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Theme: Art Integrated Teaching In Biology Reduces Stress Of Learning

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1. ABSTRACT:

Art and Science represent two foundational pillars of human understanding and experience. Each contributes our understanding of the world. While Science focuses on empirical facts and the knowledge of the physical world, Art facilitates the interpretation and emotional connection to that knowledge. In the context of Biology—a science often taught with strict adherence to its specialized content and boundaries—traditional teaching methods can inadvertently contribute to high-pressure academic environments. This pressure can hinder student engagement and comprehension, particularly in complex subjects such as Biomolecules.

This mixed-method study employed a sequential explanatory design to examine the impact of Art Integrated Learning (AIL) on reducing academic stress while enhancing comprehension in Biology. Two groups of students were studied: an Art-Based Activity Group (ABAG) and a Non-Art-Based Activity Group (NABAG). Quantitative data were collected through pre-test and post-test assessments focused on three challenging topics in Biomolecules. The results revealed that the ABAG not only achieved significantly higher post-test scores but also reported lower levels of academic stress compared to the NABAG. Qualitative analysis of student-created artwork suggested that the integration of art into the learning process allowed students to engage with the material in a more relaxed and creative manner, thereby reducing the cognitive load and pressure often associated with mastering difficult biological concepts.

The findings suggest that incorporating Art into the teaching of Biology not only improves academic performance but also contributes to a more supportive and less stressful learning environment. This approach represents a significant step toward creating a more holistic and enjoyable educational experience, where students can thrive both intellectually and emotionally.

2. Key Words: Art Integrated learning, Biology teaching, Reduce pressure, Academic Environment

3. INTRODUCTION:

3.1 The dictionary defines integration as "the act of combining or adding parts to make a unified whole." Therefore, art integration refers to blending the arts with teaching various curricular areas. Subjects like languages, social studies, sciences, and mathematics can be interconnected with art, sometimes making scientific concepts easier to understand. Abstract ideas within these subjects can be made concrete through different art forms. This method enhances knowledge and understanding of the subject matter while also fostering a greater appreciation for the arts. This approach is known as holistic or complete learning.

3.2 Literature Review

Study/Source	Focus Area	Finding/Insights	Impact
CBSE Academics (2019)	Art integration towards experiential learning	Art Integration in education, as promoted by the Central Board of Secondary Education (CBSE), is an innovative pedagogical approach that infuses creative practices across disciplines, fostering experiential learning. By integrating art with subjects like science, mathematics, and social studies, students experience a holistic learning process that nurtures creativity, critical thinking, and problem-solving skills. Art integration helps in making learning more engaging and meaningful by connecting concepts to real-life situations through creative expression.	This approach enhances students' cognitive abilities, emotional intelligence, and understanding of complex ideas by encouraging them to visualize, create, and reflect.it caters to diverse learning styles, making education more inclusive. Art Integration serves as a transformative tool, promoting deep, experiential learning, and reducing the stress often associated with traditional academic environments
Csikszentmihalyi (1990)	Art and Flow Theory	Engaging in creative activities induces a state of "flow," leading to deep concentration and enjoyment.	Reduced anxiety and stress through focused engagement in artistic activities.
Efland (2002)	Art Integration and Cognitive Engagement	Art integration increases student engagement by connecting learning to emotions and interests.	Deeper understanding of biology concepts reduces fear and academic stress.
Harland et al. (2000)	Cognitive and Emotional Development	Art-integrated learning enhances critical thinking and emotional resilience.	Improved emotional resilience leads to a more relaxed learning environment.
Gajda, Beghetto, and Karwowski (2017)	Creativity-Oriented Learning Environments	Shifts focus from rote memorization to creative understanding, promoting joy in learning.	Reduces performance pressure and stress related to grades.

