ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 8 (August 2026)

Perceived Teacher use of Varied Teaching Strategies and Grade 8 STE Students' Academic Performance in Abstract Microbial Physiology Concepts

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Date Submitted:
March 15, 2026

Date Accepted:
June 12, 2026

Date Published:
August 18, 2026

DOI:
10.5281/zenodo.21994009

ABSTRACT

In an era where 21st-century learners demand more than rote memorization to grasp the invisible world of microbes, this descriptive-correlational mini-research investigated whether the teaching strategies used in Grade 8 Biotechnology classrooms make a measurable difference in student success. The study determined the relationship between perceived use of Inquiry-Based Learning, Contextual Learning, Collaborative Learning, Model-Based Learning, and Multimedia Integration and the 2nd Grading Science performance of 30 Grade 8 STE students at Tampakan National High School, S.Y. 2025–2026. Using a validated survey and official grades, data were analyzed through weighted mean and Pearson r. Results showed all five strategies were implemented "Always," with Contextual Learning highest mean at 4.54 and Model-Based Learning lowest mean at 4.06, while students achieved "Outstanding" performance with a mean of 93.33. Correlation analysis revealed only a low positive and non-significant relationship between overall strategy use and grades, $r = 0.24$, $p = 0.201$, with Inquiry-Based Learning showing the strongest yet still non-significant link at $r = 0.31$. The findings imply that for high-achieving STE learners, frequent use of student-centered strategies sustains excellence but does not differentiate grades, highlighting that the value of these pedagogies may lie more in deepening scientific literacy and engagement than in raising already outstanding scores.

Keywords: *microbial physiology, teaching strategies, academic performance, STE students, descriptive-correlational*

INTRODUCTION

Microbial physiology examines how microorganisms grow, metabolize, and interact with their environment. It underpins biotechnology, medicine, and agriculture, yet its concepts such as fermentation, anaerobic respiration, and energy transformation remain abstract to junior high school students because these processes occur at the cellular and molecular level (Capuno et al., 2023). Given the abstract nature of these concepts, it leads to Grade 8 STE students' misconceptions. Students often rely on misconceptions when these invisible mechanisms are taught through traditional lecture methods alone (Dela Cruz & Reyes, 2022).

In the Philippine K to 12 Science curriculum, Grade 8 Biotechnology constitutes all topics introducing microbial physiology during the duration of second grading period (Department of Education, 2016). The Department of Education mandates student-centered approaches to make abstract concepts concrete and relevant (Department of Education, 2016). However, a gap exists between policy and classroom reality. Teachers face large

ISSN: 3116-3475
International Journal
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classes, limited laboratory resources, and time constraints that hinder consistent implementation of inquiry, modeling, and contextualization (Magwilang, 2022; Barrot et al., 2021). Meanwhile, Science, Technology, and Engineering students are expected to master these competencies at an advanced level.

This study addresses the gap by examining whether students perceived frequency of five key teaching strategies relates to their academic performance in microbial physiology. Determining this relationship is relevant to science education because it informs teachers which strategies to prioritize and guides administrators on resource allocation (Estrellado, 2022). For STE learners expected to lead future scientific innovation, understanding how pedagogy supports mastery of abstract content is critical for curriculum enhancement.

This study was conducted to determine the relationship between the perceived frequency of teaching strategies and the academic performance of Grade 8 STE students. This study sought to ascertain the following. First, the level of agreement of Grade 8 STE students on the frequency of teaching strategies used in teaching microbial physiology. Second, to determine the level of academic performance of Grade 8 STE students in science during the 2nd Grading period. Lastly, to determine if there is a significant relationship between the perceived frequency of teaching strategies and the academic performance of Grade 8 STE students. The null hypothesis was tested 0.05 level of significance. There is no significant relationship existed among perceived frequency of teaching strategies and the academic performance of Grade 8 STE students.

Student-centered teaching strategies are consistently linked to improved understanding in science, particularly for abstract topics. Inquiry-Based Learning develops scientific process skills by engaging learners in questioning, investigation, and evidence-based reasoning, which supports conceptual change in biology (Pedaste et al., 2015). However, implementation in Philippine public schools is often inconsistent due to logistical constraints and large class sizes, leading to differential student exposure to inquiry activities (Macugay & Bernardo, 2023; Barrot et al., 2021).

Contextual Learning addresses abstraction by anchoring microbial processes to familiar local phenomena such as *tuba* and *tapuy* production. Studies show that contextualization increases relevance and motivation, resulting in better retention of fermentation and respiration concepts among junior high school students (Aban & Tan, 2023). This aligns with Meaningful Learning Theory, which posits that new information is retained when connected to existing cognitive structures (Ausubel, 1968).

