Science Learning Environment and Critical Thinking Skills of Grade 10 Learners in a Last Mile School: Basis for an Intervention Program

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ABSTRACT

This study explored how Grade 10 students at Tiblac National High School—an Ambaguio district last mile school—perceive their science learning environment and their own critical thinking skills during SY 2024–2025. Through a descriptive quantitative approach, the research used survey questionnaires to gauge students' views on their classroom environment and a paper-pencil test to measure critical thinking abilities. Findings revealed that students felt their science classes had low personalization, insufficient support, and only moderate inclusivity, with limited opportunities for independent learning and investigative activities. They also reported experiencing moderate participation but concerning instances of exclusion and a lack of recognition for student diversity. Additionally, students perceived that their classrooms allowed some level of autonomy, but the opportunities for investigative learning and differentiated instruction were minimal. Overall, most students' critical thinking skills ranged from poor to average, with only a few showing high proficiency. These results led to tailored recommendations aimed at improving both the classroom environment and critical thinking abilities, especially for last mile schools like Tiblac NHS.

Keywords: abstraction, drawing conclusion, inference, perception, students' independence

INTRODUCTION

Teachers' understanding of students' perceptions of their science classroom environment and critical thinking skills is key to creating more supportive, engaging, and equitable learning spaces. Literature highlights the crucial role of critical thinking in 21st-century learning, yet studies show persistent gaps in fostering these skills, especially in marginalized areas such as the Philippines' last mile schools. Previous research, like that of Zhang (2022), Alsaleh (2020), and Kim (2019), has focused on urban settings or general education, leaving a gap in understanding the rural, resource-limited contexts. This study addresses this gap by examining the perceptions of Grade 10 students at Tiblac National High School, a last mile school in Ambaguio district, SY 2024–2025. It investigated the science learning environment across personalization, participation, independence, investigation, and differentiation and students' critical thinking levels. The findings aim to guide tailored interventions to improve science education and critical thinking in similar settings. Specifically, it determined the level of perception of the Grade 10 learners about their science learning environment in terms of personalization, participation, independence, investigation, and differentiation; the level of critical thinking skills of the Grade 10 learners; and the intervention program that can be designed for the last mile schools.

METHODOLOGY

This descriptive quantitative research employed survey questionnaires and a paper-pencil test to assess the science learning environment and critical thinking skills of Grade 10 students at Tiblac National High School. The study included 36 participants from a last mile school, known for limited resources and accessibility challenges.

RESULTS AND DISCUSSION

Section 1. Level of Perception of Grade 10 Students about their Science Classroom Environment

Table 1
Summary Table on Students' Level of Perception About Their Science Classroom Environment

Domains of Classroom Environment	Area Mean	Std. Deviation	Level of Perception
1. Personalization	2.04	0.34	Low
2. Participation	2.15	0.38	Moderately Participative
3. Independence	2.21	0.33	Moderate Independence
4. Investigation	2.31	0.36	Rarely
5. Differentiation	2.10	0.37	Rarely
Overall	**2.16**	**0.356**	

Table 1 reveals an overall moderate but generally low engagement and support atmosphere, as indicated by the overall mean of 2.16 (S = 0.356). Personalization scored the lowest among the 5 indicators for science classroom environment with a mean of 2.04 (S = 0.34), indicating a low level of perception in this domain. This suggests students feel the classroom environment does not sufficiently cater to individual needs or personal connections. Participation had a mean of 2.15 (S = 0.38), reflecting a moderately participative environment, suggesting limited engagement in classroom activities. Independence attained a mean of 2.21 (S = 0.33), indicating moderate independence. Which implies that Grade 10 students perceive some freedom to work autonomously but it is limited. Lastly, investigation and differentiation both scored low, with means of 2.31 (S = 0.36) and 2.10 (S = 0.37) respectively, interpreted as rarely occurring. This suggests that inquiry-based learning and tailoring instruction to diverse student needs are infrequent.

The rarity of investigative and differentiated practices highlights a significant gap in applying inquiry-based and student-centered instructional strategies, which are critical for science learning. Given that the classroom environment directly influences student motivation, attitudes, and achievement in science, these findings suggest that improvements in personalization, participation, independence, investigation, and differentiation could enhance students' learning experiences and outcomes.

