Consolidation	13	29	27	11	80
Collaboration	11	35	19	15	80
Attitude	16	28	23	13	80

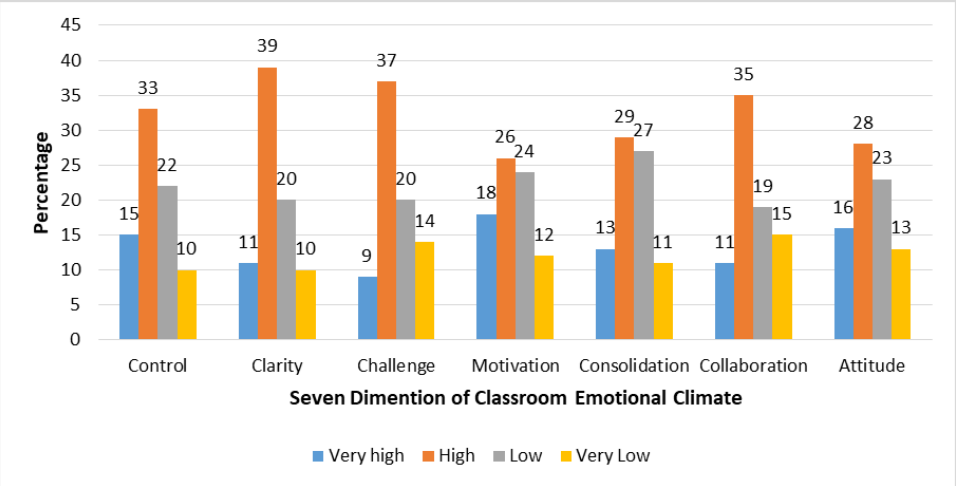

Figure 2. Histogram of the distribution results of the classroom emotional climate tendencies of West Bandung Regency Middle School students towards science learning in each dimension.

This high emotional level cannot be separated from good classroom management by the teachers concerned. This is evidenced by students' comments in the open question column at the end of filling in the questionnaire with the question "What makes you interested in science lessons?". The results are the following:

(i) Student 4: "Challenging, and I like every science lesson material"
(ii) Student 31: "Because the teacher is really good"
(iii) Student 40: "Science lessons are fun and challenging, and the teacher is good"
(iv) Student 41: "Science lessons are interesting and fun"
(v) Student 51: "Because science is important to me"
(vi) Student 55: "The lessons are fun and the teacher is fun"
(vii) Student 59: "It's fun because you practice in the laboratory"
(viii) Student 61: "Because it is related to my ideals"

3.2. Findings related to Research Question 2: "Is there a difference in classroom emotional climate towards science learning in junior high school students based on gender?"

Based on the calculation data in **Table 5**, middle school male students in West Bandung Regency regarding science learning, have a very good/high emotional level of 9.3%, 46.8% of

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students have good/high emotional levels, and bad/high emotional levels. Low at 21.8%, and very bad/low at 21.8%. Based on **Table 6**, female students at West Bandung Regency Middle School regarding science learning, have a very good/high emotional level of 16.6%, 35.4% of good/high emotional students, 33.4% of bad/low emotional students, and very poor/low as much as 14.6% (see **Figure 3**).

Table 5. Results of distribution of classroom emotional climate tendencies of West Bandung Regency Middle School male students toward science learning.

Category	Class Interval	f	Percentage
Very high	X >197,03	3	9,3
High	197,03 ≥ X > 166,21	15	46,8
Low	166,21 > X ≥ 135,39	7	21,8
Very low	X < 135,39	7	21,8
Total		32	100

Table 6. Results of distribution of classroom emotional climate tendencies of West Bandung Regency Middle School female students towards science learning.

Category	Class Interval	f	Percentage
Very high	X >193,12	8	16,6
High	193,12 ≥ X > 171,5	17	35,4
Low	171,5 > X ≥ 149,87	16	33,4
Very low	X < 149,87	7	14,6
Total		48	100

