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Investigating Effectiveness of STEM and STEAM Programmes in Developing Critical Thinking and Problem-Solving in Ilesa East Local Government Area of Osun State, Nigeria

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Abstract

This study examined the effectiveness of STEM and STEAM educational programs in enhancing critical thinking, problem-solving, and creativity among senior secondary school students in Ilesa East Local Government Area of Osun State, Nigeria. A descriptive survey design was adopted. Data were collected using a validated questionnaire, administered to 250 respondents (200 students and 50 teachers) from 10 secondary schools. Data were analyzed using frequency counts, percentages, mean, standard deviation, and t-tests. Findings indicated that both teachers and students view STEAM positively. Most students agreed that integrating arts with STEM aligns with modern job market demands, while teachers reported that project-based learning in STEAM increases motivation and real-world application of knowledge. The study concludes that integrating arts into STEM supports the development of students' creative and critical capacities and recommends stronger curriculum integration, teacher collaboration, funding, and policy support.

Keywords: Arts Integration; creativity; critical thinking; educational engagement; problem-solving; project-based learning; secondary education; STEM; STEAM

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1. Introduction

Education has long been recognized as a critical factor in the intellectual, social, and economic development of individuals and societies. As global challenges become more complex, the need for educational frameworks that foster critical thinking, problem-solving, and innovation has grown. Two significant pedagogical models have emerged to address these concerns: STEM (Science, Technology, Engineering, and Mathematics) and its transformation into STEAM (Science, Technology, Engineering, Arts, and Mathematics). These frameworks are now central to many educational systems worldwide due to their focus on equipping students with the skills necessary for success in the 21st century.

In recent years, the global education landscape has increasingly emphasized the importance of equipping students with 21st-century skills such as critical thinking, problem-solving, creativity, and innovation. Science, Technology, Engineering, and Mathematics (STEM) programmes were introduced as a response to the demand for technical skills essential for a rapidly advancing global economy. Later, STEM evolved into STEAM, incorporating the Arts to enhance creativity and holistic development. Both approaches aim to provide interdisciplinary, hands-on, and real-world learning experiences that prepare students for complex problem-solving and decision-making. Secondary school students, who are at a formative stage of intellectual and personal development, represent an ideal demographic for integrating these programmes. While STEM focuses on analytical and technical skills, STEAM includes creative thinking to complement problem-solving abilities, encouraging well-rounded development. These approaches promise to make education more engaging and relevant to real-world challenges, but questions remain about their effectiveness in fostering critical thinking and problem-solving skills, particularly in developing regions or diverse educational contexts. Different Experimental design had demonstrated effectiveness of both STEM and STEAM. Research using quasi-experimental designs has shown that STEM-based instructional methods can improve students' critical thinking skills. For instance, studies (Ran, 2025; Šeboková et al., 2026; Wicaksono, 2021), applying the Watson-Glaser Critical Thinking Appraisal in controlled experiments found that students taught using STEM approach performed better in post-tests compared to traditional teaching methods. These improvements were attributed to hands-on, inquiry-based learning that challenges students to evaluate evidence and make reasoned decisions.

The integration of arts in STEM to form STEAM has been found to enhance creativity, critical thinking, and interdisciplinary problem-solving. Conradty and Bogner (2019) opined that the addition of arts fosters innovative solutions, which are essential in addressing real-world challenges. For example, STEAM-based projects, like designing mechanical clocks, help students develop flexibility and originality in their problem-solving approaches. Studies have shown the effectiveness of PBL strategy in STEM and STEAM programmes. These methods engage students in solving real-life problems, such as environmental challenges, by applying scientific knowledge. Tran et al. (2021) demonstrated significant improvements in problem-solving abilities when students worked on structured STEAM projects.

Research on STEM education in secondary schools in Kerala, India, found that students engaged in STEM programmess showed measurable gains in their ability to analyze and solve problems compared to those in traditional science classes. This was particularly evident in tasks requiring deduction and interpretation. Capraro and Slough (2019) discussed how project-based STEM approaches enhance critical thinking through real-world application of theoretical concepts.