Section 2. Level of Critical Thinking Skills of the Grade 10 Students

Table 2
Critical Thinking Skills' Level of the Grade 10 Students

Critical Thinking Skills Level	Frequency	Percent	Overall Mean Score (sd)	Description Level
Poor Critical thinking Skills	20	55.60		
Average Critical thinking Skills	15	41.70	16.62	Average Critical
High Critical thinking Skills	1	2.80	(5.45)	Thinking Skill
Total	**36**	**100.00**		

Legend: 0 – 15 = Poor Critical Thinking Skills; 16 -30 = Average Critical Thinking Skills; 31 – 45 = High Critical Thinking Skills

The mean score for the group with poor critical thinking skills is 16.62 with a standard deviation of 5.45. The description level for this mean score is noted as "average critical thinking skill," which suggests that the scoring or categorization might have some overlap or that the mean score is near the threshold between poor and average.

The majority of Grade 10 students, 20 out of 36 (55.6%), fall into the category of "poor critical thinking skills." There are 15 Grade 10 students (41.7%) who are classified as having average critical thinking skills. Meanwhile, only 1 student (2.8%) demonstrates high critical thinking skills.

More than half of the students are identified as having poor critical thinking skills, indicating a need for targeted interventions to improve these skills. Whereas, the very small percent of students with high critical thinking skills suggests that enrichment programs or differentiated instruction could help nurture advanced critical thinking abilities. The level of critical thinking skills among Grade 10 students of Tiblac National High School is parallel with the result of the National Achievement Test for 2018, particularly in the area of critical thinking skills (DepEd, 2022).

Section 3. Proposed Intervention Program for Grade 10 Students of Tiblac National High School

Table 3

Proposed Intervention Program Based on the Results of the Study

Specific Findings	Interventions	Activities	Strategies
Classroom environment does not sufficiently cater to individual needs or personal connections	Implement student-centered learning approaches such as Inquiry-Based Learning (IBL)	Argument-Driven Inquiry (ADI) to promote scientific argumentation and creative thinking	Differentiation of tasks to meet individual learning needs
Limited engagement and autonomy in the science classroom	Use Research-Based Learning Activities that promote autonomy and engagement	Research projects in units like "Life in the Environment"	Encourage student choice and self-directed investigation
Investigation and differentiation rarely occur	Incorporate Design Thinking combined with STEAM Project-Based Learning (PjBL)	Hands-on experiments and design challenges in chemistry and environmental topics	Scaffold inquiry and problem-solving tasks to enhance critical thinking
More than half of the students have poor critical thinking skills	Develop and use teaching materials based on Science, Environment, Technology, and Society (SETS) framework	Synchronous and asynchronous learning with critical thinking tests and reflective activities	Use formative assessments and feedback to guide critical thinking development

The proposed interventions based on the results of the perceived classroom learning environment and critical thinking skills test among Grade 10 students are aligned with evidence-based practices. These aim to eventually improve academic performance, critical thinking, and student engagement, suggesting a promising pathway to elevate science education quality.

This data-driven intervention leverages well-supported student-centered practices in teaching and learning to possibly address identified weaknesses in the current science classroom, aiming for improved learning outcomes and skill development critical for students' academic and professional futures.

The RISE-UP program, with an acronym for reflective, inclusive, student-centered, engaging, and understanding-based pedagogy, is designed to create a transformative impact on science education through the enhancement of key pedagogical and learning environment elements. Specifically, it targets improvements in student engagement, teacher scaffolding, inquiry-oriented instruction, and the systematic cultivation of critical thinking competencies. These core aspects are aligned with the principles of student-centered learning and inclusive educational practices, thereby ensuring that science instruction remains relevant, equitable, and responsive to the needs of all learners, particularly in resource-constrained settings.

Central to the implementation and success of the RISE-UP program is the pivotal role of science teachers. They are not merely transmitters of content but serve as facilitators of meaningful learning experiences. In this capacity, science teachers are responsible for designing, adapting, and executing instructional strategies that are both inquiry-driven and contextually appropriate. Their responsibilities include planning and leading hands-on, student-centered activities that encourage exploration, hypothesis formation, experimentation, and reflective thinking.

Moreover, science teachers are expected to foster a classroom culture that supports open communication and collaborative problem-solving essential for the enhancement of critical thinking. Through formative assessment techniques, individualized support, and differentiated instruction, teachers guide students toward deeper conceptual understanding and higher-order reasoning. They also act as role models in demonstrating scientific inquiry, ethical reasoning, and lifelong learning.

In a resource-limited educational environment such as Tiblac National High School, the adaptability, creativity, and professional commitment of science teachers become even more vital. Their ability to implement the RISE-UP interventions with limited materials, while still maintaining instructional quality and learner motivation, underscores their integral role in ensuring the long-term sustainability and effectiveness of the program.