De Jesus et al. (2014)	Art-Based Activities in Biology Education	Use of concept mapping, diagram drawing, and role-playing improves comprehension and retention.	Lower anxiety levels and higher information retention reduce stress in biology.
NCERT (National Curriculum Framework, 2005)	Art Integration in Education Policy	Advocates for art integration across subjects, including biology, to promote holistic learning.	Encourages creative learning methods that reduce stress by moving away from rote memorization.
CBSE Circular on Art Integrated Learning (2020)	Policy Implementation and Guidelines	Mandates art integration in teaching across subjects, including biology, to enhance learning outcomes.	Supports stress reduction by making learning more engaging and enjoyable.
Nain and Chauhan (2019)	Impact of Art-Integrated Learning on Students	Found that art-integrated learning in biology improved student engagement and reduced anxiety.	Reduction in learning stress due to the creative and visual approach to complex topics.
Rangachari (2017)	Art-Based Pedagogy in Science Education	Discussed the use of drama and role-playing in biology classes, leading to improved understanding and less stress.	Reduced stress through interactive and participatory learning experiences
Winner, Goldstein, & Vincent-Lancrin (2013)	Arts for Cognitive and Emotional Development	Art-based education enhances cognitive skills and emotional development, leading to holistic learning.	Reduces learning stress by making difficult subjects more approachable and enjoyable.
Darts (2006)	Visual Culture in Science Education	Integrating visual culture with science improves comprehension and reduces the intimidation factor.	Lowers stress by demystifying complex scientific concepts through visual aids & Enhances emotional well-being by connecting learning with cultural expression.
Sabol (2013)	Art Integration and Academic Success	Art integration boosts academic performance and reduces stress, especially in STEM subjects.	Stress reduction through creative expression and interdisciplinary learning & Supports mental health by balancing cognitive and emotional demands in education.

Poonam Srivastava (2023)	Art integrated learning: An innovative and inclusive approach to Education	Art-integrated learning is a creative and constructivist approach where students use various art forms like dance, drama, music, and visual arts to explore and demonstrate academic concepts. By integrating art into the curriculum, this method fosters a 360-degree holistic learning experience, targeting cognitive, socio-emotional, behavioural, and psychomotor development. It not only enhances student engagement but also promotes inclusivity in the classroom, making it a valuable tool for comprehensive education.	Art integration involves incorporating art into academic subjects to enhance learning. By using art to teach non-art concepts and skills, students can better understand and retain information. This method is particularly effective for teaching concepts that are difficult to grasp through traditional methods. Art integration can take various forms, such as using a painting to explain a historical concept or music to teach math. Numerous resources and organizations offer training and support for teachers interested in applying art integration in their classrooms.
Sinha & Gupta(2017) Sage Publication	Art integration and mental health in Indian classrooms: A comprehensive review	Art integration promotes mental well-being and academic performance; highlights benefits specific to Indian classrooms.	Discusses specific challenges and benefits of art integration within the Indian education system.
Sharma & Kumar (2018)	Enhancing educational outcomes through art integration: Evidence from India	Art integration leads to higher engagement and better performance; analysis of Indian educational practices.	Offers insight into how art integration can be implemented in Indian classrooms.
Gupta & Sharma (2019)	The effects of art-based learning on academic performance and mental health in Indian students	Art-based learning enhances both academic outcomes and mental health; provides data from Indian schools.	Focuses on empirical data from Indian educational settings, reflecting local educational challenges.
Bhatia & Prakash (2021)	Impact of art-based pedagogy on student performance and well-being in Indian schools	Art-based pedagogy improves academic performance and mental well-being; case studies from various Indian schools.	Examines real-life applications and case studies within the Indian context.

3.3 Gap Area: Below are the potential gap areas for this research:

i) Investigate how AIT affects stress reduction in different demographic groups and whether it has different effects based on setting or student needs.

ii) Conduct comparative studies to determine how integrated arts education reduces stress and improves learning outcomes compared to traditional teaching methods.

3.4 Need for current research:

- Art integrated into art simplifies complex biological concepts and makes them easier for students to grasp.
- Creative activities give students an outlet for expression and reduce the anxiety associated with traditional rote methods.
- Art projects allow students to work at their own pace, which reduces the pressure to keep up with the class and thus minimizes stress.
- Art activities in biology will reduce stress for students who may struggle with traditional teaching methods and promote collaboration.
- Students will become more engaged in the subject, leading to increased participation and regular attendance in formal education. Introduction should include background, overview of available relevant research papers, gap area and current research needs.

4. METHODOLOGY:

A mixed methods approach combining both quantitative and qualitative research methods used in the research.

4.1 Sample:

The study was conducted on a purposive sample of 40 students enrolled in biology. Students were randomly divided into two groups: Art-Based Activity Group (ABAG) and Non-Art-Based Activity Group (NABAG), with 20 students in each group. Selection criteria included students who previously exhibited high levels of academic stress as determined by a pre-survey and teacher assessment.

