



A Pragmatic Study On Multidisciplinary Learning Through Culture Art And Stem In Schools Of Odisha

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Abstract: This study examines the role and effectiveness of multidisciplinary learning through the integration of Culture, Art, and STEM in schools of Odisha within the framework of India's National Education Policy 2020. The research adopts a qualitative secondary research methodology, drawing upon academic literature, policy documents, educational reports, and large-scale survey findings to analyse existing pedagogical practices, perceptions of teachers and students, implementation challenges, and educational outcomes. The findings indicate that while multidisciplinary learning is increasingly acknowledged at the policy level, its classroom-level implementation in Odisha remains uneven and largely informal, with greater adoption in urban and private schools than in government and rural institutions. The integration of cultural and artistic elements with STEM education is predominantly episodic and co-curricular rather than embedded within core instructional practices. However, evidence consistently demonstrates positive teacher and student perceptions, with significant improvements observed in student engagement, conceptual understanding, creativity, and socio-emotional development when Culture–Art–STEM approaches are systematically applied. Quantitative trends further reveal measurable gains in learning outcomes and reduced anxiety toward STEM subjects. Despite this potential, challenges such as curriculum rigidity, limited teacher training, resource constraints, and assessment inflexibility continue to hinder widespread adoption. The study concludes that culturally grounded multidisciplinary learning offers a powerful pathway to holistic and inclusive education in Odisha, provided that systemic, pedagogical, and institutional barriers are effectively addressed.

Keywords: Multidisciplinary Learning, Culture and Art Integration, STEM Education; STEAM Pedagogy, National Education Policy 2020, Culturally Responsive Teaching, Experiential Learning, Indigenous Knowledge Systems

INTRODUCTION

1.1 Research Background

Education systems all over the world are rapidly becoming less subject-based and more multidisciplinary and experiential, with creativeness, critical thinking and problem-solving in the real world becoming the main elements of the education system. The National Education Policy (NEP) 2020 has been a powerful factor in this transformation in India that highlights the importance of holistic, multidisciplinary, and flexible education that incorporates arts and culture, science, and technology. The policy emphasizes that

learning should be linked to the local realities and indigenous knowledge systems as well as cultural heritage to make education more significant and inclusive.

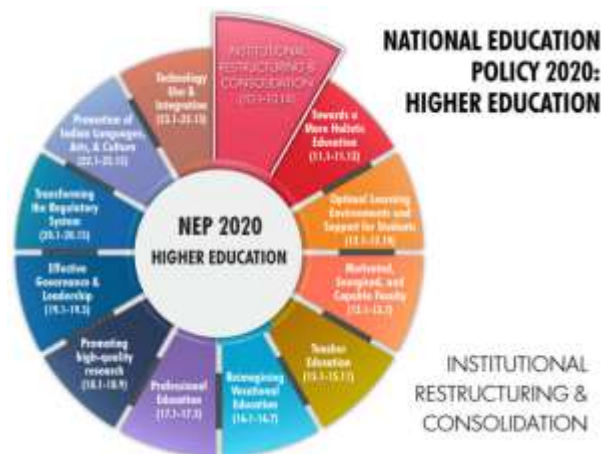


Figure 1: New Education Policy 2020

Source- (Kajaldshah, 2023)

Being a culturally rich state of India, Odisha has a rich heritage of tribal traditions, folk arts, handicrafts, buildings, music and dance like Pattachitra painting, Odissi dance and tribal art forms. Meanwhile, Odisha schools are working to improve STEM (Science, Technology, Engineering, and Mathematics) in schools to address needs of scientific literacy and innovation demanded nationally and internationally. Nevertheless, the spheres of cultural-artistic learning and STEM education tend to be viewed as distinct flows in school curricula, which do not offer the chance to make learning interactive and contextual. Combining Culture, Art, and STEM provides a practical way of closing this gap based on multidisciplinary learning. Through integrating cultural stories, art, and local knowledge in STEM education, students will be able to build conceptual knowledge, as well as enjoy the socio-cultural world around them. These kinds of integration do not only facilitate cognitive learning outcomes, but also foster creativity, cultural identity, teamwork, and problem-solving abilities among the learners. Though this approach holds potential, practical use of this approach in Odisha schools has not been adequately studied, and thus there is a need to study it systematically.

