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Art-Based Learning in Biology: A Creative Approach

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Abstract **Review Article**

This study examined the effectiveness of art-based learning strategies in improving students' academic performance in Biology compared with traditional teaching methods. Grounded in Constructivist Learning Theory, the research employed a quasi-experimental design using a non-equivalent control group with pretest–posttest measures. The participants were Grade 10 students from Sagana National High School, assigned to an art-based or a traditional learning group. Both groups were assessed using the same achievement test covering key Biology topics, including the endocrine system, nervous system, feedback mechanisms, reproductive hormones, and protein synthesis. Statistical analysis was used to compare learning outcomes before and after the intervention. Findings revealed that while both groups began with comparable levels of understanding, students exposed to art-based learning demonstrated greater improvement in academic performance in Biology than those taught through traditional methods. Specifically, the computed Cohen's d of -0.858 indicates a large effect size, suggesting that the art-based learning strategy had a substantial impact on students' academic performance. The study concludes that art-based learning is an effective instructional approach that enhances student academic performance and supports a deeper understanding of Biology concepts, highlighting its potential value in science education.

Keywords: art-based learning, biology education, constructivist learning theory, academic performance, quasi-experimental design, secondary education.

Introduction

Biology, as a branch of science, is essential for understanding life and its environment. It offers fundamental insights into living organisms, ecosystems, and the complex mechanisms that support life (De La Cruz, 2023). Biology is typically taught with significant emphasis on its disciplinary boundaries and fundamental components, and with substantial memorization demands (Ignacio & Rivera, 2022). The content in the Biology subject is organized not only to highlight understanding of biological concepts but also to apply them in everyday situations. The biology curriculum plays a vital role in education, significantly influencing students' understanding of health, the environment, and their responsibilities as global citizens. (Bara et al., 2024).

Despite its relevance and significance, teaching Biology faces several challenges that influence students' comprehension and engagement. Students have shared different views about the subject; notably, most often say that biology is complicated and that its technical terms are hard to understand (Tindan & Crisantus, 2024). Building on this, Cabigas (2023) emphasized that students may perceive Biology as a field that involves only memorizing facts if teachers emphasize knowledge excessively and if learning is limited to the classroom. Furthermore, traditional teaching remains among the most widely used methods in education. Characterized by a passive approach in which students primarily listen without actively engaging or participating (Klein et al., 2023), this method can further disengage learners. As a result, learners might lose interest in Biology and develop negative attitudes toward the subject.

Art-based learning follows the ideas of constructivist learning, which encourages students to be more engaged by helping them become active creators instead of just passive receivers of information (Surbakti et al., 2024). Using art in education supports students' personal learning, creativity, and emotional well-being (Prajapati & Pachauri, 2025).

By employing creative methods, educators can transform Biology from a passive subject into an active, inquiry-driven experience that resonates with students and connects scientific concepts to real-world issues. Engaging and relevant biology lessons help meet curriculum goals, spark curiosity, build critical thinking, and get students ready for 21st-century challenges (Bhoi, 2024).

The timeliness of this study lies in its potential to revitalize biology education, particularly in contexts where traditional teaching methods have fallen short. At Sagana National High School, where resource constraints and traditional teaching methods pose challenges, arts-based learning offers a practical, innovative solution. By incorporating this approach into biology instruction, the study aims to improve student academic performance while fostering a more inclusive, multidisciplinary learning environment. Given the increasing importance of fostering creativity and critical thinking skills in the 21st century, this study contributes to ongoing efforts to make education more dynamic, meaningful, and relevant for today's learners.

Methodology

This study employed a quasi-experimental, non-equivalent pretest-posttest control group design to evaluate the effectiveness of the Art-based learning approach on the academic performance of 74 Grade 10 students from two intact classes at Sagana National High School (SY 2025-2026). Purposive sampling was used to select these respondents. The experimental group is engaged in Biology lessons through creative activities such as drawing, modelling, and other art-integrated tasks aligned with the learning objectives, while the control group was taught using conventional instructional methods, including lecture-based discussions and textbook-guided activities.

Data was collected using a validated 30-item teacher-made multiple-choice test, aligned with Grade 10 Science competencies, administered as both a pre-test and post-test. A prior 30-item NAT instrument was used for a homogeneity test, confirming the initial similarity in the groups' learning ability despite slightly different standard deviations.

The intervention was conducted for three weeks, followed by posttests for both groups. To describe performance, data were analyzed using frequency counts, percentages, mean, and standard deviation. An independent samples t-test and Levene's test for equality of variances were used to check for significant differences between groups. Cohen's d was calculated to estimate the effect size. These analyses helped assess how the art-based learning approach affected students' academic performance. Ethical considerations, including informed consent and confidentiality, were observed throughout the research process.

Results and Discussions

Table 1. Pretest Mean Score between Art-based Group and Traditional Group

Group	N	Mean Percent Score	Standard Deviation	t	p-value	Decision
Art-based Group	38	67.50	6.01	-0.490	0.625	Fail to reject Ho
Traditional Group	36	68.15	5.37			

p-value ≤ 0.05 *is significant*

Based on the pretest data and its analysis, the absence of a statistically significant difference (t = -0.490, p = 0.625) between the Art-based Group and the Traditional Group indicates that both groups possessed a comparable range of performance levels during the pretest.