4.2 Tools:

1) Pre-test and post-test evaluation: Both groups were given standardized tests to measure their understanding of biomolecules. The tests included a combination of multiple-choice questions, short-answer questions, and problem-solving tasks designed to assess both content knowledge and conceptual understanding.

2) Perception of Stress Scale (PSS): This is a widely used psychological tool to measure the perception of stress. It assesses the extent to which situations in life are rated as stressful. Incorporating this scale into a study on Art Integrated Learning (AIL) in biology teaching could provide valuable insights into how this teaching approach affects students' stress levels. ***Attached in Appendix A***

3) Art-Based Activity Group: The Art-Based Activity Group (ABAG) participated in a series of art activities designed to teach complex concepts in the field of biomolecules. These activities included creating visual representations of biomolecules, collaborative drawing exercises, and storytelling through art that combined biological concepts with creative expression. Each activity was aligned with the learning objectives of the

curriculum. The following activities have been proposed for the ABAG group that combine art with the study of biomolecules:

a) Comics about biomolecules: Students created characters with specific roles in a cell, including protein as an enzyme, carbohydrates as an energy source, types of RNA for protein synthesis, and DNA as instructions. The aim of the course is to improve the understanding of the functions and interactions of biomolecules within a biological system.

b) Interactive biomolecule mural: students created a mural representing biomolecules structure such as carbohydrates, lipids, proteins, RNA and DNA. The mural was divided into parts and the students correctly assembled and painted each part, adding information about the function of the part they were working on. The goal of the lesson was to encourage collaboration and deepen understanding of molecular structure and function through a group art project. ***Evidences attached with Appendix: 2***

4.3 Procedure:

The study was conducted for two weeks. At the beginning of the study, both groups were given a pre-test and a perceived stress scale. ABAG then engaged in creatively integrated activities, while NABAG continued traditional lecture teaching on the same topics. After the intervention, both groups completed the post-test and the Perceived Stress Scale. Test and survey data were collected and analyzed to determine the effectiveness of AIL in reducing academic pressure.

4.4 Data analysis:

Quantitative data from the pre-tests, post-tests and stress scales were analyzed using descriptive statistics and paired t-tests to compare the performance of the two groups. Qualitative data from the surveys were analyzed using thematic analysis to identify key themes related to students' perceptions of learning and stress reduction. Qualitative data analysis to understand the impact of arts-integrated teaching in biology on reducing learning stress involves a systematic approach to interpret and understand the collected data from observation notes, focusing on students' behaviour, level of engagement, and emotional responses during arts-integrated lessons. analyze art projects and presentations created by students to demonstrate understanding and emotional expression. The Methodology section should include details on patterns, tools and techniques.

5. RESULT AND DISCUSSION:

Two groups of 20 students took part in the research. Group A, the control group, was designated the Non-Art-Based Activity Group (NABAG) and Group B, the experimental group, was identified as the Art-Based Activity Group (ABAG).Group A followed traditional teaching methods and assessment, while Group B engaged in art-based instruction on the same topic, where students conducted research, created comics, and created murals to present their understanding. During the process, data was collected to study two main parameters and perform quantitative analysis.

5.1 Quantitative analysis:

5.1.1 Analysis of pre-test and post-test assessments conducted to understand the topic: Pre-test and post-test assessments were conducted to evaluate students' understanding of the concept before and after the intervention. These assessments provided a comparative analysis of students' knowledge and highlighted the effectiveness of the teaching methods used. By examining differences in scores and depth of responses, we

were able to assess the impact of the intervention on students' conceptual understanding and overall assessment performance. Reviewing these assessments provided valuable insights into the learning progress students made as a result of the implemented arts-based learning approach.