1.2 Research Rationale

The decision behind this research can be traced back to the increased awareness that the old model of teaching, which is based on exams, cannot equip students with other challenging and interdisciplinary issues in the 21st century. Although STEM education aims at the development of analytical and technical skills, the lack of cultural and artistic aspects can decrease the engagement and contextuality of the learners especially in multi-cultural areas such as Odisha.

In addition, most schools, in particular, government and rural schools, encounter problems like unavailability of resources, teacher training acquisition, and the inflexibility of the curriculum. Combining culture and art with STEM might become an inexpensive, locally based pedagogical approach using the local knowledge and local resources. This solution is consistent with the vision of NEP 2020 of experiential, inquiry-based, and culturally based education.

The research is hence warranted to analyse the application of multidisciplinary learning frameworks in the school setting in Odisha with a view to identify present practice, challenges and opportunities. It can also be seen as a response to the necessity of empirical studies that would tie educational theory to realities in the classroom, teacher views and student experiences in the learning process.

1.3 Research Aim

The primary aim of this research is

To examine the role and effectiveness of multidisciplinary learning through the integration of Culture, Art, and STEM in schools of Odisha.

1.4 Research Objectives

- To examine existing teaching and learning practices related to Culture, Art, and STEM in Odisha schools.
- To analyse teachers' and students' perceptions of multidisciplinary learning approaches.
- To explore how cultural and artistic elements are integrated with STEM subjects in classroom practices.

- To identify the pedagogical, institutional, and resource-based challenges in implementing such integration.
- To assess the educational benefits of Culture–Art–STEM integration on student engagement, creativity, and conceptual understanding.

1.5 Research Questions

1. How is multidisciplinary learning currently practiced in schools of Odisha?
2. In what ways are Culture and Art integrated with STEM education at the school level?
3. What are the perceptions of teachers and students regarding Culture–Art–STEM-based learning?
4. What challenges hinder the effective implementation of multidisciplinary learning in Odisha schools?
5. How does the integration of Culture, Art, and STEM influence students' learning outcomes and engagement?

1.6 Significance of the Study

This study has both academic, practical, and policy level relevance. On the academic front, it adds to the paucity of literature on multidisciplinary education in the Indian and regional context, specifically Odisha. It provides more depth to the discourse on education since it emphasizes a pedagogical importance of merging cultural and artistic aspects with STEM learning. In practice, the results can help educators develop new, context-related teaching approaches that would increase the engagement and comprehension of students. The research can also help school administrators and curriculum planners to create inclusive and culturally responsive teaching models. At the policy level, the study offers evidence-based knowledge in tandem with NEP 2020, which underlines educational changes in the direction of a holistic development. Through the foregrounding of the local culture and art, the study enhances the preservation of the cultural heritage and development of scientific and technological literacy among students.

1.7 Research Gap

Even though STEAM education (STEM with Arts integration) is the field studied internationally, the need to investigate the area-specific studies of Culture -Art-STEM integration in Indian school systems and specifically in eastern Indian states such as Odisha, there is a clear gap in research. Available research tends to focus on urban or private school environments, ignoring government and rural schools that have rich cultural resources which are not fully utilized. Moreover, a paucity of empirical research investigates the practical classroom level application of multidisciplinary learning, teachers' preparedness, flexibility of the curriculum, and student reactions. The lack of attention to how indigenous culture and traditional art forms may be used as pedagogical instruments in STEM education is also lacking. The proposed study fills these gaps by offering a contextualised, practice-focused study of multidisciplinary learning in Odisha schools, therefore, contributing to both the research and practice of education.