Hence, the RISE-UP Intervention Program is a comprehensive, context-sensitive approach designed to address critical gaps in the science learning environment. Its success hinges on the active participation and leadership of science teachers, whose expertise and pedagogical practices are key to fostering a dynamic, inclusive, and intellectually stimulating classroom culture.

Conclusion

The study reveals that Grade 10 students at Tiblac National High School perceived that their science classrooms are missing key elements that make learning more engaging and supportive. They reported low levels of personalization and inclusivity, not enough support from teachers, and limited chances to explore through hands-on investigation. While some students perceive themselves as somewhat independent and involved in class, there are still concerns about feeling excluded, a lack of appreciation for diversity, and insufficient efforts to customize instruction to different learning needs.

Alongside these challenges in the learning environment, the students' critical thinking skills are generally rated as poor to average. Only a small number of students show strong critical thinking abilities.

When these factors are considered together, these findings point to a clear and urgent need for change. The study proposes the RISE-UP intervention program to improve the atmosphere in science classrooms and to help students strengthen their critical thinking skills, which is an especially important goal for last-mile schools like Tiblac NHS.

Recommendations

On science classroom environment , schools and teachers should consider targeted interventions to improve personalization, such as professional development on inclusive practices, regular feedback mechanisms, and strategies to foster a more welcoming and respectful classroom climate. Interventions should include structured participation strategies, explicit norms for inclusivity, and ongoing feedback mechanisms to address the specific issues identified-such as ensuring all voices are heard and valued and preventing students from feeling marginalized-could significantly enhance the participative climate. They should also strengthen the differentiated instructional strategies and flexible learning environments to support diverse learners and improve educational outcomes by providing coaching and mentoring to science

teachers, participation in training on differentiation of instruction, and benchmarking of best practices on differentiation. Secondary schools, most especially those in the last mile school areas, should engage their students in meaningful educational activities in the classroom that foster critical thinking abilities, which are essential for academic success and real-world problem-solving. Moreover, a copy of the designed intervention program can be forwarded to the Schools Division Office of Nueva Vizcaya through the Curriculum Implementation Division to possibly address challenges in the science classroom environment and critical thinking skills of Grade 10 students in the last mile schools.

REFERENCES

Admiraal, W., Post, L., Kester, L., Louws, M., & Lockhorst, D. (2022). Learning labs in a secondary school in the Netherlands: Effects of teachers' autonomy support on student learning motivation and achievement. *Educational Studies*, 1–18. https://doi.org/10.1080/03055698.2021.2023473

Alsaleh, N. J. (2020). Teaching critical thinking skills: Literature review. *International Journal of Academic Research in Business and Social Sciences, 11*(11*),* 584-596. https://hrmars.com/papers_submitted/11529/critical-thinking-skills-in-education-a-systematic-literature-review.pdf

Alsaleh, N. J. (2020). Teaching critical thinking skills: Literature review*. The Turkish Online Journal of Educational Technology, 19(1), 21-30.* https://files.eric.ed.gov/fulltext/EJ1239945.pdf

Bai, N. (2023). Educational challenges in the Philippines*. Philippine Institute for Development Studies.* https://pids.gov.ph/details/news/in-the-news/educational-challenges-in-the-philippines

Bautista, J. (2023)*. PH students are still among the lowest scorers in reading, math, and science – Pisa. INQUIRER.net.* https://newsinfo.inquirer.net/1871182/ph-students-still-among-lowest-scorers-in-reading-math-science-pisa#:~:text=For%20the%202022%20assessment%2C%20the

Bautista, R. G. (2021). The effects of personalized instruction on the academic achievement of students in physics. *ResearchGate*. https://www.researchgate.net/publication/351409677_THE_EFFECTS_OF_PERSONALIZED_INSTRUCTION_ON_THE_ACADEMIC_ACHIEVEMENT_OF_STUDENTS_IN_PHYSICS

Braggs, D. (2018). *The influence of differentiation: Student engagement, academic achievement, and teacher responsiveness to student variances*. Bethel University. https://spark.bethel.edu/cgi/viewcontent.cgi?article=1898&context=etd

Choi, J., & Hannafin, M. (1995). Situated cognition and learning environments: Roles, structures, and implications for design*. Educational Technology Research and Development, 43*(2), 53–69. https://doi.org/10.1007/bf02300472

