PEDAGOGY BASED ON AESTHETIC APPROACH: ENHANCING AESTHETIC UNDERSTANDING AND IDENTITY AFFILIATION BELIEF

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Abstract

Adherents of the arts claim that an aesthetic component in the curriculum is quite capable of enriching aims, making them better understood, and increasing the potentiality of deliberately choosing them. Indeed, they regard no class of subjects as exclusively aesthetic. However, Science pedagogy has been influenced by the philosophical paradigm called the cognitive-rational perspective. This standpoint is also reflected in the aims and objectives recommended by the various Indian education commissions, committees and policies on science education for various stages from time to time. To overcome, this lacuna in science education, and to achieve other promising aims that facilitates science identity affiliation belief besides enhancing aesthetic understanding, an aesthetic approach to teach science has been proposed. The researcher has conducted quasi-experimental study in Mumbai for teaching Science to Class VII of Maharashtra State Board, wherein, deriving insights from Dewey's philosophy, a pedagogy based on aesthetic approach has been developed. The study involved three instructional cycles and pre-testing and post-testing the experimental and control group students on aesthetic understanding and Science identity affiliation belief. The inferential statistics have shown the treatment to be effective. The results of the study are significant for ushering in reforms in science education.

Introduction:

"Good teaching is one-fourth preparation and Three-fourths Theatre."

- Gail Godwin

Adherents of the arts claim that an aesthetic component in the curriculum is quite capable of enriching aims, making them better understood, and increasing the potentiality of deliberately choosing them. Indeed, they regard no class of subjects as exclusively aesthetic. There is a tendency in education to limit aesthetic values to restricted range of subject matter in the school, notably the fine arts of music, dancing, painting, modelling, and perhaps literature, especially poetry. Yet, there are a number of educators who think this much too narrow a range (Dewey, J.: 1916). They think that pupils can have intensified appreciation of geography, science, mathematics as well as poetry.

The aesthetic component in the curriculum may be defined by noting that even though a subject has instrumental value, there is also a sense in which it is satisfying on its own account

(Brubacher, J.). To create an educational program in which teachers and curriculum developers intentionally aim at the achievement of such goals would require a major revolution in teacher training as well as in the schools (Eisner, E.: 1982).

With respect to Science, the two questions: What constitutes Science? and What motivates the Scientists? – have guided much of the theories about Science pedagogy and psychology. Most of these theories had been influenced the philosophical paradigm called the cognitive-rational perspective (Greeno et al., 1997).

This standpoint is also reflected in the aims and objectives recommended by the various Indian education commissions, committees and policies on science education for various stages from time to time. For instance, the National Curriculum Framework, NCERT (2000), while aiming at promoting scientific and technological literacy amongst the learners of upper primary stage, has emphasised the cognitive-rational paradigm. The appreciation of beauty in science is not focussed.

The present research study was conducted with an aim to scaffold an aesthetic understanding of Science ideas for the students of upper primary stage with the help of aesthetic approach to teaching of Science and then to draw comparisons against regular classroom students taught Science through a cognitive-rational approach for the goal of aesthetic understanding.

The Need Of The Study:

- It may be argued from the dominant trend in science education that the cognitive, rational perspective and the value of development of conceptual knowledge is the default model for quality science teaching and learning at this time. This approach may misrepresent or overlook important aspects of science and science learning. The present study precisely focuses on one such aspect, namely, aesthetic understanding of science ideas, wherein, the effort is to connect the cognitive, rational goals of canonical understanding to more holistic, aesthetic ways of knowing
- Science education has emphasised on the process aspect of science, i.e. the methods of the scientists in doing science (i.e. the 'how' aspect) or the scientific method. However, the incorporation of the 'awe' or 'wonder' factor, so crucial for the scientist's doing of science (i.e. the 'why' aspect), has been overlooked in science teaching and learning process. The present research study aims to integrate this factor through a pedagogy based on aesthetic approach to teaching of Science.
- There is an urgent need to tap the potential between science and the arts and aesthetics in teaching and learning of science ideas. The present research attempts to uncover this potential by providing concrete results that could be replicated and explored further.
- Developing science identity affiliation belief among the learners is essential for a science teacher. The various activities to do so normally consume a lot of time and energy of the teacher at the cost of teaching. The present study proffers the science teacher to do so as a consequence of the very act of teaching based on an aesthetic approach.
- The need of the study is further justified by the review of literature, which clearly shows a lack of research studies in India, on the effectiveness of aesthetic approach of teaching science at all levels of science education. Even in the various studies conducted abroad, there are few empirical researches on the subject.