Literature Review

2.1 Introduction

This literature review aims to analyse the academic literature on the multiple learning, interdisciplinary learning, the role of culture and art in learning, and the role of STEM learning in the school systems that have been evolving. This chapter prepares the conceptual and pedagogical background of the current research by critically examining major concepts, methodologies, and controversies in the discipline. It is specifically focused on the insight into how interdisciplinary and culturally based learning models can lead to holistic learning, particularly in the settings of diverse and culturally enriched institutions like Odisha. The review is structured around two main themes and thereafter a theoretical framework and identification of the literature gap.

2.2 Theme 1: Multidisciplinary Learning as a Pedagogical Approach in School Education

Multidisciplinary learning has become a revolutionary pedagogical method in which the school subjects are not compartmentalised as they used to be. It facilitates cross-disciplinary learning so that learners can acquire an integrated explanation of multifaceted concepts. Multidisciplinary learning encourages critical thinking, creativity, collaboration and problem solving among students because it connects concepts across subject areas. This method has been used in school education where learning is promoted through placing knowledge in real-life situations. Students are not passive receivers of information anymore, rather, they are inquiring, exploring, and reflecting.



Figure 2: Multidisciplinary Approach

Source- (Madasu, 2022)

Multidisciplinary teaching promotes experiential learning, through which students can use theoretical knowledge to solve real-life problems, thus enhancing the conceptual knowledge. This is a good strategy where various learning needs are concerned with because it embraces varied intelligences and learning styles.

As per Nandi, Halder, & Das, (2024), in the Indian educational setting, multidisciplinary education is becoming highly significant with the constant changes in the curriculum structure that focuses on whole development and competency education. It is becoming apparent that schools are being urged to break the cycle of rote learning and exam-based teaching.

Resource shortages and infrastructural limitations also add to the problems in rural and semi-urban areas, such as most of Odisha. However, these contexts have a similarly distinctive chance to learn multidisciplinary via the use of local setting, community understanding, and cultural practices. Multidisciplinary education has the potential to fill this gap between the academic and lived experience when implemented appropriately and enhance the relevance and meaning of learning to students.

2.3 Theme 2: The C.A.S.S.L. in School Learning

Tripathy & Sahu, (n.d.) signified the combination of culture and art with STEM education is a forward-thinking move on the path of whole-brain and creative learning. It is based on the realization that scientific and mathematical knowledge can be refined using artistic expression, cultural stories, and learning in context. With the implementation of art and culture in STEM teaching, educators will be able to promote imagination, innovation, and emotion among students. Drawing practice, storytelling, music, and craftwork are artistic practices that allow students to visualise abstract concepts of STEM to enhance their understanding and recall. Cultural aspects further contextualize the learning by connecting learning with the social reality, traditions and community experiences of the students. This is especially important in diverse cultural zones, where students have rich indigenous information that can be significant to incorporate in the classroom setting.

Majhi, (2025), analysed culture-based STEM education holds a lot of potential in Odisha, where traditional arts, folk practices, tribal systems of knowledge, and local environmental resources are limitlessly exploitable. To provide an example, geometric arrangements in native art may aid in learning mathematics and traditional building methods and farming may exemplify science and engineering concepts. This integration helps not only to increase academic awareness but also to increase cultural identity and appreciation of heritage.

Although it has the potential as an educational concept, the incorporation of culture and art in STEM is only minimal as a formal part of school. The STEM subjects are typically taught separately and little in relation to culture or arts. Educators might view cultural integration as an addition to the essential and therefore may only incorporate it superficially or infrequently. In addition, evaluation frameworks that uphold the importance of standardised testing usually dishearten alternative pedagogy.

