Communications on Applied Nonlinear Analysis
ISSN: 1074-133X
Vol 31 No. 2 (2024)

Physics Pedagogy Through Ancient Indian Wisdom- Inspiring Cultural Appreciation in Learners

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Article History:

Received: 15-10-2024

Revised: 19-11-2024

Accepted: 10-12-2024

Abstract:

The global education system is shifting towards a more inclusive and comprehensive approach that values indigenous knowledge systems. This movement addresses the need for culturally appropriate education to promote critical thinking, cultural sensitivity, and global readiness. In India, a vast repository of scientific tradition, the National Education Policy (NEP) 2020 recognises integrating the Indian Knowledge System (IKS) into the school curriculum as a pedagogical revolution rather than just a theoretical study. The present study aims to investigate the effectiveness of IKS on Cultural appreciation among secondary school students by incorporating elements of India's scientific contributions into physics teaching. An experimental method with a pre-test post-test non-equivalent group design was adopted for the study. Data were collected using two tools developed and validated by the investigator: the Cultural Appreciation Scale, employed as both pre-test and post-test to measure learners' levels of cultural appreciation, and Vedic Snapshots, a set of pedagogical activities designed to connect physics concepts with ancient Indian scientific ideas. The study's findings demonstrate that incorporating the Indian knowledge system into physics teaching is effective in fostering cultural appreciation among students. This study sheds light on the IKS-integrated pedagogical practices, contributing to a more holistic and culturally responsive education system.

Keywords: Indian Knowledge System, Ancient Indian Wisdom, Physics Education, Cultural Appreciation

INTRODUCTION

The Indian subcontinent is home to a diverse array of traditional knowledge systems that play a crucial role in its cultural, scientific, and social structure. The Indian Knowledge System (IKS) represents a vast and ancient collection of wisdom, intellectual heritage, and insights accumulated over thousands of years, encompassing fields such as medicine (Ayurveda), yoga, mathematics, astronomy, philosophy, and art. IKS perceives knowledge as connected with philosophy, science, and ethics, promoting a comprehensive understanding of the universe.

NEED AND SIGNIFICANCE OF THE STUDY

In the current discussions surrounding educational reforms, particularly within the context of the NEP 2020, there is a significant focus on incorporating IKS into modern education. The policy aims to create an educational framework grounded in Indian values, with the goal of

fostering a "strong sense of pride in being Indian" in thought, spirit, intellect, and actions. This emphasis stems from the observation that current educational content frequently leans towards modern Western cultural and intellectual traditions, often neglecting India's remarkable historical contributions, such as the development of the decimal system, the invention of zero, advancements in Science and Technology, and the groundbreaking theories of pioneers like Aryabhata.

The incorporation of Indigenous Knowledge Systems (IKS) into education is viewed as a transformative strategy to tackle modern challenges while safeguarding intellectual heritage. It fosters interdisciplinary learning, promotes global cooperation, and offers valuable insights into sustainable practices. The ancient traditions often prioritised sustainability and ecological harmony, offering important lessons for addressing current environmental issues. Specifically, the advantages related to the focus on cultural appreciation are significant. Integrating Indian Knowledge Traditions (IKT) is crucial for cultivating cultural awareness, fostering a positive self-identity, enhancing self-esteem, and promoting respect for diverse cultures. This is accomplished by helping children develop a deep understanding of their own cultural backgrounds, including history, arts, languages, and traditions.

REVIEW OF RELATED LITERATURE

Portia and Gupta (2023) examine how Indian Knowledge Systems (IKS) may be integrated with contemporary technology to promote holistic development, cultural awareness, community building, and moral progress, as well as inventive solutions across sectors. Qasim (2023) examines the Indian Knowledge System (IKS), which combines traditional Indian knowledge with contemporary education, promoting interdisciplinary learning and social accountability. Gupta (2023) examines ancient Indian methods that shape the scientific attitude in astronomy, mathematics, medicine, physics, and technology. Badoni, Prasad, and Chand (2023) underscore the connection between ancient Vedic literature and contemporary physics, emphasizing the significance of Vedic physics in comprehending natural phenomena and the continuity of knowledge within the IKS. Smitha (2014) advocates for the integration of Vedic mathematics into the school curriculum to alleviate students' mathematical anxiety, hence enhancing their prospects for future success. Smitha (2018) examined the use of Indian intellectual traditions, namely Vedic Mathematics, in improving the employability skills of educated jobless young.