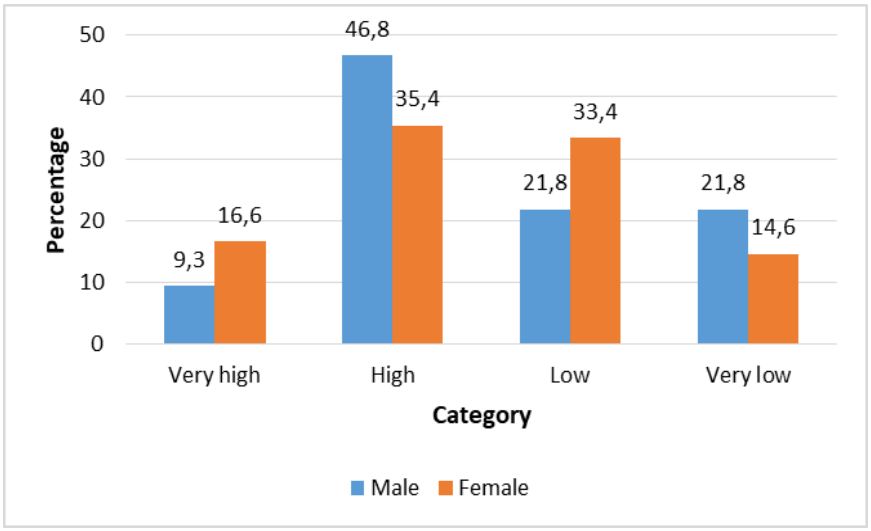

Figure 3. Histogram of comparison of classroom emotional climate of West Bandung Regency Middle School male and female students regarding science learning

The main finding is that junior high school students in Bandung Regency, both male and female students, overall have a high classroom emotional climate towards science learning. Meanwhile, compared to male students, female students had lower scores for Control, Clarity, Challenge, Motivation, Consolidation, Collaboration, and Attitude. Small and insignificant gender differences were found in all these dimensions. In comparison, the categorization of each dimension of classroom emotional climate for male and female students is shown in **Table 7,** and the percentages are in **Table 8**.

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Table 7. Comparison of the results of the distribution of classroom emotional climate tendencies of male and female West Bandung Regency Middle School students towards science learning in each dimension.

Category	Very high		High		Low		Very low	
Gender	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**
Control	7	8	14	22	6	13	5	5
Clarity	4	7	17	19	6	15	5	7
Challenge	3	6	18	21	4	14	7	7
Motivation	6	12	14	13	8	14	4	9
Consolidation	5	10	13	16	10	14	4	8
Collaboration	5	7	12	18	11	14	4	9
Attitude	5	11	13	11	8	17	6	9

Table 8. Percentage comparison of the results of the distribution of classroom emotional climate tendencies for male and female students at West Bandung Regency Middle Schools towards science learning in each dimension.

Category	Very high		High		Low		Very low	
Gender	**M (%)**	**F(%)**	**M(%)**	**F(%)**	**M(%)**	**F(%)**	**M(%)**	**F(%)**
Control	21,88	16,67	43,75	45,83	18,75	27,08	15,63	10,42
Clarity	12,50	14,58	53,13	39,58	18,75	31,25	15,63	14,58
Challenge	9,38	12,50	56,25	43,75	12,50	29,17	21,88	14,58
Motivation	18,75	25,00	43,75	27,08	25,00	29,17	12,50	18,75
Consolidation	15,63	20,83	40,63	33,33	31,25	29,17	12,50	16,67
Collaboration	15,63	14,58	37,50	37,50	34,38	29,17	12,50	18,75
Attitude	15,63	22,92	40,63	22,92	25,00	35,42	18,75	18,75

Several findings are in the following:

(i) Control. **Figure 4** shows the results of the distribution of male and female students' classroom emotional climate tendencies toward science learning in the control dimension. In terms of students' perceptions about how well they behave in class and focus on the ability to control the class tasks carried out by teachers, there is an insignificant gender difference where male students have a perception of 65.63%, more positive than female students, namely 62.50%. This differs from research on secondary school students, where female students have more positive perceptions of involvement, order, and organization than male students (Koul *et al.*, 2023).

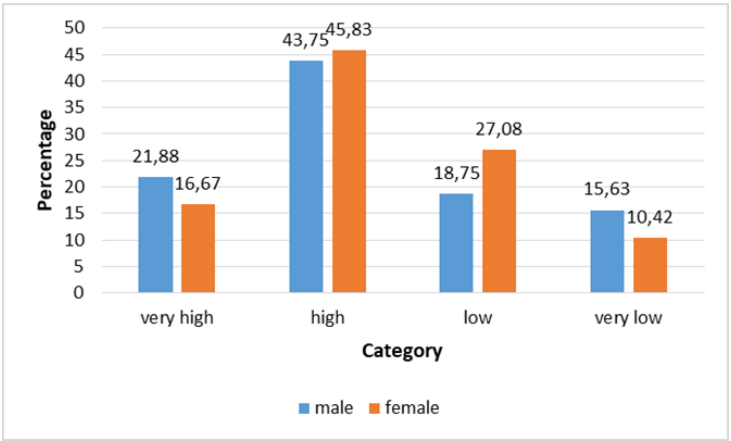

Figure 4. Comparison of the results of the distribution of classroom emotional climate tendencies for male and female West Bandung Regency Middle School students towards science learning in the control dimension.