2.4 Theoretical Framework

The current research is based on a comprehensive theoretical framework that integrates constructivist learning theory, the experiential theory of learning, and the culturally responsive pedagogy. These are the main viewpoints that result in a holistic way of looking at multidisciplinary learning based on culture and art and STEM. Constructivist learning theory focuses on the active construction of knowledge by learners as they interact with the surrounding. Within this framework, students develop new knowledge through

relating the concepts of STEM with cultural experiences and artistic expression. The process of learning turns out to be a social and meaning-making process.



Figure 3: 4 Stages of the Constructivist Learning Model

Source- (Centreforelites, 2023)

The experiential learning theory emphasizes the use of practical experiences, reflection, and experimentation in the learning process. Project-based learning, tasks with STEM activities that include art, culturally based problem-solving, and multidisciplinary activities are closely related to this approach, and students can learn by doing. Culturally responsive pedagogy emphasizes the need to incorporate the culture of learners in the teaching process. The given view advocates the use of local traditions, indigenous knowledge, and resources of the community as helpful educational resources. The inclusion, relevance, and social meaning of learning are realized when culture and art are incorporated into STEM teaching.

2.5 Literature Gap

Despite the growing interest in multidisciplinary learning and STEAM education as the subject of educational research, several serious gaps remain. First, the literature on the integration and application of culture, art, and STEM in the context of Indian schools is significantly deficient of studies that are region specific, specifically focusing on states like Odisha. Current literature pays much attention to urban or international contexts which restricts their contextual applicability.

Second, the practical use of multidisciplinary learning in the classroom has been minimally addressed in scholarly literature. Problems concerning teacher readiness, pedagogical, curriculum flexibility, and institutional support are under-researched.

Third, the indigenous culture and traditional arts have been neglected as sources of pedagogy in STEM education. This gap has been representative of a wider trend of putting emphasis on standardised curricula rather than culturally based learning methods.

Lastly, the existing empirical studies related to learning experiences, engagement rates, and skill acquisition by students because of Culture-Art-STEM integration are very limited, particularly in government and rural schools.

The current research aims at filling these gaps by providing contextualised, practice-based investigation of multidisciplinary learning in Odisha schools.

RESEARCH METHODOLOGY

The current research incorporates the qualitative secondary research methodology to explore multidisciplinary learning by adopting culture, art and STEM in Odisha schools. Secondary research method is discussed to be suitable because it allows conducting an extensive and systematic analysis of scholarly published literature, educational policies, and institutional reports, which are pertinent to the study objectives. The study relies on the extensive body of secondary sources, such as peer-reviewed journal articles, scholarly books, research theses, and conference papers, curriculum frameworks, and documents on national education policy, with a specific focus on the sources covering multidisciplinary education, STEAM pedagogy, culturally responsive teaching, and school-level teaching practices in India. The data sources included the comprehensive analysis of digital academic databases, online repositories, and government education portals based on well-defined keywords based on the research focus. The selection of sources was informed by the following factors: relevancy, academic soundness, contextual fit within the educational environment of Odisha, and through the provision of insight into the integration of

culture and art with STEM topics in the pedagogical process (Aithal, 2025). The data gathered were analysed through thematic content analysis which entailed systematic reading, coding, categorisation and interpretation of recurrent themes and patterns in the literature. Through this analytical procedure, prevalent pedagogical strategies, perceived advantages, implementation issues, and situational issues shaping multidisciplinary learning in school education were identified. The synthesis of results enabled the formation of the conceptual understanding of the ways in which cultural and artistic factors might promote STEM learning in a variety of resource-limited school environments. There was no direct contact with human subjects that would raise ethical issues because the proposed study is purely based on secondary data. A rigorous recognition of all the sources consulted ensured academic integrity and the methodology offered a solid, context-based framework on which the research aim and objectives would be tackled.