Collaborative Learning fosters peer discussion and argumentation, enabling students to confront misconceptions about microbial energy transformation. Meta-analyses indicate that group work enhances achievement in biology when paired with structured tasks and accountability (Rivera & De Guzman, 2024). Similarly, Multimedia Integration supports dual coding of verbal and visual information, allowing learners to visualize molecular pathways like glycolysis (Mayer, 2009). Research confirms that animations and simulations reduce cognitive load when learning cellular processes (Almulla, 2023).

Model-Based Learning, whether physical or digital, externalizes mental models of invisible systems (Treagust & Duit, 2008). Yet, limited resources and teacher training hinder its use in many schools, resulting in infrequent hands-on modeling despite its known benefits for understanding microbial metabolism (Magwilang, 2022). Together, these five strategies are mandated by DepEd to develop scientific literacy (Department of Education, 2016). Synthesis of current literature indicates that while all strategies improve engagement and conceptual understanding (Vygotsky, 1978), their direct impact on grades may be mediated by student aptitude, prior knowledge, and homogeneity of the sample (Bernardo et al., 2022; Reyes, 2023).

METHODS

This study utilized a descriptive-correlational research design (Creswell & Creswell, 2023). The researchers emphasized that the study only determines the relationship of the perceived frequency of teaching strategies and the academic performance of Grade 8 STE students but does not explain causation. The respondents were 30 Grade 8 STE students of Tampakan National High School for S.Y. 2025–2026, selected through complete

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International Journal
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enumeration of the intact class. The limited number of sample size of the Grade 8 STE students class affects the generalizability and the correlation test.

The instrument was a researcher-made survey questionnaire with two parts. Part A measured perceived frequency of Inquiry-Based Learning with 4 item questions (1-4), Contextual Learning with 4 item questions (5-8), Collaborative Learning with 4 item questions (9-12), Model-Based Learning with 4 item questions (13-16), and Multimedia Integration with 4 item questions (17-20) a total of 20 items on a 5-point Likert scale (Pimentel, 2021) to ensure equal distribution of questions each sub-indicators. The instrument underwent content validation by three experts, yielding an S-CVI/Ave of 1.00 (Polit et al., 2021). Pilot testing with 15 non-STE students produced an overall Cronbach's alpha of 0.965 (Taber, 2021). Part B consisted of students' official 2nd Grading Science grades obtained with consent.

Data gathering involved securing permission from the school head, administering the survey with signed consent and assent, and retrieving grades while maintaining anonymity through coding. Ethical protocols under the Data Privacy Act of 2012 were observed.

For analysis, weighted mean and standard deviation described the perceived frequency of strategies and were interpreted as: 4.21–5.00 = Always, 3.41–4.20 = Often, 2.61–3.40 = Sometimes, 1.81–2.60 = Rarely, 1.00–1.80 = Never (Pimentel, 2021). Frequency, percentage, and mean described academic performance based on DepEd grading scales (Department of Education, 2015). Pearson r tested the relationship between variables at $\alpha = 0.05$ after normality was confirmed (Field, 2024). All computations used SPSS Version 27.

RESULTS AND DISCUSSION

This section of the study presents the analysis and results with reference to the statistical tools used in determining the relationship between Perceived Frequency of Teaching Strategies and the academic performance of Grade 8 STE students.

Perceived frequency of teaching strategies in Microbial Physiology

Table 1 shows all five strategies were perceived as used "Always," with an overall mean of 4.40. Contextual Learning has the highest mean score of 4.54 with a verbal interpretation of "Always". It means that teachers always used Contextual Learning strategies in teaching Microbial Physiology and was supported by the study of Aban &Tan, (2023) indicating that teachers consistently linked fermentation to local contexts such as *tuba* and *tapuy* (Aban & Tan, 2023).

Table 1. *Perceived Frequency of Teaching Strategies in Microbial Physiology*

Teaching Strategy	Mean	SD	Verbal Interpretation
Contextual Learning	4.54	0.43	Always
Multimedia Integration	4.50	0.50	Always
Collaborative Learning	4.50	0.61	Always
Inquiry-Based Learning	4.42	0.71	Always
Model-Based Learning	4.06	0.78	Often
Overall	4.40	0.49	Always

Model-Based Learning was lowest with the highest variability and a mean score of 4.06 interpreted as "Often". It means that teachers often used Model-Based Learning in teaching Microphysiology. Magwilang (2022) suggested that it can be attributed to uneven implementation due to resource constraints reported. Item-level data revealed three "Never" responses for building models of glycolysis, while Inquiry-Based Learning showed bimodal responses for the Balloon Fermentation activity, supporting Macugay and Bernardo's (2023) finding of differential access to inquiry. This means that while strategies aligned with active learning reforms (Department of Education, 2016), their actual delivery varied across topics.