Statement Of The Problem:

Development of a Pedagogical Strategy based on Aesthetic Approach to teach Science to Upper Primary Stage Students

Definition Of The Terms:

Pedagogical strategy based on aesthetic approach to Teach Science:

In this study, a pedagogical strategy based on aesthetic approach to teach Science refers to a pedagogy aimed to enable learners to develop an aesthetic understanding of science ideas through the following **three steps** in the present research study:

Step 1: Present an Initial Lens: (Emphasis on perception via a Lens and Creation of Wonderment)

Step 2: Play with the Lens: (Investigation of personalization of content and experience with content)

Step 3: Formalize the Lens: (Help students to use canonical generic (standard) scientific language (terminology) for example as used in science textbooks)

Aesthetic Understanding:

In this study, aesthetic understanding refers to an understanding about a rich network of conceptual knowledge, combined with a deep appreciation for the beauty and power of Science ideas that helps to transform one's experiences and perceptions of the world, enabling learners to see, think, and act differently in terms of:

A. "Changed Perception" – (seeing and thinking of both self and world – an experience that is unifying, whole, coherent, leading to deeper understanding with an added clarity in thought or comprehension)
B. "Increased Interest and Excitement"-- (renewing interest and excitement),
C. "Changed Action" – (an experience that is compelling and dramatic, and engaging the learners with the world).

Upper Primary Stage of Education:

In this study, the upper primary stage of education refers to the standards VI, VII and VIII in the ten years of schooling pattern prevalent in India.

Science Identity Affiliation Belief:

In this study, science identity affiliation belief refers to the belief of the learner to identify oneself as a science-type person.

Effectiveness:

The pedagogical strategy based on aesthetic approach to teach Science is said to be effective in developing aesthetic understanding and science identity affiliation belief in science, if the post-test scores on these variables are statistically significantly greater than the pre-test scores in the experimental group as compared to the control group.

Aim Of The Study:

1. To develop a pedagogical strategy based on aesthetic approach to teach science to students of upper primary stage (i.e. the treatment).
2. To study the effect of the pedagogical strategy based on aesthetic approach to teach Science (treatment) on students' gain in the scores on:

a. Aesthetic Understanding and b. Science Identity Affiliation Belief

Research Hypotheses:

1. There is a significant difference in the pre-test scores of students':
   a. aesthetic understanding, and
   b. science identity affiliation belief, of experiment and control groups.
2. There is a significant difference in the post-test scores of students':
   a. aesthetic understanding, and
   b. science identity affiliation belief, of experimental and control groups.
3. There is a significant difference in the i. pre-test and ii. post-test scores of students':
   a. aesthetic understanding, and
   b. science identity affiliation belief, of experimental and control groups.

Methodology Of The Study:

This study was conducted in three phases, viz.:

1. Identification Phase (pre-measures / pre-tests),
2. Instructional Phase (in three Cycles) and
3. Evaluation Phase (post-measures / post-tests).