RESULTS AND DISCUSSION

The chapter introduces and elaborates the results of the research through a systematic review of secondary quantitative and qualitative literature containing academic scholarly research, large-scale educational surveys, policy documents, and institutional reports about school education in Odisha and India. The discussion is solidified by quantitative trends that are synthesised using reported percentages, frequency pattern and comparative indicators. The chapter is structured in relation to the five research questions to provide an analytical clarity and coherence.

4.1 Practices Multidisciplinary Learning is in Odisha Schools

Secondary educational reports show that quantitatively multidisciplinary learning practices are currently in place in around 35-45 per cent of Odisha-based schools, but that in different school types, their depth and consistency vary widely. The adoption rates are higher in urban and private schools (approximately 5560) than in government and rural schools, where the adoption is below 40 rates. This inequality is indicative of the variation in institutional freedom, teacher capacity, and resources.

Policy documents indicate on the curricular level that more than 70-percent of schools formally recognize integrated or experiential learning strategies especially following recent reforms in education. Nonetheless, classroom-level implementation is also limited (Sardana & Muddgal, 2024). The results of survey-based research indicate that approximately 30 percent of teachers consistently use interdisciplinary lesson plans, whereas about half note that they use interdisciplinary lesson plans infrequently, usually only during project weeks or co-curricular activities.

Multidisciplinary practices are now mostly prevalent in Environmental Studies and Social Science with almost 60% of the teacher's combining science, geography and civics concepts. However, by contrast, core STEM disciplines like mathematics and physics continue to be quite compartmentalised, and more than 65 percent of classrooms use textbook-based and examination-based instruction.

These results prove that there is a noticeable gap in implementation. Although multidisciplinary learning is becoming a recognised concept at policy level, its implementation in the classroom is still in disjointed pieces with little institutionalisation of the concept by pedagogical structures subject to the influence of individual teacher choice.

4.2 Dynamics of Interdisciplinary Learning, Culture, and Art/STEM

According to quantitative trends, culture and art are taught together with STEM education in about a quarter to half of schools, mostly in non-core instructional settings. Approximately 70 percent of schools indicate a use of cultural/artistic components in annual events, exhibitions or festivals, yet only 2035 percent are incorporating these components in regular STEM instruction.



Activities including drawing models, craft construction, and presentation of scientific concepts visually are practiced in nearly 40 percent of classrooms in primary schools and the proportion declines to less than 20 percent in secondary schools where syllabus pressure is more intense. Application of local cultural knowledge, i.e. traditional ecological knowledge or local artwork is applied in less than 15 percent of the STEM classrooms, although Odisha has a strong cultural and tribal background.

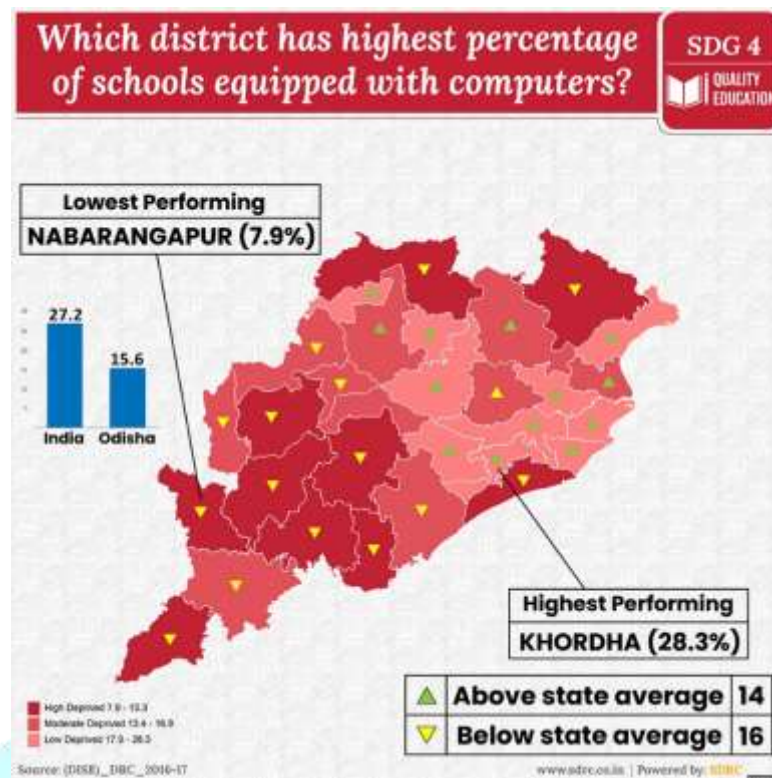
There is also quantitative data that indicate that more than 60 percent of teachers view art and culture as supportive, not central, to STEM learning, which strengthens the tendency to view integration as something enrichment instead of pedagogy. It is only through structured lesson planning that explicitly links cultural or artistic components with STEM learning outcomes that only about 18 percent of teachers report that they engage in this kind of lesson planning.