Table: 1 (Scores of Pre and Post Assessment)

Class 11
Topic: Biomolecules
Data of Pre & Post assessment
(Maximum Marks: 15)

Group- A (NABAG) Obtained Marks		
Student No	**Pre Assessment**	**Post Assessment**
1	10	7
2	8	9
3	9	8
4	12	10
5	3	4
6	6	7
7	9	8
8	10	12
9	8	6
10	7	8
11	5	4
12	9	6
13	10	8
14	11	10
15	13	12
16	6	6
17	7	8
18	9	7
19	8	9
20	12	10

Group -B (ABAG) Obtained Marks		
Student No	**Pre Assessment**	**Post Assessment**
1	7	9
2	10	11
3	12	12
4	7	9
5	8	9
6	9	10
7	13	12
8	10	12
9	9	11
10	4	6
11	6	8
12	3	5
13	13	14
14	9	11
15	8	9
16	7	8
17	6	8
18	10	12
19	12	14
20	8	11

Table 1 data represents the Pre and Post learning of each group on the Biomolecules. Pre Test data reflected students' prior knowledge of the topic and Post Test data was collected to evaluate students' understanding and progress by each groups.

After collection of data from each group T-test was conducted for statistically validate whether Art Integrated Teaching in Biology effectively enhance students' performance and providing empirical evidence for the effectiveness of this teaching approach. The primary goal of the T-test is to compare two groups or conditions to determine if there is a statistically significant difference in their means.

After the calculation, the T-test result with pre-test p-value is 0.476 and post-test p-value is 0.003. and the interpretation is as follows:

1. Pre-test (p = 0.476):

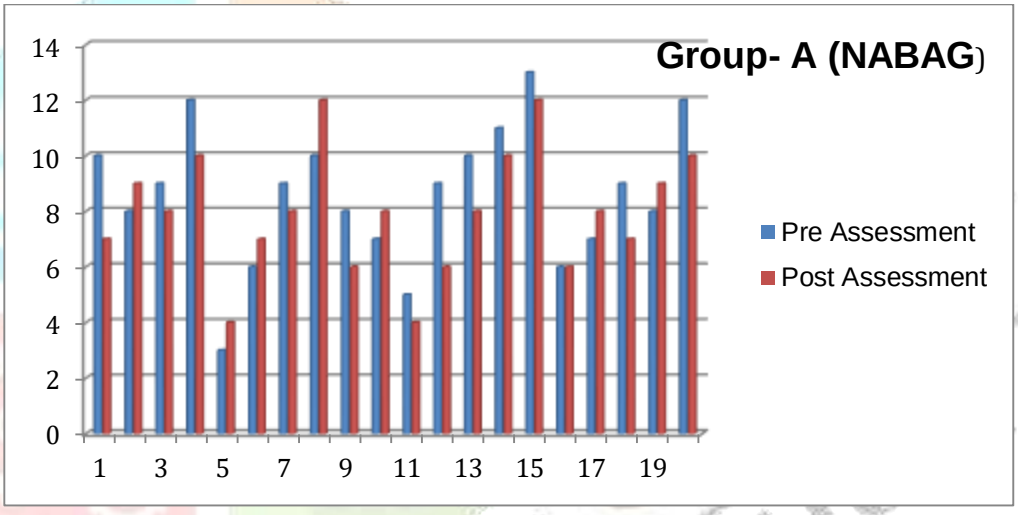
A p-value of 0.476 indicates that there is no statistically significant difference between the groups being compared before the art integrated teaching methodology and there is no evidence to suggest a meaningful difference between the groups in their learning.

2. Post-test (p = 0.003):

A p-value of 0.003 suggests that there is a statistically significant difference between the groups after the art integrated teaching methodology. This p-value is well below the conventional threshold of 0.05, indicating strong evidence that the observed difference is unlikely to be due to chance. Therefore, the art integration teaching in biology had a meaningful impact.

5.1.2: Comparative analysis of performance of each group in pre and post assessment:

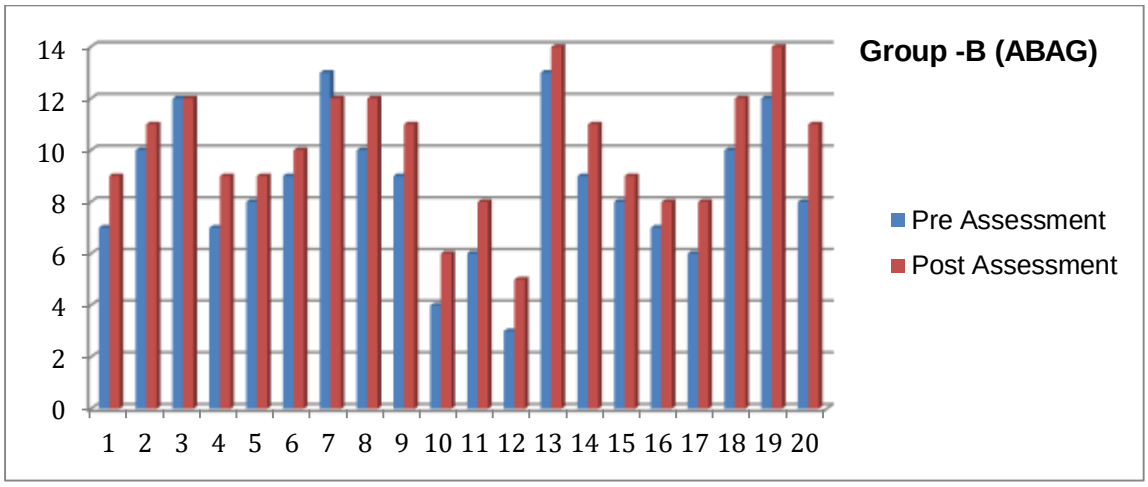
Group A:



Graph 1: Pre and Past assessment of Group A (NABAG)

Graph 1, illustrates that there is no significant difference between the pre- and post-assessment results after students were taught using traditional teaching methods. The students' performance remained consistent with their initial learning abilities, indicating that the teaching approach did not markedly enhance their understanding or retention of the material. The lack of noticeable improvement suggests that the traditional methodology may not have effectively addressed the diverse learning needs of the students, leading to minimal impact on their conceptual grasp and overall academic growth.

Group B:

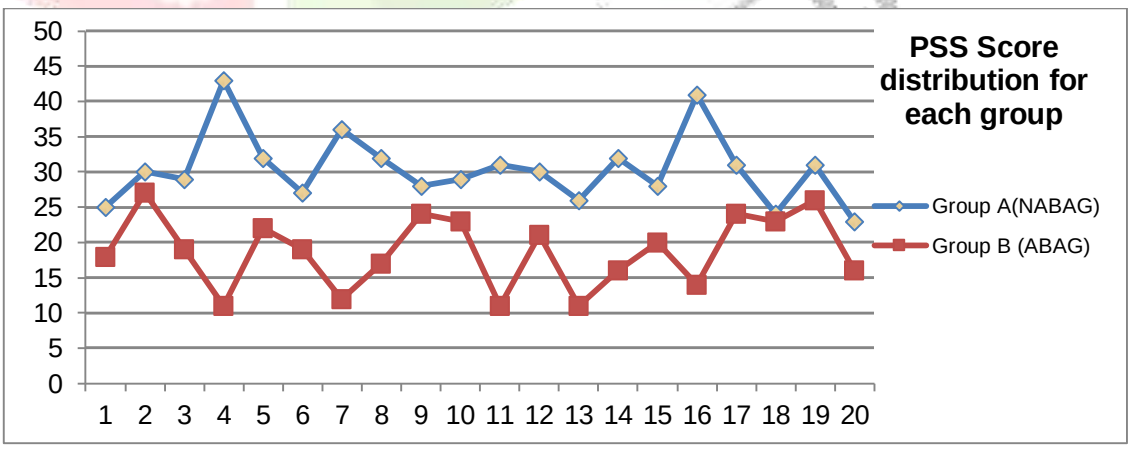


Graph 2: Pre and Past assessment of Group b (ABAG)

Graph 2 illustrates the data showing that students who participated in art-based activities during the teaching process demonstrated a significantly better understanding of the concept. The graph reflects that these students not only grasped the material more effectively but also engaged more actively in the learning activities. This increased participation suggests that the art-based approach facilitated a deeper connection with the subject matter, making the learning experience more interactive and enjoyable. The visual representation in the graph highlights the correlation between the use of art-based teaching methods and the enhanced comprehension and retention of the concepts.

5.1.3: **Perceived Stress Scale (PSS) Analysis:** The Perceived Stress Scale (PSS) was utilized to assess and compare the stress levels of students in the Non-Art-Based Activity Group (NABAG) and the Art-Based Activity Group (ABAG) as they engaged with Biology content.

Data was collected from the both groups and interpreted as follows:



Graph 3: Individual PSS score distribution for each group

Graph 3 refers that the ABAG students displayed a noticeable reduction in their PSS scores. This suggests that the Art Integrated Teaching approach contributed to a decrease in their perceived stress. Conversely, the NABAG students showed higher score of their PSS scores after being taught using traditional methods, indicating that their stress levels are comparatively high.