OBJECTIVES OF THE STUDY

The primary objective of this experimental study was to evaluate the effect of IKS integrated teaching on the level of cultural appreciation of school students.

1. To determine the initial level of cultural appreciation among secondary school students prior to the experiment.
2. To assess the level of cultural appreciation among secondary school students after the implementation of the experiment.
3. To evaluate the effectiveness of the Indian Knowledge System (IKS) integrated teaching in enhancing the level of cultural appreciation of secondary school students.

4. To compare the effectiveness of the Indian Knowledge System integrated teaching method with that of the existing method in improving the level of cultural appreciation of secondary school students.

HYPOTHESES OF THE STUDY

1. There is no significant difference in the pre-test scores of the level of cultural appreciation between the experimental group and the control group.
2. There is no significant difference in the post-test scores of the level of cultural appreciation between the experimental group and the control group.
3. The Indian Knowledge System (IKS) integrated teaching method has no significant effect on the level of cultural appreciation of secondary school students.
4. There is no significant difference between the effectiveness of the Indian Knowledge System integrated teaching method and the existing method in enhancing the level of cultural appreciation of secondary school students.

METHODOLOGY

Research Method and Design

The experimental method was adopted for the current study to investigate the effectiveness of the Indian Knowledge Systems (IKS) integrated teaching method in enhancing student's level of cultural appreciation.

The design employed was a non-equivalent pre-test post-test control group design. The sample consisted of 80 secondary school students, divided into two groups: an Experimental Group (n = 40) and a Control Group (n = 40). Although the groups were selected randomly, intact classes were used, resulting in a non-equivalent design.

Sample

- Total number of participants: 80
- Experimental Group: 40 students
- Control Group: 40 students
- Sampling method: Random selection of intact classes from secondary schools

Intervention

The Experimental Group was taught using the IKS integrated teaching method, which incorporated ancient Indian contributions related to each physics concept, including atomic theory, Laws of Motion, Equations of Motion, the Law of Gravitation, and Electricity. Vedic snapshots, which explain the development and significance of each concept, were validated by subject matter experts before implementation. The Control Group was taught using the existing method of instruction on the same concepts.

Variables

Independent Variable

- **Method of Teaching**
  - IKS Integrated Teaching Method (Experimental)
  - Existing Method (Control)

Dependent Variable

- **Cultural Appreciation**

Tools Used for Data Collection

- **Cultural Appreciation Scale**
  - Developed and standardized by the investigator
  - Used as both pre-test and post-test
  - Measures the students' level of cultural appreciation
- **Vedic Snapshots** (prepared and validated by the investigator)

ANALYSIS OF DATA

Comparison of Pre-test scores on the level of cultural appreciation in Control group and Experimental group.

Table 1

Data and Result of independent t-test for comparing pre-test scores of Control group and Experimental group

Test	N	Control group		Experimental group		t
		Mean m1	SD1	Mean m2	SD2	
Pre test	40	91.4	5.93	91	6.53	0.520

**p>0.01

The table value of t with df=78 is 2.639 at the 0.01 level and 1.990 at the 0.05 level. The calculated t-value, 0.520, is not significant at the 0.01 level ($t = 0.520$; $p > 0.01$), indicating that there is no significant difference between the means of the pretest scores in the Control group and the Experimental group.

Comparison of Post-test scores on the level of cultural appreciation in Control group and Experimental group.

