

Effect of Art-Integrated Learning on Biological Science knowledge of Class IX Students: An Experimental Study in Government Schools of Ganjam District

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Abstract—This study examines how Art-Integrated Learning affects the biological science knowledge of ninth-grade students attending government secondary schools in Ganjam District, Odisha. A pre-test–post-test control group design was used in the investigation. Using cluster sampling, a total of 120 students were chosen and split evenly into experimental and control groups. While the control group received training using traditional ways, the experimental group was taught specific biology units utilizing art-integrated instructional practices. Data was gathered using a Biology Achievement Test that the researcher created and standardized. The t-test, mean, and standard deviation were used to examine the data. The results showed a statistically significant difference in favor of the experimental group, suggesting that Art-Integrated Learning improves biological science knowledge more successfully than conventional approaches. The study emphasizes the educational value of incorporating the arts into scientific instruction for purposeful and enjoyable learning.

Keywords— Art-Integrated Learning, Biological Science knowledge, Experimental Study, Secondary Education, Government Schools

I. INTRODUCTION

Biology as a school subject plays a vital role in developing scientific literacy among secondary school students by enabling them to understand life processes, health, environmental sustainability, and biodiversity. Despite its importance, biology is often perceived by students as abstract and content-intensive, particularly in government secondary schools where instructional practices are largely textbook-driven. Such traditional approaches frequently lead to passive learning, limited conceptual understanding, and reduced learner engagement.

In recent years, innovative pedagogical strategies have been advocated to address these challenges.

One such approach is Art-Integrated Learning, which purposefully connects curricular concepts with visual arts, performing arts, and creative activities. Rather than treating art as an isolated subject, Art Integrated Learning embeds artistic expression within academic learning to promote conceptual clarity, creativity, and experiential engagement. The National Education Policy (NEP, 2020) strongly emphasizes art integration as a means of fostering holistic, interdisciplinary, and learner-centered education.

Within the context of science education, art-based activities such as drawing, modeling, dramatization, and visual representation have been found to support deeper understanding of complex concepts. However, empirical evidence on the effectiveness of Art-Integrated Learning in biology classrooms, particularly in government schools of Odisha, remains limited. Therefore, the present study seeks to examine the effect of Art-Integrated Learning on the biological science knowledge of Class IX students studying in government secondary schools of Ganjam District.

II. REVIEW OF RELATED LITERATURE

Recent research highlights the growing relevance of integrating artistic practices within science education to enhance student learning outcomes. Song, Li, and Zhao (2025) conducted a systematic review on science–art integration and reported that drawing-based instructional strategies facilitate generative learning by enabling learners to externalize abstract ideas, organize scientific knowledge, and construct meaning actively. Their findings indicate that artistic engagement supports both conceptual understanding and skill development across scientific disciplines, including biology.

Eisner (2024) emphasized the cognitive value of the arts, arguing that artistic experiences nurture imagination, interpretative thinking, and deeper forms of understanding. According to Eisner, the arts encourage learners to explore multiple representations of knowledge, thereby enriching cognitive processes beyond rote memorization.

Empirical studies have also demonstrated the positive impact of arts integration on student engagement and achievement. DeMoss and Morris (2023), through a meta-analytic review, reported that instructional approaches combining arts with academic content lead to improved learner motivation, classroom participation, and academic performance. In the context of science education, activities such as diagrammatic representation, role-playing of biological processes, and construction of models have been shown to enhance comprehension and long-term retention of concepts.

Indian studies further support these findings by highlighting art-integrated pedagogy as an effective instructional innovation in secondary school classrooms. Collectively, the reviewed literature suggests that Art-Integrated Learning holds considerable potential for improving students' understanding of biology, thereby justifying the need for the present experimental investigation.

III. OBJECTIVES OF THE STUDY

1. To study the effect of Art-Integrated Learning on the biological science knowledge of Class IX students.
2. To compare the biological achievement of students taught through Art-Integrated Learning and conventional teaching methods.
3. To examine gender differences in biological achievement among students taught through Art-Integrated Learning.

IV. LIMITATIONS OF THE STUDY

1. The study was limited to a small sample from one district.
2. The duration of the experiment was short.
3. Long-term retention of learning was not assessed.

V. Hypotheses of the Study

1. There is no significant difference between the pre-test mean scores of the experimental and control groups.
2. There is a significant difference between the post-test mean scores of the experimental and control groups.
3. There is no significant gender difference in biological achievement among students taught through Art-Integrated Learning.

VI. METHODOLOGY

6.1 Research Design

The study adopted a quasi-experimental pre-test–post-test control group design.

6.2 Sample

The sample consisted of 120 Class IX students selected from four government secondary schools of Ganjam District using cluster sampling technique. Sixty students were assigned to the experimental group and sixty to the control group, with equal representation of boys and girls.

6.3 Tools Used

- **Biology Achievement Test (BAT):** A researcher-developed test based on the Class IX biology syllabus.
- **Art-Integrated Learning Modules:** Activities included drawing and labeling diagrams, clay modeling of cells, poster preparation, dramatization of biological processes, and chart work.