Conradty and Bogner (2019) highlighted the role of STEAM in fostering creativity and interdisciplinary problem-solving. Ngo and Phan (2019) analysed the benefits of PBL strategies within STEAM frameworks, finding improvements in both engagement and cognitive skills. Obidike (2018) opined that African youth and women should be equipped with skills in science, technology, engineering, arts, and mathematics to prepare them for future careers through

workshops, mentorship, and training programs. She helped communities use technology to solve local problems and bridged education and workforce gaps. She also advocated for more women in STEM fields and worked with global organizations to expand access to STEM education. Udeani (2018) has actively contributed to STEM and STEAM education, focusing on teacher training and curriculum development. She was known for her work in integrating innovative teaching methodologies to improve science education in Nigeria, through such initiatives as Experimento. She had trained educators to use hands-on and practical approaches to teach STEM subjects in primary and secondary schools. Her work focused on making science education engaging and accessible, equipping both teachers and students with the skills to solve real-world problems using STEM and STEAM principles. Also, Olaitan (2019) focused on improving STEM education in Nigeria. His work emphasized reforming the STEM curriculum to make it more practical and relevant to real-world challenges. He highlighted the importance of critical thinking and innovative teaching techniques to better prepare students for technological advancements and workforce demands. He has also worked to address challenges in STEM education, such as outdated curricula and inadequate teacher training, by proposing actionable solutions through research and public discourse. His contributions aim to foster a stronger foundation in STEM education across Nigeria.

Amao (2018) worked to promote STEM and STEAM education, particularly among young people and women. where she focuses on developing initiatives that encourage students to pursue careers in science, technology, engineering, and mathematics. Her efforts include organizing workshops, mentorship programs, and career guidance sessions to bridge the gap between academic training and industrial needs. She also emphasised the importance of STEAM integrating arts into STEM to foster creativity and innovation among learners, preparing them for the demands of the global workforce. Oladipo (2019) worked on leveraging technology to improve education and workforce readiness in Nigeria and across Africa. She promoted integrating digital skills, artificial intelligence, and data science into STEM education to prepare students for the 21st-century economy. She is also a strong proponent of inclusivity, encouraging the participation of underrepresented groups, especially women, in STEM fields. She worked on such project that modernise curricula and increase the adoption of innovative teaching methods that combined science, technology, and the arts to foster creativity and problem solving skills.

Sadik (2018) advocated for integrating Arts into STEM in order to promote the application of scientific knowledge to solve real-world issues, such as environmental sustainability. She worked on developing educational frameworks that encourage critical thinking, problem-solving, and creativity, aiming to create a future workforce capable of innovation and leadership. Her influence extends to mentoring and empowering students through research collaborations and educational programmes that provide hands-on experiences in STEM fields. By integrating the arts into STEM, she aims to inspire creativity in science and technology, reinforcing the value of interdisciplinary learning.

Adeleke (2018) worked on various initiatives to promote hands-on learning in STEM fields, especially among underrepresented groups like women and girls. She also emphasized the importance of integrating arts into STEM education to help students develop creative and critical thinking skills, making learning more engaging and applicable to real-world challenges. Adeleke (2018) advocated for practical education models that prepare students for future workforce demands in technology and innovation, with a focus on empowering youth through accessible, creative learning opportunities. Her activities were geared towards inspiring the next generation of thinkers and problem-solvers in the STEM and STEAM fields, particularly in a rapidly evolving global economy. In today's rapidly changing world, the need for critical thinking and problem-solving skills is more urgent than ever, particularly for students in secondary schools. While STEM (Science, Technology, Engineering, and Mathematics) education has been celebrated for its potential to nurture these skills, the integration of STEAM (which adds the arts to STEM) offers a more holistic approach that encourages both analytical and creative thinking.

Meanwhile, senior secondary school students are generally burdened by traditional teaching methods and curricula that focus more on memorization than on developing students' cognitive abilities, an approach that limits their ability to think critically and creatively. While STEM and STEAM programmes promise to bridge this gap, it however, remains unclear how well they are working in the Nigerian context. There are questions about whether these programmes are truly equipping students with the problem-solving skills needed to navigate the complex challenges in an increasingly technological world. Moreover, many senior secondary schools in Ilesa East Local Government Area of Osun state face challenges such as limited resources, inadequate trained teachers, and a curriculum that is not fully adapted to the demands of modern education. These barriers could be affecting the true potential of STEM and STEAM programmes to foster critical thinking in students. It is against this background that this study sought to investigate the effectiveness of STEM and STEAM programmes in developing critical thinking and problem-solving skills among secondary school students in Ilesa East Local Government Area of Osun state.