Table 2

Data and Result of independent t-test for comparing post-test scores of Control group and Experimental group

Test	N	Control group		Experimental group		t
		Mean m1	SD1	Mean m2	SD2	
Post test	40	92.4	5.60	146	5.76	42.7

**p<.001

The table value of t with df =78 is 2.639 at the 0.01 level and 1.990 at the 0.05 level. The calculated t-value, 42.7, is significant at the 0.01 level (t = 42.7; p < .001), which means that there is a significant difference between the means of the post-test scores in the Control group and the Experimental group.

Comparison of Pre-test and Post-Test scores on the level of cultural appreciation in Experimental group.

Table 2

Data and Result of paired t-test for comparing pre-test and post-test scores of Experimental group.

Group	N	Post-test		Pre-test		t
		Mean m1	SD1	Mean m2	SD2	
Experiment	40	146.7	5.76	91	6.53	32.5

**p<.001

The table value of t with df = 39 is 2.708 at the 0.01 level and 2.022 at the 0.05 level. The calculated t-value, 32.5, is significant at the 0.01 level (t = 32.5; p < .001). This indicates a significant difference between the means of the post-test and pre-test scores in the Experimental group.

Comparison of the Effect of IKS-Integrated Teaching and the Existing Method of Teaching on the level of cultural appreciation Using ANCOVA.

To compare the effect of the Indian Knowledge System integrated teaching method and the existing method of teaching on the level of cultural appreciation, the pre-test and post-test scores were subjected to the statistical technique of Analysis of Covariance, and the results obtained were presented as follows in Table 3.

Table 3

Summary of analysis of Co-variance of pre-test and post-test scores in the level of cultural appreciation among students in Experimental and Control groups

Group	N	Pre-test		Post-test	
		M	SD	M	SD
Experimental	40	91	6.53	146.7	5.76
Control	40	91.4	5.93	92.4	5.60
Source	Df	SS	MS	F	P
Pre-test	1	48.0	48.0	1.49	0.225
Instruction condition	1	58909.5	58909.5	1836.13	<.001
Error	77	2470.4	32.1		
Corrected Total	79	61427.9			

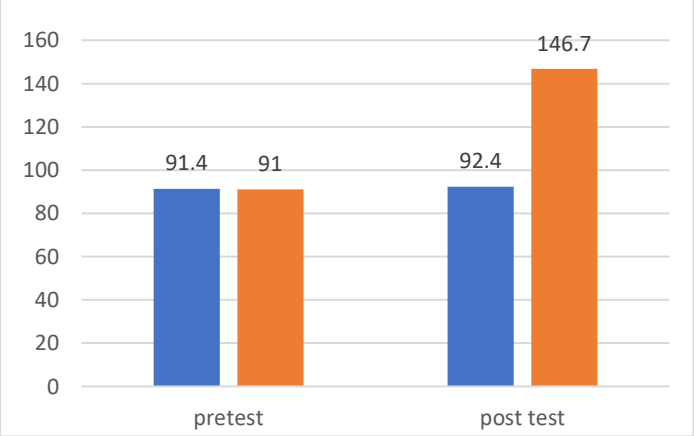
Note. *M = mean, SD = Standard deviation, df = degree of freedom, SS = sum of squares, MS = mean square, F = variance ratio.*

The ANCOVA result shows that the table value of F with df 1/77 is 7.01 at the 0.01 level and 3.98 at the 0.05 level. The obtained F value for the group variable is $F(1, 77) = 1836.13$; $p < 0.001$. The results clearly show that students taught using the Indian Knowledge System (IKS) integrated teaching method performed better than those taught through the existing method of teaching Physics.

The p-value for the covariate (pretest score) is 0.225, which is greater than 0.05, showing that there is no significant effect of pretest scores on post-test performance. This indicates that pre-existing differences in students' prior knowledge did not influence the results, and the effectiveness of the IKS integrated teaching method is not due to initial disparities between the groups. It can be interpreted that teaching using the IKS integrated teaching method is superior to the existing method for enhancing the level of cultural appreciation among secondary school students is also clear from Figure 1.