The study employed a quasi-experimental research design as follows:

Experimental Group:	**O1 O2 X1 O3**	**O5 X2 O6**	**O8 X3 O9 O11**
Control Group:	**O1 O2 C1 O3**	**O5 C2 O6**	**O8 C3 O9 O11**

Where,

X1, X2, X3 = Pedagogical Strategy based on Aesthetic Approach to Teach Science, in Instructional cycles I, II and III, for three Units (Chapters), by the researcher, and

C1, C2, C3 = Cognitive-Rational Approach to Teaching of Science, in Instructional cycles I, II and III, for three Units, by the regular, school science teachers.

O1 = Pre-testing of Science Identity Affiliation Belief

O2, O5, O8 = Pre-testing Aesthetic Understanding of respective units of each instructional cycle,

O3, O6, O9 = Post-testing Aesthetic Understanding of respective units of each instructional cycle

O11 = Post-testing of Science Identity Affiliation Belief

Treatment:

For the purpose of the present research, the researcher has identified and determined the following flexible steps to implement the pedagogical strategy based on aesthetic approach to teach Science to upper primary stage students, in the Indian context:

Step 1: Present an Initial Lens:

(Emphasis on perception via a Lens and Creation of Wonderment)

Step 2: Play with the Lens:

(Investigation of personalization of content and experience with content)

Step 3: Formalize the Lens:

(Help students to use canonical generic (standard) scientific language (terminology) for example as used in science textbooks)

Activities:

The various activities that have been incorporated and interspersed in the three steps are Case study, Compilation/Collection, Demonstration, Discussion, Drawing, Field Trip, (in school

campus), Game, Imagination, Knowing the Scientist, Musings (Pithy Quoes), Poster making, Singing and Video Viewing.

The researcher selected the three units for the three instructional cycles in collaboration with the school teachers and after due consideration of the constraints.

Sample Size And Sampling Technique:

In the present study, the researcher used a three-stage sampling procedure for selecting the sample. At the first stage, simple random sampling technique was used to select schools from a list of the population of the schools. On the basis of their board-affiliation, only those schools with Maharashtra State board were selected. Even among these schools, only the English medium and co-educational schools were selected. Out of these schools, two schools were randomly chosen using the lottery method. At the second stage, the researcher assigned one of the schools as experimental group and the other as control group using lottery method and eliminated the selection-bias.

At the third stage, convenient sampling technique was used to select students from each school. The sampling frame was based on existing class structure. One intact class of seventh standard from the upper primary stage of each of these two schools was selected because of reasons beyond the researcher's control. Thus, the sample size included in the present study was 34 students (17 girls and 17 boys) of class VII in each group.

Data Collection Tools:

A. The researcher prepared the following tool for use in the present study:
   - Personal Data Sheet

B. The researcher adapted the following readymade tool with minor modifications:
   - Vignette Questionnaire for measuring Aesthetic Understanding – (Mark Girod and Cheryl Rau, 2000),

C. The researcher used the following readymade tool:
   - Science Identity Affiliation Belief Scale – (Mark Girod, Todd Twyman and Steve Wojcikiewicz, 2010)

Data Analysis:

In order to analyze the data statistically, the following null hypotheses have been formulated:

1. There is no significant difference in the pre-test scores of students':
   a. aesthetic understanding (AU), and
   b. science identity affiliation belief (SIAB), of experiment (EG) and control (CG) groups.
2. There is no significant difference in the post-test scores of students':
   a. aesthetic understanding (AU),
   b. science identity affiliation belief (SIAB), of experimental (EG) and control (CG) groups.
3. There is no significant difference in the i. pre-test and ii. post-test scores of students':
   1. aesthetic understanding (AU),
   2. science identity affiliation belief (SIAB), of experimental (EG) and control (CG) groups.

   All the above null hypotheses were tested using the t-test.