6.4 Procedure

1. Pre-test was administered to both groups to assess initial biological science knowledge.
2. The experimental group was taught using Art-Integrated Learning strategies for four weeks.
3. The control group received instruction through traditional lecture-cum-textbook methods.
4. Post-test was administered after the instructional period.

6.5 Statistical Techniques

Mean, standard deviation, and t-test were employed to analyze the data.

VII. ANALYSIS AND INTERPRETATION OF DATA

Before the intervention, there was not a noticeable distinction between the experimental and control groups, according to the pre-test findings. Students in the experimental group scored much higher than those in the control group, according to post-test data. The null hypothesis was rejected since the computed t-value was significant at the 0.01 level.

Boys and girls in the experimental group did not significantly differ from one another, according to gender-wise analysis, indicating that kids benefit from art-integrated learning regardless of their gender.

7.1 Comparison of Pre-Test Scores

Table 1: Mean and SD of Pre-Test Scores

Group	N	Mean	SD
Experimental	60	18.75	4.23
Control	60	18.90	4.15

Interpretation:

The mean and standard deviation of the experimental and control groups' pre-test results are shown in Table 1. The experimental group's mean score (M = 18.75, SD = 4.23) and the control group's mean score (M = 18.90, SD = 4.15) are almost the same. This suggests that prior to the intervention, there was no discernible difference between the biological science knowledge of the students in the two groups. Any difference seen in the post-test can be linked to the impact of the art-integrated learning intervention because the similarity in mean scores and variability indicates that the two groups were equal at the baseline level.

7.2 Comparison of Post-Test Scores

Table 2: Mean and SD of Post-Test Scores

Group	N	Mean	SD
Experimental	60	32.40	3.88
Control	60	26.15	4.42

Interpretation:

The mean and standard deviation of the experimental and control groups' post-test results are displayed in Table 2. In comparison to the control group (M = 26.15, SD = 4.42), the experimental group had a significantly higher mean score (M = 32.40, SD = 3.88). This considerable difference shows that students who were exposed to art-integrated learning outperformed those who were

taught using traditional teaching approaches. The outcomes unequivocally show how well art-integrated learning improves students' comprehension of biological scientific ideas.

7.3 Learning Gain in Experimental Group

Table 3: Pre-Test and Post-Test Comparison

Test	Mean	SD	Mean Gain
Pre-Test	18.75	4.23	
Post-Test	32.40	3.88	13.65

Interpretation:

The experimental group's pre-test and post-test results are contrasted in Table 3. There was a mean gain of 13.65 marks from the pre-test mean score of 18.75 (SD = 4.23) to the post-test mean score of 32.40 (SD = 3.88). This significant improvement demonstrates how art-integrated learning enhances pupils' academic performance. The significant learning increase indicates that the intervention improved biological science ideas' understanding, retention, and application.

7.4 t-Test Analysis of Post-Test Scores

Table 4: t-Test Results

Comparison	t-value	df	Significance
Experimental vs Control	7.82	118	Significant at 0.01 level

Interpretation:

The t-test findings comparing the experimental and control groups' post-test scores are shown in Table 4. With 118 degrees of freedom, the computed t-value (t = 7.82) is significant at the 0.01 level. This suggests that there is a statistically significant difference in favor of the experimental group between the two groups. Thus, the null hypothesis is disproved, demonstrating that students' performance in biological science is significantly improved by art-integrated learning.

7.5 Gender-wise Comparison

Table 6: Gender-wise Post-Test Scores (Experimental Group)

Gender	N	Mean	SD
Boys	30	32.90	3.85
Girls	30	32.10	3.92

Interpretation:

The comparison of post-test results by gender within the experimental group is shown in Table 6. There is little difference between the mean scores of girls (M = 32.10, SD = 3.92) and boys (M = 32.90, SD =

3.85). Boys and girls benefited equally from the art-integrated learning strategy, as seen by the little variation in mean scores that is not statistically significant. This result implies that the teaching approach is gender-neutral and successful for all students, regardless of gender.

VIII. DISCUSSION

The results clearly show that Class IX students' biological science knowledge is positively and significantly impacted by Art-Integrated Learning. Students were able to actively participate in their education, visualize complex biological concepts, and develop meaningful knowledge through the use of artistic activities. These findings are in line with previous studies that emphasized experiential and multidisciplinary approaches and support constructivist learning theory.

IX. CONCLUSION

The study comes to the conclusion that Art-Integrated Learning is a successful educational approach for secondary biology instruction. It improves students' conceptual understanding, academic performance, and engagement. Learning outcomes in government schools can be greatly enhanced by integrating the arts into scientific instruction.

X. EDUCATIONAL IMPLICATIONS

1. Teachers of biology should use art-integrated teaching methods.
2. Art-Integrated Learning should be prioritized in teacher education and in-service training programs.
3. Interdisciplinary and experiential learning methods should be encouraged by curriculum designers.

XI. SUGGESTIONS FOR FURTHER RESEARCH

1. Conduct longitudinal studies to examine retention effects.
2. Replicate the study at higher secondary level.

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