Figure 1

The bar diagram shows the pre-test and post-test means of the level of cultural appreciation among the students in the Experimental and Control groups



TENABILITY OF THE HYPOTHESIS

The first null hypothesis formulated is:

There is no significant difference in the pre-test scores of level of cultural appreciation between the experimental group and the control group

The above-stated hypothesis was tested for significance and the findings are given below:

The calculated t-value, 0.520, is not significant at the 0.01 level ($t = 0.520$; $p > 0.01$), indicating that there is no significant difference between the means of the pretest scores in the Control group and the Experimental group**.** Hence null hypothesis is accepted.

The second null hypothesis formulated is:

There is no significant difference in the post-test scores of the level of cultural appreciation between the experimental group and the control group.

The above-stated hypothesis was tested for significance and the findings are given below:

The calculated t-value, 42.7, is significant at the 0.01 level ($t = 42.7$; $p < .001$), which means that there is a significant difference between the means of the post-test scores in the Control group and the Experimental group**.** Hence, the null hypothesis is rejected, and the alternate hypothesis is accepted.

There is a significant difference in the post-test scores of the level of cultural appreciation between the experimental group and the control group.

The third null hypothesis formulated is:

The Indian Knowledge System (IKS) integrated method of teaching has no significant effect on the level of cultural appreciation of secondary school students.

The above-stated hypothesis was tested for significance and the findings are given below:

The calculated t-value, 32.5, is significant at the 0.01 level ($t = 32.5$; $p < .001$). This indicates a significant difference between the means of the post-test and pre-test scores in the Experimental group. Hence the null hypothesis is rejected and alternate hypothesis is accepted.

The Indian Knowledge System (IKS) integrated method of teaching has significant effect on the level of cultural appreciation of secondary school students.

The fourth null hypothesis formulated is:

There is no significant difference between the effectiveness of the Indian Knowledge System integrated method of teaching and the existing method in enhancing the level of cultural appreciation of secondary school students.

The obtained F value for the group variable is $F(1, 77) = 1836.13$; $p < 0.001$. The results clearly show that students taught using the Indian Knowledge System (IKS) integrated teaching method performed better than those taught through the existing method of teaching Physics. It can be interpreted that teaching using the IKS integrated teaching method is superior to the existing method for enhancing the level of cultural appreciation among secondary school students Hence null hypothesis is rejected. Hence the alternate hypothesis is accepted.

There is significant difference between the effectiveness of the Indian Knowledge System integrated method of teaching and the existing method in enhancing the level of cultural appreciation of secondary school students.

FINDINGS OF THE STUDY

The IKS integrated teaching method was found more effective than existing methods in enhancing the level of cultural appreciation among secondary school students.

EDUCATIONAL IMPLICATIONS

The research highlights the potential of integrating Indian Knowledge Systems (IKS) into physics education. By connecting scientific principles to cultural contexts, it can deepen students' understanding and appreciation of the subject, increasing engagement, cultural awareness, a sense of Indianness and motivation to learn. IKS can also promote interdisciplinary learning, linking physics with history and culture. Successful implementation requires teacher training and high-quality curriculum materials. The study suggests that further research is needed on the long-term impact of IKS integration on student learning outcomes and its effectiveness across diverse student populations and educational settings.

CONCLUSION

The integration of the Indian Knowledge System into the school curriculum, evidenced by this study, confirms a positive effect on students' cultural appreciation. This integration is crucial for societal progress, as it bridges the wisdom of the past with the challenges of the present. By integrating IKS, students are equipped not only with specialised skills but also with a foundation of cultural awareness, positive identity, and ethical values, ensuring they graduate with a profound sense of pride and rootedness in their heritage. This shift promotes an inclusive

and sustainable educational future, honouring ancient intellectual achievements and revitalising them for the benefit of future generations.

The incorporation of IKS is akin to giving students a cultural compass. While modern education provides the map (specialised skills) to navigate the world, IKS provides the magnetic north (cultural identity and ethical grounding), ensuring that no matter how complex the terrain gets, students always know where they come from and how to remain aligned with foundational human values.