The main purpose of this study is to assess the effectiveness of STEM and STEAM programmes in developing critical thinking, problem solving and creativity among senior secondary school students in Ilesa East Local Government area of Osun state. Specific objectives were to:

i. examine how teachers integrate arts into STEM subjects to create STEAM.

ii. investigate how STEM and STEAM programmes impact students' engagement and skill development.

iii. interogate the role of project-based learning in STEM/STEAM education.

iv. determine how students from different academic backgrounds perceive STEM and STEAM programmes.

v. identify the challenges schools face in implementing STEM and STEAM programmes effectively.

The following research questions were provided to guide the study:

i. How do teachers integrate arts into STEM subjects to create STEAM?

ii. How do STEM and STEAM programmes impact senior secondary school student's engagement and skill development in Ilesa East Local Government Area of Osun State?

iii. What are the roles of project-based learning in STEM/STEAM education?

iv. What are the challenges school face in implementing STEM and STEAM programmes in Secondary Schools in Ilesha East Loval Government Area?

Hypothesis

$H_0$1: There is no significant difference in the perception of STEM and STEAM between arts and science students in Ilesa East Local Government Area, Osun State.

2. Methodology

2.1. Participants

The study adopted a descriptive survey research design for its execution. The population consisted of all senior secondary school students and teachers in Ilesa East Local Government Area, Osun State. The sample involved 20 SSII students (Senior Secondary School II) randomly drawn from each of the 10 Senior Secondary Schools that participated in the study, and five (5) teachers were purposively selected across the main subjects that constituted STEAM, drawn from each of the 10 schools, giving a sample size of 250 participants -200 SSII students and 50 teachers in the core subject areas. Consent of participants (teachers and students) was sought, before the administration of the instruments.

2.2. Research instruments

A researcher-developed and validated questionnaire titled Effectiveness of STEM and STEAM Programmes (ESSP) in Senior Secondary Schools for both students and teachers, consisting of eight sections with varying responses each way (with 0.78 & 0.81 reliability indexes), was used to collect relevant data for the study. The questionnaires were validated by experts in STEAM subjects and measurement and evaluation.

2.3. Data analysis

The data collected were analyzed using a mixed-method approach. Pretest and post-test scores were analysed quantitatively and quantitatively, with means and standard deviations calculated to assess changes in critical thinking and problem-solving skills. T-test analysis was employed to determine if the differences were statistically significant.

3. Results

3.1. Descriptive statistics

Table 1 presents the gender distribution of the respondents. It showed that 53.0% of the students were male, with 47.0% being female, while 58.0% of the teachers were male and 42.0% were female.

Table 1: Respondents' distribution by gender

Gender	f	%	f	%
	Student **N=200**		Teacher **N=50**	
Male	106	53.0	29	58.0
Female	94	47.0	21	42.0
Total	200	100.0	50	100.0

Source: Field Survey, 2025

Table 2 revealed the analysis of how teachers integrate arts into STEM subjects to create STEAM. The items in the teachers questionnaire that the respondents agreed with were: incorporating Arts into STEM subjects makes learning more engaging and enjoyable (78.0%), Integrating Arts into STEM subjects fosters innovation and critical thinking in students (75.0%), Hands-on activities in STEAM allow for experiential learning, which are helpful to students (73.0%), Collaboration, communication, and adaptability are often improved through STEAM activities (73.50%), STEAM better reflects modern job markets, where creativity and technical skills are both valuable (89.50%).

Table 2: Analysis of how teachers integrate arts into STEM subjects to create STEAM

S/N	ITEMS	RESPONSE			
		Agree		Disagree	
		F	%	f	%
1	Incorporating Arts into STEM subjects makes learning more engaging and enjoyable	156	78.0%	44	22.0%
2	Integrating Arts into STEM subjects fosters innovation and critical thinking in students.	150	75.0%	50	25.0%
3	Hands-on activities in STEAM allow for	146	73.0%	54	27.0%

	experiential learning, which are helpful to students.				
4	Collaboration, communication, and adaptability are often improved through STEAM activities	147	73.5%	53	26.5%
5	STEAM better reflects modern job markets, where creativity and technical skills are both valuable.	179	89.5%	21	10.5%