In terms of score variability, the Art-based Group had a higher standard deviation (SD = 6.0) compared to the Traditional Group (SD = 5.37). Although there is a difference between the two groups, the values are relatively close, indicating that the variability in scores was generally similar across both groups.

Ensuring that groups are equivalent at the pretest stage is essential in experimental and quasi-experimental research. According to Shadish, Cook, and Campbell (2020), when there are no significant differences between groups at baseline, it becomes possible to attribute changes after the intervention to the treatment.

As noted by Creswell and Creswell (2021), statistically similar pretest scores help reduce selection bias and support more credible conclusions. Ignacio and Rivera (2022) also found no significant pretest differences between the experimental and control groups. This pretest equivalence allowed the researchers to attribute learning improvements primarily to the arts-based teaching method rather than to differences in students' initial abilities. Furthermore, results underscore that the finding of no significant pretest difference in this study strengthens internal validity. This result clarifies the impact of creative teaching methods (Sousa & Pilecki, 2022).

Table 2. Posttest Mean Score between Art-based Group and Traditional Group

Group	N	Mean Percent Score	Standard Deviation	t	p-value	Decision
Art-based Group	38	72.76	3.78	2.973	0.004	Reject Ho
Traditional Group	36	69.35	5.82			

p-value ≤ 0.05 *is significant*

Building upon the pretest findings of baseline equivalence, the posttest results revealed that the Art-based Group exhibited a higher mean score (72.74%) compared to the Traditional Group (69.35%), with a mean difference of 3.41. This percentage point difference was statistically significant (t = 2.973, p = 0.004).

The Art-based Group's standard deviation decreased from 6.01 to 3.78, indicating improved consistency

after the intervention, while the Traditional Group's standard deviation increased from 5.37 to 5.82, reflecting greater variability. This suggests that the Art-based approach led to more uniform student performance.

The significant improvement in scores suggests that incorporating creative and visual elements into Biology instruction facilitates students' understanding of key concepts. Art-based strategies allow learners to visually and concretely represent complex biological processes, promoting deeper comprehension, more effective knowledge organization, and enhanced retention.

This finding is consistent with research by Quillin and Thomas (2021), who showed that drawing-to-learn strategies in biology help students better understand complex processes by enabling them to express and organize their thoughts. Henriksen (2021) also points out that bringing the arts into science teaching encourages creativity and improves both scientific reasoning and understanding. Additionally, Sousa and Pilecki (2022) explain that using the arts in teaching activates different ways of thinking, such as visual, physical, and analytical skills. Engaging students in this way helps them remember information better and supports lasting understanding of complex science ideas. These similarities between current results and earlier studies support the idea that using art-based learning is an effective way to boost students' academic performance in Biology.

Table 3. Comparison of the Mean Difference of the Posttest and Pretest Scores of the Respondents

Group	N	Mean Gain	SD	t	p-value	Decision
Art-based Group	38	5.26	4.51	3.686	< .001	Reject Ho
Traditional Group	36	1.20	4.94			

p-value ≤ 0.05 *is significant*

The findings in Table 3 show that the Art-based group achieved greater and more consistent learning gains compared to the Traditional group. The independent-samples t-test revealed a statistically significant difference ($t = -3.686$, $p < .001$), indicating that the art-based learning approach was more effective in improving students' learning comprehension. Additionally, the lower standard deviation in the Art-based group suggests more uniform improvement among students, while the Traditional group showed more varied results.

These findings are in line with earlier research showing that integrated and creative teaching methods can improve both achievement and consistency in learning. Quillin and Thomas (2021) found that making visual representations helped students better understand complex biological processes and led to measurable improvements after the intervention. Similarly, Ryoo and Linn (2021) found that visual construction activities help students process information more deeply and remember it longer. Van Meter and Firetto (2020) also found that generative drawing activities helped students understand and remember science concepts better. Students who made visual explanations did better than those who only learned from text. Collectively, these studies provide evidence that art-based and representational instructional strategies yield greater and more consistent learning gains than traditional approaches in science education.

Table 4. Effect of Art-based learning Strategy in the Academic Performance of the Respondents

Group	N	Mean Gain	Mean Difference	t	p-value	*Cohen's d*
Art-based Group	38	5.26	4.06	3.686	< .001	0.858
Traditional Group	36	1.20				

Cohen's d: small effect size = around 0.2 *p-value* ≤ 0.05 *is significant medium effect size = around 0.5 large effect size = around 0.8 or higher*

Results revealed that the Art-based Group demonstrated a statistically significant and larger mean gain (5.26) compared to the Traditional Group (1.20), with a mean difference of 4.06 (t = 3.686, p = <.001, Cohen's d = 0.858). This indicates that the Art-based learning approach yielded a more substantial improvement in students' academic performance in biology.