Cypher Learning. (2022, May 17). *10 ways to provide differentiation in PD for teachers.* K-20 Blog. https://www.cypherlearning.com/blog/k-20/differentiation-in-professional-development-teacher

Department of Education, (2016). *Republic of the Philippines Department of Education K to 12 curriculum guide science (Grade 3 to Grade 10)*. https://www.deped.gov.ph/wp-content/uploads/2019/01/Science-CG_with-tagged-sci-equipment_revised.pdf

Department of Education (2019). *DepEd's Last Mile Schools Program to address gaps in isolated, disadvantaged areas.* https://www.deped.gov.ph/2019/07/22/depeds-last-mile-schools-program-to-address-gaps-in-isolated-disadvantaged-areas/

Dole, S., Bloom, L., & Kowalske, K. (2015). Transforming pedagogy: Changing perspectives from teacher-centered to learner-centered. *Interdisciplinary Journal of Problem-based Learning, 10*(1). https://doi.org/10.7771/1541-5015.1538

Eakins, M., Reyes, J., & Santos, L. (2024). Classroom management strategies and school environment on student engagement. *International Journal of Research and Innovation in Social Science, 8*(5), 123–135. https://rsisinternational.org/journals/ijriss/articles/classroom-management-strategies-and-school-environment-on-student-engagement/

Gheyssens, E., Griful-Freixenet, J., & Struyven, K. (2023). *Differentiated instruction as an approach to establish effective teaching in inclusive classrooms*. https://doi.org/10.1007/978-3-031-31678-4_30

Graetz, K. A. (2019). *Chapter 6. The psychology of learning environments. Educause.* https://www.educause.edu/research-and-publications/books/learning-spaces/chapter-6-psychology-learning-environments

Kim, B. (2019). *Introduction to critical thinking.* https://open.library.okstate.edu/criticalthinking/chapter/__unknown__-2/

Kennedy, O. O. (2010). *Teaching learning resources and academic performance of students in mathematics in selected secondary schools in Bondo District.* https://ir.kiu.ac.ug/items/88aa436c-c8da-4092-9c81-4c5c335022ad

Lagura, R. T. (2024). Exploring science education in last-mile schools: Experiences and challenges. *International Journal of Religion, 5*(10), 2890–2906. https://doi.org/10.61707/qh4a9s12

Lualhati, G. P. (2018). What is happening in your class? Exploring Filipino science classroom atmosphere. *International Journal of Recent Innovations in Academic Research, 2*(7), 207–218. https://www.researchgate.net/publication/366247871_What_is_Happening_in_your_Class_Exploring_Filipino_Science_Classroom_Atmosphere

Miao, J., & Ma, L. (2022). Students' interaction, self-regulation, and learning engagement in higher education: The importance of social presence to learning. *Frontiers in Psychology, 13*(815220). https://doi.org/10.3389/fpsyg.2022.815220

Otieno, K. O. (2010). Teaching/learning resources and academic performance in mathematics in secondary schools in Bondo District of Kenya. *Asian Social Science, 6*(12). https://doi.org/10.5539/ass.v6n12p126

Pablico, J., Moustapha Diack, & Lawson, A. (2017). Differentiated instruction in the high school science classroom: Qualitative and quantitative analyses. *International Journal of Learning, Teaching and Educational Research.* https://www.academia.edu/34196680/Differentiated_Instruction_in_the_High_School_Science_Classroom_Qualitative_and_Quantitative_Analyses

Pacala, F. A. A. (2022). Discipline-based vs. spiral learning approach to science education: A critical analysis in the Philippine setting. *IJIET (International Journal of Indonesian Education and Teaching), 7*(1), 41–47. https://doi.org/10.24071/ijiet.v7i1.5598

Richardson, V. (2003). Constructivist pedagogy. *Teachers College, 105*(9), 1623–1640. https://doi.org/10.1046/j.1467-9620.2003.00303.x

Uzma Shahzadi, Nimmi, & Dr. Itbar Khan. (2020). Exploring the relationship between critical thinking skills and academic achievement. Sjesr, 3(1), 236–242. https://doi.org/10.36902/sjesr-vol3-iss1-2020(236-242)

Zhang, Y. (2022). The research on critical thinking teaching strategies in college English classroom. *Creative Education, 13*(4), 1469–1485. https://doi.org/10.4236/ce.2022.134090

Zohar, A., & Dori, Y. J. (2003). Higher-order thinking skills and low-achieving students: Are they mutually exclusive?. *Journal of the Learning Sciences, 12*(2), 145–181. https://doi.org/10.1207/S15327809JLS1202_1