Source: Field Survey, 2025

Table 3 revealed the analysis of how STEM and STEAM programmes impact senior secondary school students' engagement and skill development in Ilesa East Local Government Area of Osun State. The items in the students questionnaire that the students agreed with were; STEM and STEAM programmes focus on project -based learning, which keeps students actively involved (100.0%), many STEM and STEAM projects involve group work, helping students build communication and teamwork skills (97.5%), Students learn to present their findings, create reports and visually represent data(87.0%), Students gain experience with coding, robotics, 3D modeling and digital art (81.0%), the Arts in STEAM encourage students to think creatively, design new solutions, and innovations (89.0%), Exposure to STEM and STEAM programmes increase students interest in pursuing science, engineering, or technology fields (86.0%).

Table 3: Analysis of how STEM and STEAM programmes impact senior secondary school students' engagement and skill development in Ilesa East Local Government Area of Osun State (N = 200)

S/N	ITEMS	RESPONSE							
		Strongly Agree		Agree		Disagree		Strongly Disagree	
		f	%	f	%	f	%	f	%
STUDENTS (N = 200)									
1	STEM and STEAM programmes focus on project -based learning, which keeps students actively involved.	142	71.0%	58	29.0%	0	0.0%	0	0.0%
2	Many STEM and STEAM projects involve group work, helping students build communication and teamwork skills.	83	41.5%	112	56.0%	4	2.0%	1	0.5%
3	Students learn to present their findings, create reports, and visually represent data.	73	36.5%	101	50.5%	21	10.5%	5	2.5%
4	Students gain experience with coding, robotics, 3D modeling and digital art.	54	27.0%	107	54.0%	20	10.0%	19	9.5%
5	The Arts in STEAM encourage students to think creatively, design new solutions, and innovations	79	39.5%	99	49.5%	11	5.5%	11	5.5%
6	Exposure to STEM and STEAM programmes increase students interest in pursuing science, engineering, or technology	75	37.5%	97	48.5%	16	8.0%	12	6.0%

	fields								
TEACHERS RESPONSE (N = 50)									
1	STEM and STEAM encourage experiential learning through projects, experiments, and real-world applications	13	26.0%	34	68.0%	3	6.0%	Nil	Nil
2	The Integration of Arts in STEAM makes learning more engaging, especially for students who may not initially be interested in traditional STEM subjects	19	38.0%	31	62.0%	Nil	Nil	Nil	Nil
3	Students become more motivated when they see practical applications of their learnings	18	36.0%	28	56.0%	3	6.0%	1	2.0%
4	STEM and STEAM encourage students to analyze problems and think critically	19	38.0%	30	60.0%	1	2.0%	Nil	Nil
5	Adding the Arts Fosters original thinking and innovation	20	40.0%	30	60.0%	Nil	Nil	Nil	Nil
6	Many STEM and STEAM projects require group work, teaching students how to communicate and collaborate effectively	8	16.0%	39	78.0%	1	2.0%	2	4.0%
7	Programmes introduce students to fields like Engineering, biotechnology, game design, and architecture	14	28.0%	34	68.0%	2	4.0%	Nil	Nil
8	STEAM, in particular, helps bridge gender and diversity gaps in STEM fields by making subjects more accessible and appealing	16	32.0%	33	66.0%	1	2.0%	Nil	Nil
9	Many STEM and STEAM projects encourage innovation, which can lead to entrepreneurship opportunities	41	82.0%	9	18.0%	Nil	Nil	Nil	Nil

Source: Field Survey, 2025

While the items in the teachers questionnaire that the teachers agreed with were: STEM and STEAM encourage experiential learning through projects,experiments and real world applications (94.0%), the Integration of Arts in STEAM makes learning more engaging, especially for students who may not initially be interested in traditional STEM subjects (100.0%), Students become more motivated when they see practical applications of their learnings (92.0%), STEM and STEAM encourage students to analyze problems and think critically (98.0%), Adding

the Arts Fosters original thinking and innovation (100.0%), Many STEM and STEAM projects require group work, teaching students how to Communicate and collaborate effectively (94.0%), Programmes introduce students to fields like engineering ,biotechnology, game design and architecture (96.0%), STEAM, in particular, helps bridge gender and diversity gaps in STEM fields by making subjects more accessible and appealing(98.0%), Many STEM and STEAM projects encourage innovation, which can lead to entrepreneurship opportunities (100.0%).