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Frequency Distribution of 2nd Grading Science Grades

Table 2 reveals "Outstanding" performance with a mean of 93.33. It means that 86.67 percent of the class or 26 students got a grade ranging from 90-100 and were Outstanding and 13.33 percent of the class got a grade range of 85 – 89 were Very Satisfactory during the second grading in Microphysiology.

Table 2. *Frequency Distribution of 2nd Grading Science Grades*

Grade Range	Verbal Description	f	%
90 – 100	Outstanding	26	86.67
85 – 89	Very Satisfactory	4	13.33
Mean = 93.33	SD = 2.90	Outstanding	

All 30 students scored 85 or higher, showing homogeneity in achievement (Fraenkel et al., 2023) but it does not explain their direct impact on grades may be mediated by student aptitude, prior knowledge, and homogeneity of the sample (Bernardo et al., 2022; Reyes, 2023).

However, this level was expected for STE students who undergo screening and advanced curriculum, indicating mastery of microbial physiology competencies consistent with program objectives (Capuno et al., 2023; Estrellado, 2022).

Correlation Between Teaching Strategies and 2nd Grading Science Grades

Table 3 shows that there is no significant relationship between Teaching Strategies and 2nd Grading Science based on the r = 0.24, p = 0.201. Inquiry-Based Learning had the highest correlation but was not significant. The non-significant results are can maybe attributed to possible ceiling effect (Field, 2024). Both variables had limited variability: strategies were all "Always" and grades were all "Outstanding" or "Very Satisfactory."

Table 3. *Correlation Between Teaching Strategies and 2nd Grading Science Grades*

Teaching Strategy	r-value	p-value	Interpretation	Significance
Inquiry-Based Learning	0.31	0.096	Low positive	Not significant
Multimedia Integration	0.22	0.243	Low positive	Not significant
Contextual Learning	0.18	0.341	Negligible positive	Not significant
Model-Based Learning	0.12	0.528	Negligible positive	Not significant
Collaborative Learning	0.05	0.793	Negligible positive	Not significant
Overall Strategies	0.24	0.201	Low positive	Not significant

This suggests that for homogenous high-achievers, frequency of strategy use does not differentiate grades, aligning with Bernardo et al. (2022) but it does not explain their direct impact on grades may be mediated by student aptitude, prior knowledge, and homogeneity of the sample (Bernardo et al., 2022; Reyes, 2023).

CONCLUSION AND RECOMMENDATION

This study concluded that there was no significant relationship between teaching strategies and 2nd grading science grades, r = 0.24, p = 0.201. This implies that teaching strategies used does not reliably correspond to higher or lower grades during the second grading period of Grade 8 STE students and failed to reject the null hypothesis. Grade 8 STE students perceived that their science teacher "Always" employed all five teaching strategies in microbial physiology. Contextual Learning was most frequent, while Model-Based Learning was least frequent but still "Often" used. This indicates strong alignment with DepEd's student-centered directives (Department of Education, 2016). Moreover, the academic performance of Grade 8 STE students in science for the 2nd Grading was "Outstanding," with a mean grade of 93.33 and no student scoring below 85.

Supported by the results and conclusions, the researchers proposed the following recommendations to grade 8 science teachers teaching during second grading on Microphysiology to focus on strengthening Model-Based Learning through low-cost physical or digital models of glycolysis and the Krebs cycle. Although grades were outstanding, consistent modeling may reduce misconceptions and support deeper visualization of molecular processes that tests alone cannot capture (Magwilang, 2022; Treagust & Duit, 2008).

For School Administrators: Provide equitable laboratory support and training to standardize Inquiry-Based Learning activities across all STE sections. The uneven implementation of experiments like Balloon Fermentation indicates a need for resource allocation to ensure all students experience hands-on inquiry (Macugay & Bernardo, 2023; Barrot et al., 2021).