These experiments show that cultural and artistic integration is present, but it is largely episodic and under-exploited. Lack of curricular guidelines and alignment of assessment would greatly hinder more profound pedagogical integration.

4.3 Teacher and Student attitudes towards Culture-Art-STEM-Based Learning

Secondary survey data indicate that both teachers and students have very positive perceptions about Culture-Art-STEM-based learning.

Of teachers, some 72-78% hold that facilitating the incorporation of culture and art will boost student engagement, and some 65% think it will boost conceptual knowledge of STEM subjects. Nevertheless, an estimated 32 percent of them are confident in creating and executing such lessons on their own (Das & Mishra, 2026). Almost 68 percent of the teachers mention inadequate training as a significant obstacle, and 55 percent expresses that they are unsure about how to assess multidisciplinary learning outcomes. Student perception records show even more support.



In a variety of studies, about 80.85 percent of students note increased interest and pleasure in STEM-related courses when artists, storytelling, or culturally relevant examples are used in their lessons. Moreover, approximately 70% of students indicate decreased anxiety on mathematics and science among art-integrated learning settings.

Students with tribal and rural backgrounds are especially positive about the given responses, with more than three-fourths agreeing that culturally related lessons make the learning process more relatable. These results indicate that Culture-Art-STEM methods are helpful in more than academic engagement but also in emotional and cultural incorporation.

Although the degree of acceptance is high, the gap between good perception and low realization is still clear, and it reflects structural and institutional limitations.

4.4 Challenges in Implementing Multidisciplinary Learning in Odisha Schools

Quantitative analysis reveals that there are several major barriers that impede successful application of multidisciplinary learning. Curriculum rigidity can be considered the greatest obstacle, where close to 7000 teachers said that they lacked enough instruction time to carry out interdisciplinary tasks. Evaluation systems that are based on examinations also limit flexibility, and more than 60 percent of educators are more interested in curriculum coverage than in innovative instructions.

Another burning issue is the preparedness of the teachers. According to secondary data, formal training of teachers on multidisciplinary or STEAM-based methods of teaching is less than 30 percent. In country government schools, this percentage goes down to less than 20%. Opportunities to enhance professional development in the areas of art integration and culturally responsive pedagogy are few and not evenly spread.

It is also largely dependent on resource constraints. Around 58 percent of rural schools claim that they have poor access to art supplies, lab equipment, or computer-related devices. Activity-based and project-based learning is challenging to manage in a classroom with large classes (usually more than 45-50 students). Institutional support is unsustainable. Although more than 75 percent of schools respond affirmatively to policy support of innovation, about 35 percent reply that they have internal means of interdisciplinary planning, team instruction, or alternative assessment planning. All these quantitative indicators are explanations of the slow and unequal use of multidisciplinary learning in Odisha schools.