Table 4 displays the analysis of the roles of project-based learning in STEM/STEAM education. The responses of the teacher - respondents were: Enhancing student Engagement and Motivation (94.0%), Encouraging Hands-On, Experiential Learning (90.0%), Fostering Critical Thinking and Problem-Solving (94.0%), Promoting Collaboration and Communication (98.0%), Integrating Cross-Disciplinary Learning (82.0%), Developing Creative and Innovation (76.0%), Preparing students for Future Careers (84.0%), Encouraging Self-Directed Learning and Ownership (88.0%), Making Learning More Inclusive and Accessible (82.0%).

Table 4: Analysis of the roles of project-based learning in STEM/STEAM education
(N = 50)

S/N	ITEMS	RESPONSE			
		Agree		Disagree	
		F	%	f	%
1	Enhancing Student Engagement and Motivation	47	94.0	3	6.0
2	Encouraging Hands-On, Experiential Learning	45	90.0	5	10.0
3	Fostering Critical Thinking and Problem-Solving	47	94.0	3	6.0
4	Promoting Collaboration and Communication	49	98.0	1	2.0
5	Integrating Cross-Disciplinary Learning	41	82.0	9	18.0
6	Developing Creativity and Innovation	38	76.0	12	24.0
7	Preparing students for Future Careers	42	84.0	8	16.0
8	Encouraging Self-Directed Learning and Ownership	44	88.0	6	12.0
9	Making Learning More Inclusive and Accessible	41	82.0	9	18.0

Source: Field Survey, 2025

Table 5 revealed the analysis of the challenges schools face in implementing STEM and STEAM programmes in Secondary Schools in Ilesa East Local Government Area of Osun State. The student - respondents agreed as follows: Lack of funding and Resources (89.0%), lack of specialized training in STEM/STEAM teaching methods prevents effective implementation (86.5%), many schools curricula are heavily focused on standardized testing, leaving little room for flexible, project based learning (88.0%), some students lack confidence in STEM subjects, leading to Disengagement (80.0%), teachers often have tight schedules and high workloads making it difficult to incorporate long term STEM/STEAM projects (85.0%).

Table 5: Analysis **of** the challenges schools are facing in implementing STEM and STEAM programmes in Secondary Schools in Ilesa East Local Government Area
(N = 200)

S/ N	ITEMS	RESPONSE							
		Strongly Agree		Agree		Disagree		Strongly Disagree	
		F	%	f	%	F	%	F	%
1	Lack of funding and Resources	132	66.0	46	23.0	6	3.0	16	8.0
2	Lack of specialized training in STEM/STEAM teaching methods prevents effective implementation	87	43.5	86	43.0	9	4.5	19	9.0
3	Many schools' curricula are heavily	84	42.0	92	46.0	15	7.5	9	4.5

	focused on standardized testing, leaving little room for flexible, project based learning				
4	Some students lack confidence in STEM subjects, leading to Disengagement	73 36.5	87 43.5	18 9.0	22 11.0
5	Teachers often have tight schedules and high workloads making it difficult to incorporate long term STEM/STEAM projects.	92(46.0%)	78 39.0	14 7.0	16 8.0

Source: Field Survey, 2025

Table 6 shows the analysis of the significant difference in the perception of STEM and STEAM between arts and science students in Ilesa East Local Government Area. The result revealed that there is no significant difference in the perception of STEM and STEAM between Arts and Science students in Ilesa East Local Government Area ($t = 0.892$, $df = 198$, $p > 0.05$). This reveals that art students' perception of STEM and STEAM in Ilesa East Local Government Area is the same as that of the science students; this implies that the hypothesis is not rejected.

Table 6: Summary of t-test Analysis on the significant difference in the perception of STEM and STEAM between arts and science students in Ilesa East Local Government Area

	N	Mean	S.D	T	Df	Sig. (2-tailed)	Remark
Science	89	20.30	6.56	0.892	198	0.711	Not Significant
Art	111	19.98	5.84				