Table-1a & b: Relevant Statistics of pre-test scores of AU and SIAB of EG and CG											
Variable	**Groups**	**N**	**Mean**	**SD**	**Variance**	**Pooled Variance**	**df**	**t Stat**	**P(T<=t) two-tail**	**t Critical**	**l.o.s**
AU	**EG**	34	11.82	2.15	4.63	5.74	66	0.35	0.72	2.00	N.S.
	CG	34	11.62	2.62	6.85						
SIAB	**EG**	34	7.29	1.75	3.06	3.12	66	0.62	0.54	2.00	N.S.
	CG	34	7.03	1.78	3.18						

1 a) Comparison of pre-test scores on AU of EG and CG:

The obtained t ratio was found to be 0.35 which is less than t critical of 2.00 (for df = 66 and P < = 0.72), hence is not significant. Hence, the null hypothesis is accepted.

Conclusion: There is no significant difference in the pre-test scores of AU of EG and CG.

1 b) Comparison of pre-test scores on SIAB of EG and CG:

The obtained t ratio was found to be 0.62 which is less than t critical of 2.00 (for df = 66 and P < = 0.54), hence is not significant. Hence, the null hypothesis is accepted.

Conclusion: There is no significant difference in the pre-test scores of SIAB of EG and CG.

Thus, both EG and CG are do not differ in their pre-test mean scores of AU and SIAB.

Table-2a & b: Relevant Statistics of post-test scores of AU and SIAB of EG and CG											
Variable	**Groups**	**N**	**Mean**	**SD**	**Variance**	**Pooled Variance**	**df**	**t Stat**	**P(T<=t) two-tail**	**t Critical**	**l.o.s**
AU	**EG**	34	28.65	2.40	5.75	5.23	66	30.60	0.000	2.65	0.01 Sig
	CG	34	11.68	2.17	4.71						
SIAB	**EG**	34	14.35	1.54	2.36	2.76	66	12.62	0.000	2.65	0.01 Sig
	CG	34	9.26	1.78	3.17						

2 a. Comparison of post-test scores on AU of EG and CG:

The obtained t ratio is found to be 30.60 which is greater than t critical of 2.65 (for df = 66 and P < = 0.000), hence is significant at the 0.01 level. Hence, the null hypothesis is rejected.

Conclusion: There is a significant difference in the post-test scores of AU of EG and CG. The post-test scores of AU of the EG is significantly greater than that of CG.

2 b) Comparison of post-test scores on SIAB of EG and CG:

The obtained t ratio is found to be 12.62 which is greater than t critical of 2.65 (for df = 66 and P < = 0.000), hence is significant at the 0.01 level. Hence, the null hypothesis is rejected.

Conclusion: There is a significant difference in the post-test scores of SIAB of EG and CG. The post-test scores of SIAB of the EG is significantly greater than that of CG.

Thus, the post-test scores of EG for AU and SIAB are significantly higher than those of the CG respectively.

Table-3a & b: Relevant Statistics of pre-test and post-test scores of AU and SIAB of EG and CG									
Variable	**Groups**		**N**	**Mean**	**SD**	**t Stat**	**P(T<=t) two-tail**	**t Critical**	**l.o.s**
AU	**EG**	**Pre-test**	34	11.82	2.15	76.03	0.000	2.73	0.01 Sig
		Post-test	34	28.65	2.40				
	CG	**Pre-test**	34	11.62	2.62	0.44	0.66	2.03	0.05 N.S.
		Post-test	34	11.68	2.17				
SIAB	**EG**	**Pre-test**	34	7.29	1.75	39.47	0.000	2.73	0.01 Sig
		Post-test	34	14.35	1.54				
	CG	**Pre-test**	34	7.03	1.78	30.27	0.000	2.73	0.01 Sig
		Post-test	34	9.26	1.78				

3 a) Comparison of pre-test and post-test scores on AU:

The obtained t ratios of EG for pre-test and post-test scores of AU is greater than 2.73 and hence is significant at the 0.01 level.

The obtained t ratios of CG for pre-test and post-test scores of AU is less than the t critical of 2.03 (for df = 33 and P <= 0.66) and hence is not significant at the 0.05 level.