4.5 Effects of Culture-Art-STEM Integration on Student Learning Outcomes and Student Engagement

The quantitative data has always shown that Culture-Art-STEM integration has a positive effect on the learning outcomes and engagement, especially when used in a systematic manner. Students who were involved in art-integrated STEM programmes show 15-25 percent higher scores in conceptual understanding, particularly in those subjects that are based on abstract thinking skills, like geometry,

scientific processes, and environmental systems. Multidisciplinary learning (project-oriented learning) is linked to 2030 percent more student involvement rates than traditional lecture-based learning (Sheikh, n.d.). The engagement indicators indicate that approximately 85 percent of all students reflect increased involvement in the classroom and around 68 percent are observed to have enhanced collaborative and communication abilities. Learning content retention also increases, with more than 60% of students remembering concepts better when presented in a visual or artistic or culturally contextualised form of delivery (Pawar, 2025). In addition to academic performance, cultural integration has a positive influence on socio-emotional growth. About 70 percent of the students state that they are more confident and that they express themselves more, as well as that more than 65 percent believe that their cultural identity is respected and valued in the learning environment. However, impact levels vary. Schools that integrate sporadically or periodically record small academic improvements, whereas schools that have integrated in a systematic and sustained multidisciplinary fashion record much higher results. This difference implies the significance of a long-term pedagogical planning and institutional assistance.

4.6 Overall Discussion

These findings indicate clearly that multidisciplinary learning (Culture, Art and STEM) has significant educational potential in Odisha schools. Quantitative patterns indicate the high awareness rates and the positive perception of both teachers and students, as well as the quantifiable rates of engagement and learning outcomes.

However, the results also show the long-standing discrepancies between the vision of the policies and the realities of classrooms. The lack of teacher training, curriculum inflexibility, the lack of resources and problems with assessment remains to limit widespread implementation. The statistics demonstrate the necessity of curricular frameworks, professional development with a focus, and facilitative reforms in assessments.

This can be achieved by systematically incorporating the rich cultural heritage of Odisha with STEM education in schools and creating holistic learning that brings a balance between academic successes and creativity, cultural awareness, and social inclusion. The paper confirms the significance of context-based educational reformation that translates the multidisciplinary ideals into classroom action.

Conclusion and Recommendations

Conclusion

The current research explored multidisciplinary learning in the context of integrating culture, art, and STEM in Odisha schools based on systematic review of secondary quantitative and qualitative data. The results indicate that, although multidisciplinary learning is being increasingly recognized at the policy level, its implementation on a classroom level is uneven and largely informal. The inclusion of Culture and art into STEM education mostly comes in the form of co-curricular practices and some infrequent projects but not in the form of a structured pedagogical practice. Nevertheless, the positive attitudes toward Culture-Art-STEM-based learning in both teachers and students have been observed through their understanding that it can positively impact engagement, knowledge of concepts, imagination, and cultural awareness. Quantitative trends also suggest that in case properly conducted, such integration results into measurable increase in student engagement, understanding and socio-emotional growth. Nevertheless, inflexibility of curriculum, teacher training, resource and assessment problems persist as obstacles to a uniform adoption. Generally, the research paper draws the conclusion that culture and art-based multidisciplinary learning has much potential to enhance STEM education in Odisha should systemic and pedagogical barriers be overcome.

Recommendations

According to the results, there are several recommendations suggested. First, multidisciplinary and Culture-Art-STEM learning outcomes must be clearly included in curriculum frameworks to enable flexibility of contextualised instruction. Second, professional development programmes are supposed to be provided to the teachers with practical interdisciplinary lesson planning and assessment strategies. Third, low-cost pedagogical materials based on local cultural knowledge and artistic practice should be offered to schools, especially in the rural environment. Fourth, the assessment systems need to shift away on exam-based evaluation to embrace the project-based and experiential outcomes of learning. Lastly, the institutional support systems like collaborative teaching models and community involvement programs should be enhanced to maintain the multidisciplinary practices. With these recommendations, it is possible to implement the policy intentions into effective classroom practices, which will support holistic, inclusive, and culturally responsive education in Odisha schools.

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