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(ii) Challenge. **Figure 5** shows that female students have a lower challenge score, namely 56.25%, compared to male students, namely 65.63%. For example, overall, they thought that the science projects chosen for them were less challenging than male students and male students were more likely to agree that their teachers asked them to think harder than female students (Koul et al., 2023).

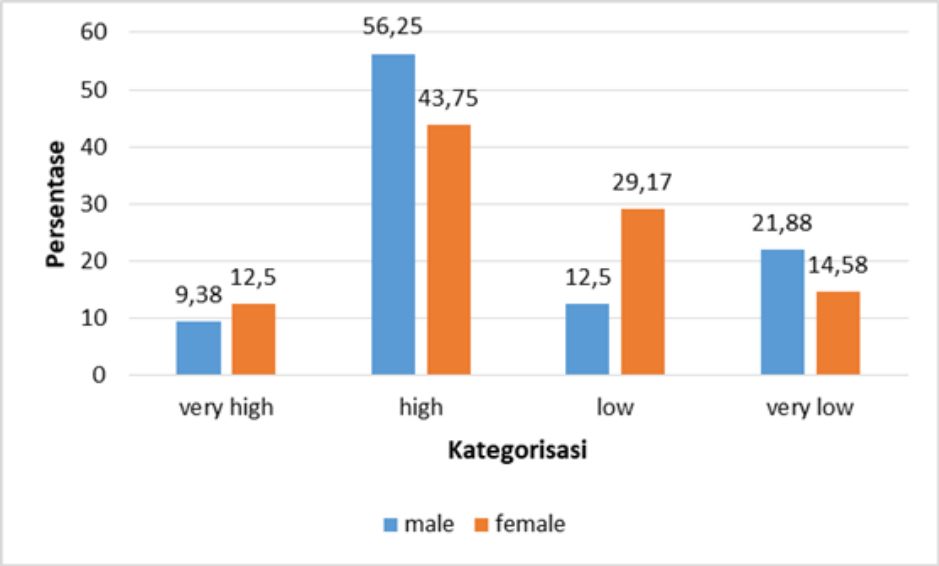

Figure 5. Comparison of the results of the distribution of classroom emotional climate tendencies for male and female West Bandung Regency Middle School students towards science learning in the challenge dimension.

(iii) Clarity and Motivation. **Figures 6a dan 6b** show the distribution of male and female students' classroom emotional climate tendencies toward science learning in the dimensions of material clarity and motivation. Female students have significantly less positive perceptions of clarity, motivation, and consolidation than male students, which suggests the need for research to determine the reasons for these differences. In terms of material clarity, male students are more positive, namely 65.63%, along with the motivation that male students also have a more positive perception, namely 62.50%. Meanwhile, female students' perceptions showed 54.16% on material clarity and 52.08%. Previous research on preferred classroom environments revealed no gender differences in students' desire for clarity of rules or level of difficulty of material (Koul *et al.*, 2023). However, in another study, middle school female students had more positive perceptions of the clarity of rules in their classrooms (Jensen & Solheim, 2020). However, in this study, male students felt that their teachers gave clearer directions and explanations than female students thought.

(iv) Collaboration. **Figure 8** shows the results of the distribution of male and female students' classroom emotional climate tendencies toward science learning in the collaboration dimension. Another scale for which gender differences were not significant was collaboration, the degree to which students felt that they collaborated effectively with their peers to complete assignments. Male students are more positive, namely 53.13%, compared to female students, namely 52.08%. In the literature, gender comparisons for collaboration or cooperation vary, and some suggest that male students have a more positive view than female students (Sinclair & Fraser, 2002; Den Brok *et al.*, 2006), other research shows male students studying mathematics in Sweden have a more positive view