The data suggests that incorporating art into the learning process not only made the subject matter more accessible but also helped alleviate the anxiety and stress often associated with understanding complex biological concepts. ABAG students reporting lower stress levels than those in NABAG.

5.2 Qualitative Analysis: The class observation analysis indicated that students in the Art-Based Activity Group (ABAG) demonstrated greater interest and motivation, actively engaging in the learning of biomolecules compared to those in the Non-Art-Based Activity Group (NABAG). Furthermore, there was a significant increase in student participation and the adoption of an application-based approach to learning within the ABAG. These findings suggest that art-based teaching positively influenced student engagement and learning outcomes.

6. Conclusion:

The research sought to assess the impact of Art Integrated Teaching on reducing stress and enhancing academic performance in Biology, employing pre-test and post-test assessments to measure learning improvements. Initially, the pre-test results indicated that both the Art-Based Activity Group (ABAG) and the Non-Art-Based Activity Group (NABAG) had comparable levels of understanding of Biology concepts. However, following the intervention, ABAG students exhibited a markedly improved understanding of the material compared to NABAG students. This improvement is attributed to the engaging and creative nature of Art Integrated Teaching, which enabled ABAG students to better comprehend and apply complex biological concepts through art-based activities.

The Perceived Stress Scale (PSS) analysis revealed that ABAG students experienced a significant reduction in stress after participating in Art Integrated Teaching activities. This decrease in stress suggests that the integration of art into teaching not only facilitated a deeper understanding of Biology but also created a more relaxed and supportive learning environment. Conversely, NABAG students reported significant stress levels, with some even experiencing higher stress after traditional teaching methods. This finding highlights that conventional teaching approaches may be inadequate in addressing the stress associated with learning complex subjects like Biology.

The research conclusively demonstrates that Art Integrated Teaching in Biology effectively reduces learning stress and enhances academic performance. By making the subject more accessible, engaging, and enjoyable, art-based activities not only improved students' conceptual understanding but also alleviated the anxiety and pressure typically associated with challenging topics. The positive outcomes observed in post-test assessments and PSS analysis strongly support the integration of art into educational practices as a valuable strategy for enhancing student learning experiences and academic results. The incorporation of art—through activities such as drawing, comic creation, and mural development—provided students with alternative means of expression and understanding, thereby reducing the pressure of traditional rote learning. This creative approach fostered a more supportive and relaxed learning environment, making the academic experience both more enjoyable and less stressful. The study underscores the potential of art-based interventions as a multifaceted solution to manage stress in high-pressure academic settings, addressing the critical need for effective strategies to support students' well-being and academic success.

7. Limitations: The research on Art Integrated Teaching in Biology provides valuable insights and following limitations should be considered:

i) The study involved a limited number of students (20 in each group), which may not be representative of a larger or more diverse population.

ii) The study did not account for various external factors that could influence stress and academic performance, such as personal background, interest in art, and existing stressors, which may affect the study's outcomes.

iii) The research primarily focused on quantitative measures of stress and academic performance. The qualitative impact of art integration on students' creativity, engagement, and personal growth was not fully explored.

iv) While the study focused on immediate changes in stress and academic performance, it did not evaluate the long-term effects of Art Integrated Teaching, which are essential for understanding the sustained impact of the intervention.

v) The study did not define the extent to which learning outcomes may vary, which could affect the reliability and consistency of the observed results.

8. Scope of this research:

i) Art Integrated Teaching may impact student learning and stress reduction across various subjects beyond Biology, such as Mathematics, History, Accountancy , Economics and Psychology.

ii) Examine the long-term effects of Art Integrated Teaching on students' academic performance, stress levels, and overall well-being.

iii) Study whether art-based methods provide additional benefits for students facing specific learning challenges

iv) Study the qualitative aspects of art integration, such as improvements in creativity, critical thinking, and time bound expressions.

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Appendix:1

Class 11 **Subject: Biology**

Name of Student: _____ **Group:**

Perceived Stress Scale (PSS) for Art Integrated Teaching in Biology reduces stress of learning

Instructions: The following questions ask about your feelings and thoughts during the last month while learning biology through Art Integrated Learning. For each statement, please indicate how often you felt or thought a certain way on a scale from 0 to 4.