4. Discussion

The findings of this study showed that incorporating the arts into STEM subjects makes learning more engaging and enjoyable and fosters innovation and critical thinking in students. Some studies argued that STEAM dilutes the rigor of STEM by emphasizing subjective or creative elements over technical depth. Toulmin (2019) and Williams (2017) argued that adding Arts to STEM can confuse curriculum focus and overwhelm teachers. Hands-on activities in STEAM allow for experiential learning, which is helpful to students. Also, Collaboration, communication, and adaptability, which are often seen to have been improved through STEAM activities, are the ways teachers integrate arts into STEM subjects to create STEAM. This finding aligned with that of Yakman and Lee (2012) that STEAM is built upon the foundation of STEM, and with the addition of art to foster students' creative thinking. According to Yakman and Lee (2012), STEAM not only focuses on providing academic knowledge but also encourages creativity and critical thinking through artistic activities. This approach helps students develop the ability to solve complex problems by combining knowledge from multiple fields. Also, the finding of Jolly (2014) revealed that many STEAM implementations are at the surface level, failing to genuinely integrate the disciplines.

Furthermore, findings showed that STEM and STEAM programmes impacted senior secondary school students' engagement and skill development, because STEM and STEAM programmes focus on project -based learning, which keeps students actively involved in group work, helping students build communication and teamwork skills. Also, students learn to present their findings, create reports, and visually represent data; students gain experience with coding, robotics, 3D modeling, and digital art. While teachers reported that the integration of Arts in STEAM makes learning more engaging, especially for students who may not initially be

interested in traditional STEM subjects, students become more motivated when they see practical applications of their learning, encouraging students to analyze problems and think critically, adding that Arts fosters original thinking and innovation, involved in group work, teaching students how to communicate and collaborate effectively. This aligns with the work of Prince (2014) that the physical construction of learning enabled students to engage because they could see and understand what they were doing. Nevertheless, critics argued that the statement assumes all students are artistically inclined, which may not be true, and could alienate students who prefer purely logical or technical approaches. Bailey & Borwein (2017) suggested that overemphasis on art may reduce focus on core STEM competencies, making students less competitive in technical fields.

Furthermore, the roles of project-based learning in STEM/STEAM education were: Enhancing students' engagement and motivation, encouraging hands-on experiential learning, fostering critical thinking and problem-solving, promoting collaboration and communication, integrating cross-disciplinary learning, developing creativity and innovation, preparing students for future careers, encouraging self-directed learning and ownership. This finding lends crendence to Haerullah and Hasan (2017) who outlined the advantages of learning by using the roles of project-based learning model, including fostering the mindset of students is comprehensive in viewing and solving problems faced in life, in applying knowledge, attitudes, and skills in an integrated manner which is expected to be practical and useful in students' daily lives, it can also increase learning motivation and encourage the ability to do work, and improve problem solving skills. Students become more active and are challenged to solve more complex problems.

Moreover, the challenges school face in implementing STEM and STEAM programmes in Secondary Schools in Ilesa East Local Government include lack of funding and Resources, lack of specialized training in STEM/STEAM teaching methods which prevents effective implementation, schools' curricula are heavily focused on standardized testing, leaving little room for flexible and project - based learning, some students lack confidence in STEM subjects, leading to disengagement. This is in agreement with the report of Susilo & Sudrajat (2019) that the common challenges discussed in most literature are financing, teachers' development, and involvement of parents and the community.

Conclusion

Arts integration into STEM education offers a vital pathway to cultivating creativity, critical thinking, and innovation among students, which are necessary for navigating the complexities of 21st-century education. By embedding artistic disciplines into scientific and technological learning, STEAM education engages students more deeply and provides them with the skills to approach problem-solving from multiple perspectives. Despite the challenges educators face in integrating arts with STEM, evidence from successful programs underscores the potential benefits for student development. Moving forward, a comprehensive theoretical and practical framework is needed to guide educators in implementing effective STEAM education, ensuring a balanced approach that fosters both technical and creative skills essential for future leaders.

Recommendations

From the findings of this study, the following recommendations were made:

A STEM/STEAM curriculum needs to be implemented from elementary to high school because the early implementation of STEM and STEAM-based curricula sharpens students' creative thinking skills and broadens their interest in careers in STEM, increasing the pool of people considering careers in STEM and STEAM fields who can contribute to research, development, and innovation. Effort should be made to focus on developing curriculum materials and instructional models for STEM and STEAM integration that are primarily concerned with developing students' creative thinking.

Teachers in the Arts subjects should be encouraged and properly trained on how to integrate Arts Subjects into STEM. There should be strong collaboration amongst the Arts, science, and technology teachers for successful integration of Arts into STEM programmes.

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