Recent empirical research in science education provides strong support for these findings. Quillin and Thomas (2021) showed that students who participated in drawing-to-learn and model-based representational activities in biology achieved notably higher gains than those taught through traditional methods. In a similar way, Ryoo and Linn (2021) found that using guided visual modeling in science classes helped students understand concepts better than traditional teaching methods. They showed that when students create their own models, they participate more, avoid misunderstandings, and do better on posttests. Since art-based learning involves active participation, building representations, and using multiple learning modes, it aligns well with instructional methods shown to produce strong effects in science education (Freeman et al., 2020). Therefore, the data suggest that the Art-based learning approach is a more effective method for developing students' academic performance.

Based on the results of this research, the art-based learning approach significantly improved students' academic performance in Biology compared to traditional teaching methods. The pretest scores confirmed that both the Art-based Learning group and the Traditional Learning group started with similar baseline abilities, ensuring that the observed differences were due to the instructional approach rather than prior knowledge. Posttest scores and gain analyses demonstrated that students in the Art-based Learning group not only achieved higher overall scores but also exhibited more consistent and uniform learning improvements. These findings indicate that incorporating creative, arts-based instructional strategies can enhance conceptual understanding, strengthen retention, and actively engage students in the learning process. This highlights the value of art-based approaches as a complementary method in science education, suggesting that such strategies can play a significant role in improving both the effectiveness and the inclusivity of teaching practices.

Integrating the findings of this study, several recommendations are proposed to enhance science instruction, particularly in biology. Given the positive impact of the Art-based Learning Approach, teachers are encouraged to incorporate it into their biology lessons. Adopt a blended learning approach that combines traditional and art-based strategies to accommodate diverse learning styles. To facilitate effective implementation, professional development and training should be provided to equip educators with the necessary skills and resources. Future research should explore the long-term effects of art-based learning on comprehension, memory, and critical thinking, and investigate its impact across different age groups, learning environments, and subjects.

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References

Bara, E., Bara, G., & Pupe, S. (2024). The role of biology curriculum in promoting student health, environmental awareness, and academic success: Teacher responsibilities. Edelweiss Applied Science and Technology, 8(2), 1–14. https://doi.org/10.55214/25768484.v8i2.1081

Bhoi, C. (2024). Evaluating the effectiveness of innovative learning approaches in teaching biology to secondary school students: A comparative study of traditional and interactive pedagogical methods. Journal of Education Method and Learning Strategy, 2, 894–906. https://doi.org/10.59653/jemls.v2i03.779

Cabigas, D. L. (2023). *Using transdisciplinary approach in biology instruction*. International Journal of Trend in Scientific Research and Development, 7(2).

Creswell, J. W., & Creswell, J. D. (2021). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). SAGE Publications.

De La Cruz, J. (2023, September 4). What is biology? Concepts, history, and branches. Learnt Blog. https://learnt.io/blog/what-is-biology

Freeman, S., et al. (2020). Active learning increases student performance in science, engineering, and mathematics. Proceedings of the National Academy of Sciences.

Henriksen, D., Creely, E., Henderson, M., & Ratto, M. (2021). Creativity and technology in teaching and learning: A literature review of the uneasy space of implementation. Educational Technology Research and Development, 69, 2091–2108. https://doi.org/10.1007/s11423-020-09912-z

Ignacio, M. F. M., & Rivera, K. C. (2022). Integrating arts-based activities in teaching biology. Zenodo. https://doi.org/10.5281/zenodo.6851324

Klein, K., Calabrese, J., Aguiar, A., Mathew, S., Ajani, K., Almajid, R., & Aarons, J. (2023). *Evaluating active lecture and traditional lecture in higher education*. Journal on Empowering Teaching Excellence, 7(2), Article 6. https://doi.org/10.26077/ba42-a5cc

Prajapati, S., & Pachauri, Y. (2025). Creative classrooms: The journey of art-integrated learning (2005–2023). Asian Journal of Applied Science and Technology, 9(1), 107–121. https://doi.org/10.38177/ajast.2025.9110

Quillin, K., & Thomas, S. (2021). Drawing-to-learn: A framework for using visual representation in biology education. CBE—Life Sciences Education, 20(1), ar3. https://doi.org/10.1187/cbe.20-03-0050

Ryoo, K., & Linn, M. C. (2021). Designing learning environments for science modeling. Journal of Research in Science Teaching.

Sousa, D. A., & Pilecki, T. (2022). *From STEM to STEAM: Using brain-compatible strategies to integrate the arts.* Corwin Press.

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). Experimental and quasi-experimental designs for generalized causal inference (2nd ed.). Houghton Mifflin.

Surbakti, T. I. P., & Fauzi, K. M. S. M. A. (2024). *The application of the constructivist approach in art education*. Gorga: Jurnal Seni Rupa, 13(2), 625–630. https://doi.org/10.24114/gr.v13i2.58479

Tindan, T., & Chrisantus, B. (2024). Exploring students' perceived difficulties of learning biology. IOSR Journal of Research & Method in Education, 14(2), 29–36. https://doi.org/10.9790/7388-1402022936

van Meter, P., & Firetto, C. (2020). Cognitive model of drawing construction in learning from science texts. *Educational Psychology Review*.