- 0 = Never
- 1 = Almost Never
- 2 = Sometimes
- 3 = Fairly Often
- 4 = Very Often

Sr. No	Question	Scale				
		0	1	2	3	4
1	In the last month, how often have you felt that learning biology was overwhelming due to traditional teaching methods?					
2	In the last month, how often have you been upset because of unexpected difficulties in understanding biological concepts?					
3	In the last month, how often have you felt confident in your ability to learn biology when it was integrated with art-based activities?					
4	In the last month, how often have you felt that the use of art in biology made learning more enjoyable?					
5	In the last month, how often have you felt nervous or stressed about biology exams or assignments?					
6	In the last month, how often have you felt that integrating art into biology made it easier to handle academic pressures?					
7	In the last month, how often have you felt that learning biology through art helped you better manage your study time?					
8	In the last month, how often have you felt that biology classes using art made the subject less intimidating?					
9	In the last month, how often have you felt that your workload in biology was too heavy to manage, even with art-based learning?					
10	In the last month, how often have you felt that you were on top of things in your biology studies due to the creative approach?					
11	In the last month, how often have you felt that the use of art in biology helped reduce your anxiety about academic performance?					
12	In the last month, how often have you felt irritated due to the pressure of performing well in biology despite the use of creative methods?					

13	In the last month, how often have you felt that art integration made biology less challenging to understand?					
14	In the last month, how often have you felt that learning biology through art was a waste of time?					
15	In the last month, how often have you felt that the creative aspects of your biology classes reduced your overall stress?					

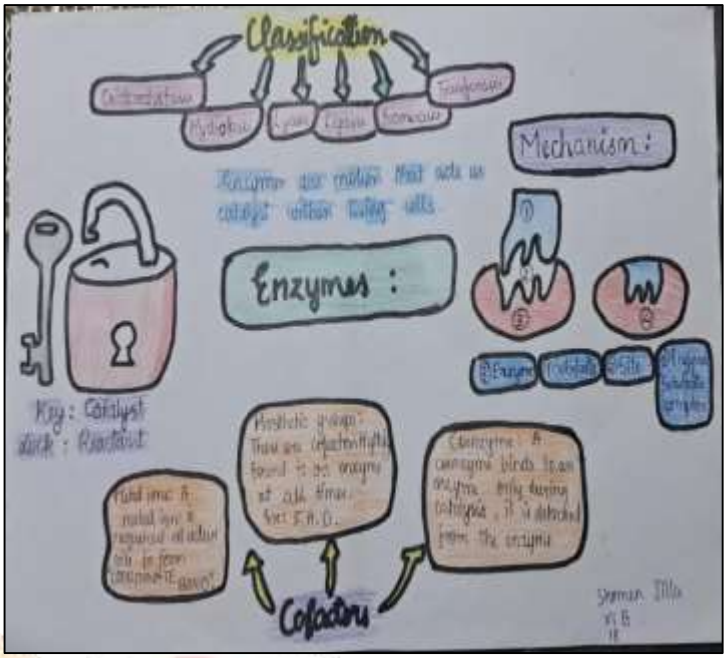
Scoring:

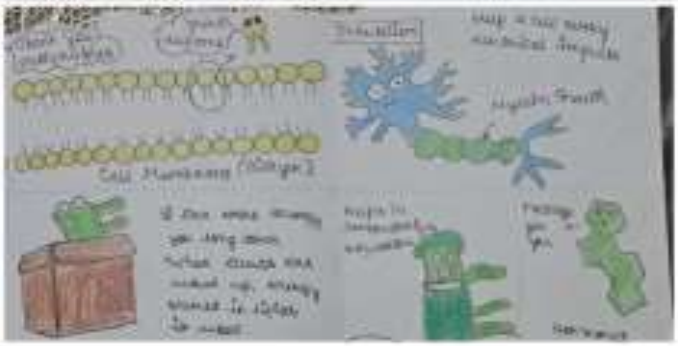
- Positive items: (3, 4, 6, 7, 8, 10, 11, 13, 15) are reverse-scored (0 = 4, 1 = 3, 2 = 2, 3 = 1, 4 = 0).
- Negative items: (1, 2, 5, 9, 12, 14) are scored as they are.