Lastly, Curriculum developers should retain emphasis on Contextual Learning, Multimedia Integration, and Collaborative Learning in Biotechnology units while adding explicit modeling exemplars (Aban & Tan, 2023; Almulla, 2023; Rivera & De Guzman, 2024). Future researchers should use larger, heterogeneous samples including non-STE classes and incorporate qualitative data to assess scientific literacy and engagement, since grades alone did not capture the pedagogical impact for high-achievers (Reyes, 2023; Creswell & Creswell, 2023).

References

Aban, M. J. M., & Tan, D. A. (2023). Contextualized teaching in biology: Effects on students' conceptual understanding and motivation in rural Philippine schools. *Journal of Science Education and Technology, 32*(2), 198–212.

Almulla, M. A. (2023). The effectiveness of multimedia and animation in teaching science: A meta-analysis of empirical studies. *International Journal of Educational Technology in Higher Education, 20*(1), 1–22.

Ausubel, D. P. (1968). *Educational psychology: A cognitive view*. Holt, Rinehart & Winston.

Barrot, J. S., Llenares, I. I., & del Rosario, L. S. (2021). Students' online learning challenges during the pandemic and how they cope with them: The case of the Philippines. *Education and Information Technologies, 26*(6), 7321–7338.

Bernardo, A. B. I., Ouano, J. A., & Salanga, M. G. C. (2022). What counts in learning science: Filipino students' engagement, self-efficacy, and perceptions of teaching practices. *The Asia-Pacific Education Researcher, 31*(3), 283–295.

Capuno, R., Necesario, R., Etcuban, J. O., Espina, R., Padillo, G., & Manguilimotan, R. (2023). Assessing conceptual difficulties in biology among junior high school students: Implications for curriculum and instruction. *International Journal of Instruction, 16*(1), 1–18.

Creswell, J. W., & Creswell, J. D. (2023). *Research design: Qualitative, quantitative, and mixed methods approaches* (6th ed.). SAGE Publications.

Dela Cruz, R. S., & Reyes, V. C. (2022). Misconceptions in microbial physiology among Grade 8 students: A diagnostic study. *Philippine Journal of Science Education, 5*(1), 45–62.

Department of Education. (2015). *DepEd Order No. 8, s. 2015: Policy guidelines on classroom assessment for the K to 12 basic education program*.

Department of Education. (2016). *K to 12 curriculum guide: Science – Grade 3 to Grade 10*. Estrellado, C. J. P. (2022). Differentiated instruction in science for diverse learners in Philippine public schools. *Asia Pacific Journal of Multidisciplinary Research, 10*(2), 105–113.

Field, A. (2024). *Discovering statistics using IBM SPSS statistics* (6th ed.). SAGE Publications.

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2023). *How to design and evaluate research in education* (11th ed.). McGraw Hill.

Macugay, E. B., & Bernardo, A. B. I. (2023). Inquiry-based science teaching and Filipino students' scientific literacy: Evidence from PISA 2018. *Large-scale Assessments in Education, 11*(1), 1–20.

Magwilang, E. B. (2022). Teaching abstract biology concepts through multiple representations: Practices and challenges of Philippine secondary science teachers. *Asia-Pacific Science Education, 8*(1), 41–67.

Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). Cambridge University Press.

Pedaste, M., Mäeots, M., Siiman, L. A., de Jong, T., van Riesen, S. A. N., Kamp, E. T., Manoli, C. C., Zacharia, Z. C., & Tsourlidaki, E. (2015). Phases of inquiry-based learning: Definitions and the inquiry cycle. *Educational Research Review, 14*, 47–61.

Pimentel, J. L. (2021). A note on the usage of Likert scaling for research data analysis. *USM R&D Journal, 29*(1), 1–10.

Polit, D. F., Beck, C. T., & Owen, S. V. (2021). Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. *Research in Nursing & Health, 44*(4), 631–639.

Reyes, V. C. (2023). Beyond test scores: Affective outcomes of student-centered pedagogy in high-achieving science classrooms. *Philippine Journal of Educational Measurement, 9*(1), 22–37.

Rivera, R. P., & De Guzman, M. F. D. (2024). Cooperative learning and conceptual change in biology: Evidence from Philippine secondary schools. *Educational Studies, 50*(2), 201–218.

Taber, K. S. (2021). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education, 48*(6), 1273–1296.

Treagust, D. F., & Duit, R. (2008). Conceptual change: A discussion of theoretical, methodological and practical challenges for science education. *Cultural Studies of Science Education, 3*(2), 297–328.

Villanueva, M. G. F., & Prudente, M. S. (2024). Diagnosing and addressing misconceptions in fermentation and anaerobic respiration among preservice biology teachers. *Research in Science & Technological Education, 42*(1), 1–19.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.