REFERENCES

1. Mandavkar, P. (2023). Indian Knowledge System (IKS). *Available at SSRN 4589986*.
2. Khan, S., & Sharma, M. (2023). An Overview on Indian Knowledge System. *Integrated Journal for Research in Arts and Humanities*, *4*(4), 42-46.
3. Das, R. K. (2023). Indian Knowledge System and National Education Policy (NEP) 2020. *Integrated Journal for Research in Arts and Humanities*, *4*(4), 47–51. https://doi.org/10.55544/ijrah.4.4.8
4. Gupta, N. A. (2023). A study of the scientific approach inherited in the Indian knowledge system (IKS). *THE SCIENTIFIC TEMPER*, *15*(02), 2385–2389. https://doi.org/10.58414/scientifictemper.2024.15.2.55
5. Gupta, A. (2023). A study of the scientific approach inherited in the Indian knowledge system (IKS). *The Scientific Temper*, *15*(02), 2385-2389.
6. Portia, N. M., & Gupta, N. D. (2024). Reconciling Traditional Indian Knowledge with Technological Advancements. *Deleted Journal*, *2*(09), 2816–2821. https://doi.org/10.47392/irjaem.2024.0411
7. Sudhakar, K. (2023). India's knowledge system-A needed approach in NEP2020 to regain the deep roots of our nation-India. *GRT Journal of Education, Science and Technology*, *2*(1), 8-14.
8. Qasim, S. H. (2023). Indian Knowledge System: Reconfiguring education in present scenario. *International Journal for Multidisciplinary Research*, *6*(1). https://doi.org/10.36948/ijfmr.2024.v06i01.13644
9. Badoni, B., Prasad, Y., & Chand, K. (2023). A review of NEP Physics in context of Vedic Text under Indian Knowledge System (I.K.S). *RESEARCH REVIEW International Journal of Multidisciplinary*, *9*(9), 11–18. https://doi.org/10.31305/rrijm.2024.v09.n09.002
10. NEP. (2020). National Education Policy 2020 (Issue 31). https://doi.org/10.1201/9781003254942-12
11. Singh, M. N. I., & Meitei, M. A. P. INTEGRATING INDIAN KNOWLEDGE SYSTEMS WITH MODERN SCIENTIFIC AND TECHNOLOGICAL EDUCATION IN HIGHER EDUCATION. Transforming Higher Education Through Indian Knowledge Systems, 44.
12. Smitha S (2018) 'Enhancing Employability Skills of Educated Unemployed Through Vedic Mathematics', International Journal of Current Advanced Research, 07(5), pp. 12867-12870. DOI: http://dx.doi.org/10.24327/ijcar.2018.12870.2278Timane, D. R., &

Wandhe, D. P. (2024). Indian Knowledge System. SSRN Electronic Journal. https://doi.org/10.2139/SSRN.4742285

13. Enriching School Mathematics Smitha S (2014) 'Education with Ancient Indian Treasure of Vedic Algorithms - Application of Vedic 'Anurupyena' Method', INTERNATIONAL JOURNAL OF INFORMATIVE & FUTURISTIC RESEARCH, 01(9), pp. 218-224. DOI: IJIFR/V1/E9/032
14. Amani, S. (2023). Integrating Indian Knowledge System: Revitalizing India's educational landscape. *International Journal for Multidisciplinary Research*, *6*(3). https://doi.org/10.36948/ijfmr.2024.v06i03.23666
15. Ghonge, M. M., Bag, R., & Singh, A. (2020). Indian education: Ancient, medieval and modern. In *Education at the Intersection of Globalization and Technology*. IntechOpen.
16. Raina, D. (1999). *Images and Contexts: The Historiography of Science and Modernity in India.* Oxford University Press.
17. Kumar, V. K., & S., S. (2023). Investigating the effect of Indian Knowledge Systems on Physics Learning Attitudes- An Experimental Study among Secondary School Students. In Mahatma Gandhi University, *School of Pedagogical Sciences*.