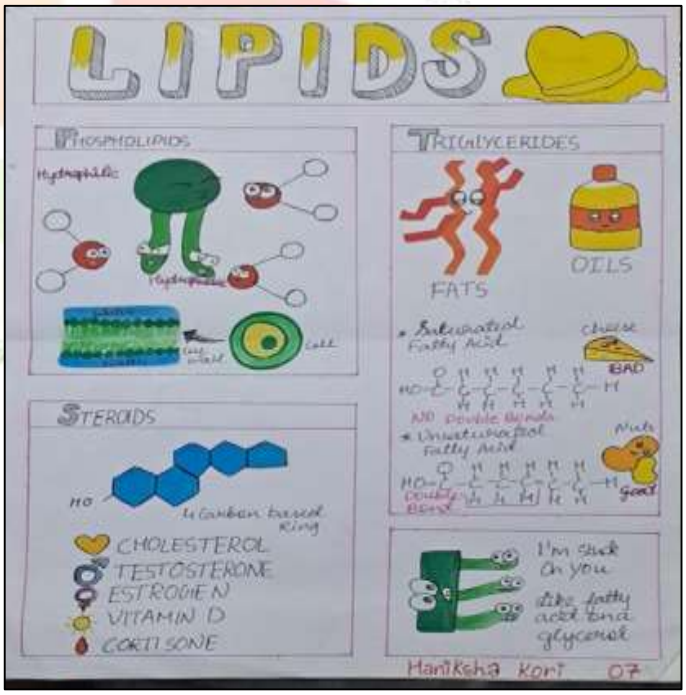
- Add the scores to obtain the total perceived stress score.
- Lower scores indicate lower perceived stress, which suggests that Art Integrated Learning is contributing to a reduction in high-pressure academic environments.
- Higher scores may indicate that stress remains high despite AIL interventions.

Appendix: 2 (Activity outcomes)

Activity A: Comic Strips

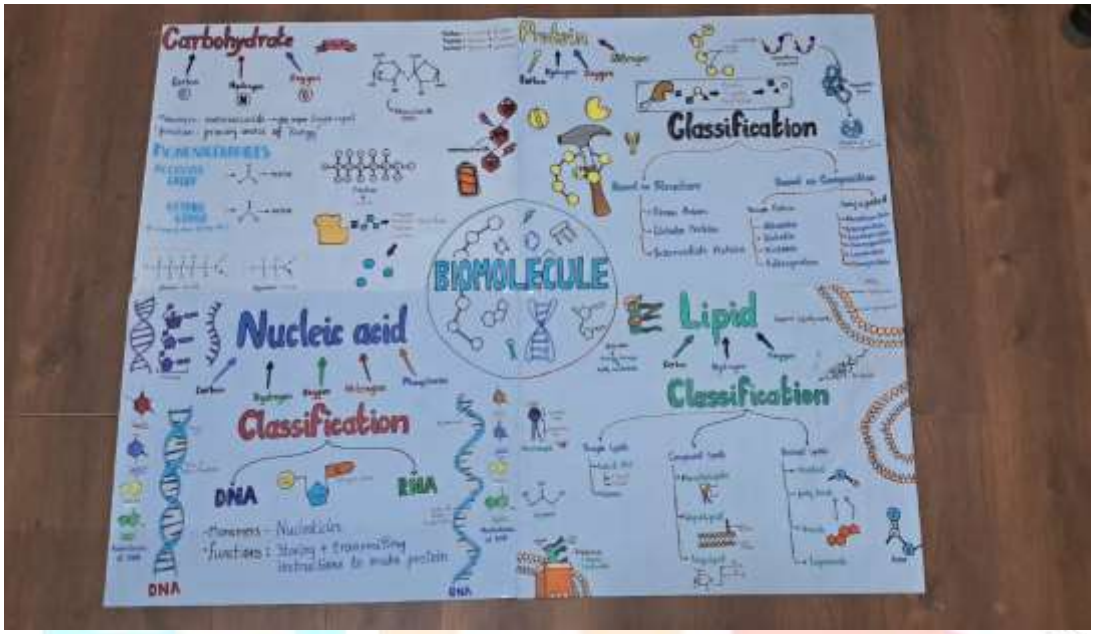






Activity B: (Mural)

Mural Size is "(23.4 x 33.1) X 4" inches
(4 A1 size papers attached together)



Mural on the floor on Biomolecules