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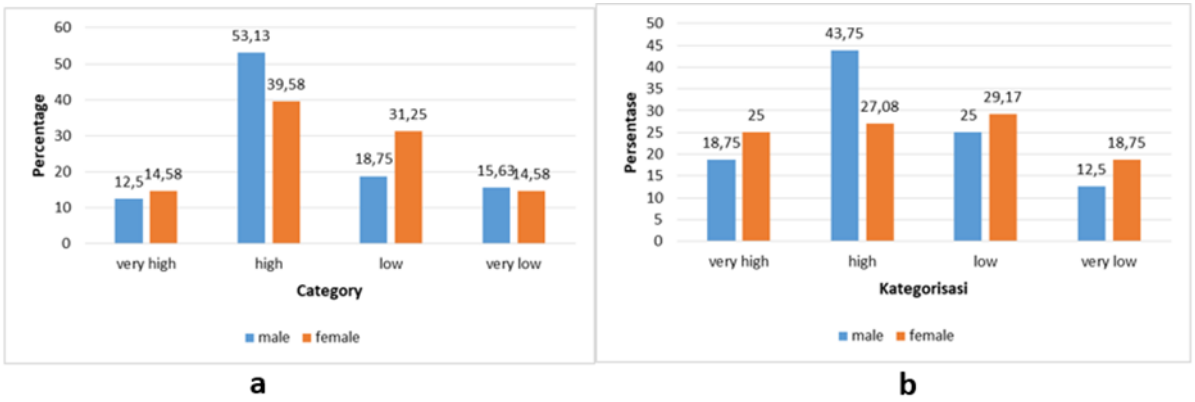
of their level of participation in group work than female students (Samuelsson & Samuelsson, 2016).



Figures 6. Comparison of the results of the distribution of classroom emotional climate tendencies for male and female West Bandung Regency Middle School students towards science learning in the dimensions of (a) clarity and (b) motivation.

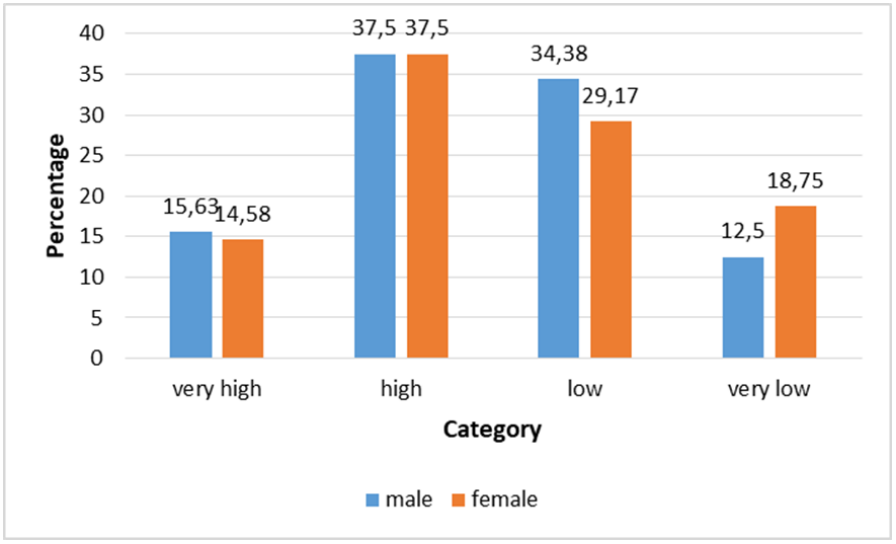


Figure 8. Comparison of the results of the distribution of classroom emotional climate tendencies for male and female West Bandung Regency Middle School students towards science learning in the collaboration dimension.

(v) Consolidation for school students towards science learning in the consolidation dimension. As shown in **Figure 9**, in the consolidation dimension, this research found that male students were more positive, namely 56.26%, compared to female students at 54.16%. Females's greater desire than males for clarity and teacher support to overcome feelings of low self-efficacy through consolidating understanding and providing feedback consistent with (Pelch, 2018) and (Carlone, 2004), who reported that these types of hands-on experiences in physics classes can reinforce the belief that physics is a subject for male students. Likewise, female students may have less experience in engineering and programming than male students in their early years, reinforcing beliefs of lower self-efficacy (Meirovich, 2012). As a result, integrated science classroom teachers may need to provide more explicit instruction and feedback, especially to female students who may be unfamiliar with or feel less confident in their skills in arithmetic or physics-related problems.