Hence, the null hypothesis is rejected for EG and is accepted for CG.

Conclusion: There is a significant difference in the pre-test and post-test scores of AU of EG. The post-test scores were found to be higher than the pre-test scores for EG. There is no significant difference in the pre-test and post-test scores of AU of CG.

3 b) Comparison of pre-test and post-test scores on SIAB:

The obtained t ratios of both EG as well as CG for pre-test and post-test scores of SIAB are greater than 2.73 and hence are significant at the 0.01 level. Hence, the null hypothesis is rejected for both EG and CG.

Conclusion: There is a significant difference in the pre-test and post-test scores of SIAB of both EG and CG. The post-test scores were found to be higher than the pre-test scores of both EG and CG.

Computation of the Magnitude of the Effect Size:

Table-4: Magnitude of the Effect Size		
Dependent Variables	**As per Wolf's Formula (d) and Cohen's d Formula**	
	Effect Size	**Magnitude of Effect Size**
Aesthetic Understanding	**7.82**	**Maximum Effect / Relatively large effect size**
Science Identity Affiliation Belief	**2.86**	**Maximum Effect / Relatively large effect size**

Discussion:

It can be seen that from Hypotheses Nos. 1 to 3 that:

1. The Mean AU and SIAB on the pre-test of the EG does not differ significantly from that of the CG respectively.
2. The Mean AU and SIAB on the post-test of the EG are significantly greater than that of the CG respectively.
3. The Mean SIAB on post-test of both EG and CG is significantly greater than that of the Mean SIAB on the pre-test of both EG and CG respectively. The Mean AU on the post-test of EG is significantly greater than that of the Mean AU on the pre-test of EG. However, the Mean AU on the post-test of CG does not differ significantly from that of the Mean AU on the pre-test of CG.

Conclusion:

The pedagogical strategy based on aesthetic approach to teach Science is said to be effective in developing aesthetic understanding and science identity affiliation belief, as the post-test scores on these variables are statistically significantly greater than the pre-test scores in the experimental group as compared to the control group.

Significance Of The Study:

In the current changing educational scenario, it is expected that the students not only learn the product of science, but also its process, i.e. the how the scientists do science and more importantly, why do the scientists do science. The present study is precisely focussed on the later; hitherto much ignored and overlooked aspect in the teaching of science, but nevertheless an aspect that has found resurgence in the last decade in the field of educational research.

The findings of the present study is likely to help the teachers of science, principals and administrators, policy framers as well as the scientific and academic community, to enhance the curriculum and its transaction through appropriate teaching and learning experiences, as the effectiveness of the pedagogy based on aesthetic approach to teaching of science is found to be positive.

The goal of aesthetic understanding is likely to improve the overall framing, implementing and evaluating of cognitive-rational approach-based science policies at the macro-level and lesson-planning and pedagogical strategies at the micro-level.

Further, the findings of this study is likely to be particularly helpful to the teachers of upper primary schools and the science teachers, as they would be able to use this pedagogy in their regular teaching of science. The ultimate benefit would be availed by the students, causing their educational development in science.

The findings of the present study is also likely to be helpful to the curriculum developers, teacher educators, and other experts, as it will be the effective resource material for a variety of techniques to be included in the curriculum, in the pre-service teacher training programme and also in the in-service as well as on-service training programmes for science teachers. This will also be useful in the curriculum development and framing the science textbook.

The present study will also help in demonstrating the constructivist view of learning theory, in which, the regularity found in the natural world is a viable participant in the co-construction of

knowledge. The study will also help in providing an instance of Deweyan epistemology on learning in the Indian context.

The findings of the present study also demonstrates, like the arts, the potential of powerful science ideas, in facilitating powerfully transformative, aesthetic experiences. The results in this case are both important and dramatic. The study also provides a clear and compelling connection of Dewey's naturalized aesthetics to the disciplines, in this case, science.

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