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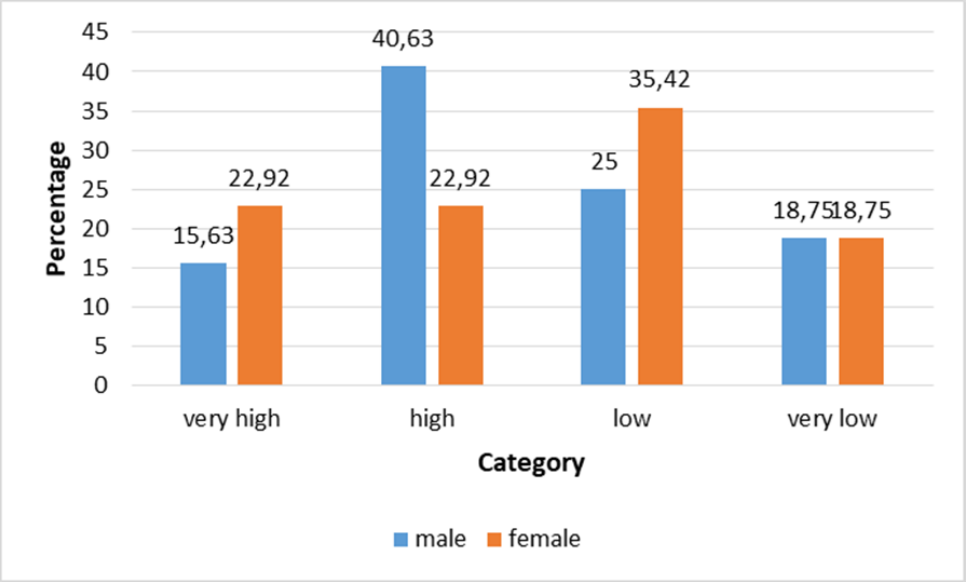

Figure 9. Comparison of the results of the distribution of classroom emotional climate tendencies for male and female students at West Bandung Regency Middle.

(vi) Attitude. **Figure 10** shows that the attitude of male students is more positive, namely 56.62% compared to female students, 45.58%. In a study involving structural equation modeling of teacher-student relationships, classroom emotional climate, and student attitudes in integrated STEM classes, directing teacher-student interactions had a strong positive influence on female students' perceptions of classroom emotional climate, but there was a strong negative influence on female students' attitudes towards STEM (Fraser *et al.*, 2020). This shows that teachers can improve their classroom emotional climate through more emphasis on direct interaction. However, improving students' attitudes toward STEM requires less emphasis on direct interactions when implementing integrated STEM projects.

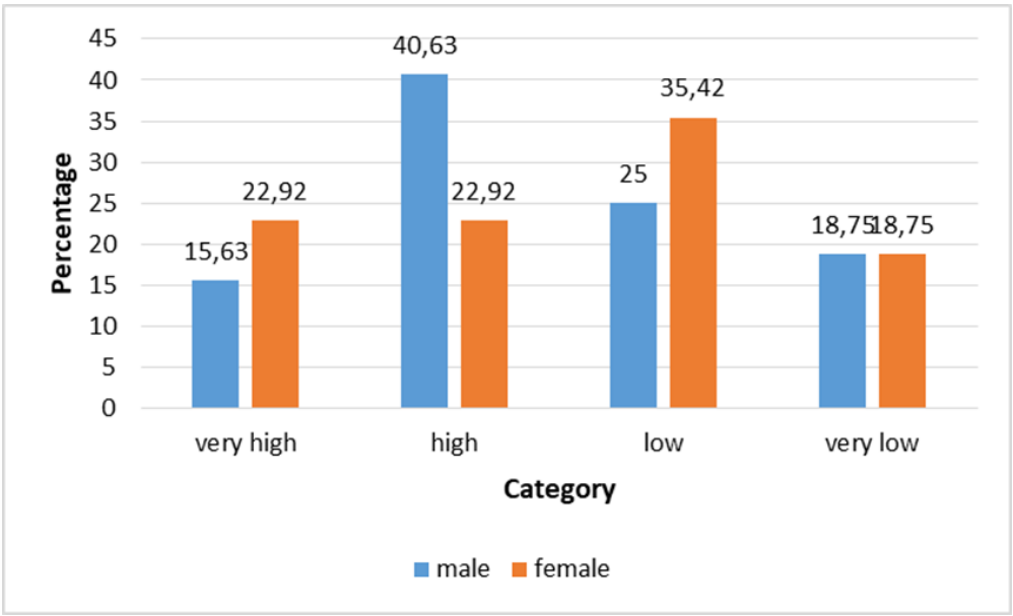

Figure 10. Comparison of the results of the distribution of classroom emotional climate tendencies of male and female West Bandung Regency Middle School students towards science learning in the attitude dimension.

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4. CONCLUSION

This research explains the results of an investigation into the emotional climate of junior high school students in the classroom regarding science learning, which is included in the high categorization. Numerous studies of gender differences in perceptions of classroom environments in science, mathematics, and technology over the past several decades have revealed small and nonsignificant differences. In another study, female students were more positive about their classroom environment than male students in the same class. For example, female students perceived their teachers as more supportive in science laboratory classes than male students. Science lessons had a more positive classroom climate regarding cohesion, teacher support, task orientation, and cooperation. In line with previous research, this study did not find any significant differences between the classroom emotional climate of male and female junior high school students. Further research can be carried out more specifically in each class or school to identify the classroom emotional climate and explore further why these results occur.

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6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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