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Institutional Preparedness for the Integration of Stem / Steam Learning in Punjab

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Abstract: ***Education that takes a STEM (science, technology, engineering, and mathematics) approach is gaining popularity on a global scale because it places a significant emphasis on science, technology, engineering, and mathematics. STEM stands for the acronym Science, Technology, Engineering, and Mathematics. The goal of the study that will be presented in this article is to determine the degree to which educational institutions in Punjab are prepared to include STEM and STEAM education into their respective curriculum. In order to gather data for the study, questionnaires and interviews were held at a variety of educational institutions located all around the province of Punjab. The majority of the questions that were asked were on the ease with which different resources could be accessed, the level of education that was obtained by the teachers, and the condition of the infrastructure. According to the findings of the research, even though there is a growing interest in STEM and STEAM education in Punjab, there is still an inadequate supply of resources, inadequate teacher training, and inadequate infrastructure to support it. This is the case despite the fact that there is a growing interest in the subject. Despite the fact that there is a rising interest in the topic, this is the situation as it now stands. Following the recommendations made in the study report, the government of Punjab and educational institutions should make investments in resources, teacher training, and infrastructure to strengthen institutional preparedness for the combination of STEM and STEAM education. These investments should be made in order to strengthen institutional preparedness for the combination of STEM and STEAM education. In order to accomplish the goal of this piece of writing, a research study will be conducted to investigate the extent to which educational institutions in the state of Punjab are prepared to embrace STEM and STEAM curriculums. The research was carried out by disseminating questionnaires and carrying out interviews at educational institutions that might be found all across the state of Punjab. The questions that were asked brought up a number of important topics, including the preparation of teachers, the accessibility of resources, and the state of the infrastructure. Even though there is a rising interest in STEM/STEAM education in Punjab, the findings show that there is a lack of resources, teacher training, and infrastructure to support its implementation. This is despite the fact that there is a growing interest in such education. This is the situation despite the fact that there is a growing demand in education of this kind. This is still the case despite the fact that there is a growing need for education of this sort. In order to increase institutional preparation for the combination of STEM and STEAM learning, it is recommended in the report of the research that the government and educational institutions make investments in resources, teacher training, and infrastructure. If educational institutions in Punjab behave in this manner, they will be able to better provide their students with the relevant skills for their future and better prepare their students for the problems that will be faced in the 21st century.***

Keywords: Science–arts integration, STEM education, STEAM integration, science education

1. Introduction

Stem/Steam education has gained significant attention worldwide

The National Academies of Sciences, Engineering, and Mathematics are the ones who are responsible for the development of these frameworks.[1] The acronym STEM refers to the fields of science, engineering, technological development, and mathematics. While not the only ones, this collection of topics does contain the academic fields of science and engineering, in addition to the mathematical sciences. But, they are not the only ones. In addition to this, it is inclusive of a vast array of academic subfields and specialised areas of study. These are the subjects that are included in the STEAM curriculum. "Science, technology, engineering" is what is meant to be conveyed by the acronym "STEM," whereas "science, technology, engineering, arts, and mathematics" is what is meant to be conveyed by the acronym "STEAM.""STEM" refers to "science, technology, engineering, arts, and mathematics," while "STEAM" refers to "science, technology, engineering, arts, and mathematics.""STEM" stands for "science, technology, engineering." Both "science, technology, engineering, and mathematics" (sometimes shortened as "STEM") and "science, technology, engineering, arts, and mathematics" (often abbreviated as "STEAM") are used interchangeably throughout this article. "Science, technology, engineering, and mathematics" is what is meant to be abbreviated when referring to STEM. "Science, technology, engineering, arts, and mathematics" is what is meant to be abbreviated by the acronym "STEAM."**National Assessment of Education Progress (NAEP)**

According to the findings of the 2019 National Assessment of Education Progress (NAEP) science assessment report,[2] researchers discovered that approximately only thirty percent of fourth grade teachers reported that their students only participated once or twice in inquiry-based science activities during a given school year. This information was gleaned from responses given by teachers about their students' participation in the assessment. This information was collected from the replies provided by the instructors on the involvement of their pupils in the evaluation. The teachers' comments on how involved they wanted their students to be in the assessment were used to compile this information, which was then analysed. This information was compiled with the help of the instructors' comments on the level of involvement in the assessment that they desired for their pupils. After that, the information was analysed. This realisation was made possible by the fact that the teachers were questioned about the frequency with which their students participated in scientific activities. This served as the catalyst for this realisation. The federal government of the United States places a substantial focus, for a number of reasons including those having to do with the economy and society, on the education of the nation's children in the fields of science and technology. This is done for a variety of reasons, some of which are listed above. It would be the country known as the United States of America (NAEP, 2019).

STEAM integrated curriculum based methods, and examining patterns of integration

Disparities in academic achievement in the area of science become clearly visible from a young age. This is due to the fact that there are a myriad of elements that contribute to this phenomenon. As a direct result of this, programmes that aim to find solutions to these challenges need to focus their attention on the preschool and early primary school years. This is because these are the years in which children are most impressionable..[3] It is of the biggest need to keep this in mind while talking with children and teens who are learning a second language, since it is of the utmost necessity. They are the ones who are responsible for providing an answer to the question of what supports the learning processes for children whose first languages are not English in the most effective manner, and it is their responsibility to provide an answer to that question.

Challenges

Educational institutions in Punjab are up against a number of challenges, some of which include a lack of financial resources, the absence of a clearly defined regulatory framework for STEM and STEAM education, and a paucity of trained professionals who are qualified to teach these subjects. These are just some of the challenges that educational institutions in Punjab are up against. Because the vast majority of educators have only received training in the more conventional approaches to instructing students, STEM and STEAM education continue to be largely foreign to them. This is due to the fact that most educators have only received training in the more conventional approaches. The findings of the research indicate that teachers need to undergo substantial training in order for them to be able to appropriately combine the STEAM curriculum with the STEM curriculum in their classrooms.

Contemporary approaches to science education for EB students

In the most recent decades, there has been a movement towards the practise of placing a higher emphasis on the learning of science using methods that are based on inquiry. This is done with the intention of actively involving students in the process of doing scientific research within the confines of the classroom setting. This was done as a component of an effort that is being carried out to bring education in the scientific domains into the modern era. This allows for a more holistic and engaging educational experience for the students. These activities may include the creation of scientific experiments, engagement with real-world situations, the investigation of difficulties, the explanation of students' understandings, the elaboration of students' previous and new knowledge, as well as the evaluation of students' own self-reflection. EB children enter the classroom having had a variety of experiences and connections with the natural world; provided, however, that their teachers are able to tap into the affordances that these rich experiences have to offer. EB children enter the classroom having had a variety of experiences and connections with the natural world. When they first step foot in a classroom, EB children have already accumulated a wealth of experiences and relationships with the natural world. Before they ever step foot in the classroom, the children who take part in EB have already established a relationship with the wild world around them.[4-6] It is conceivable to make use of these experiences and interactions as resources in order to make sense of things in science; however, this will only be practical if teachers are able to make use of these rich experiences. Teachers of English-speaking students typically use their students' language resources as if they were their sole access for disciplinary methods of communication when they are engaged in inquiry-based learning situations (this is known as taking a logo-centric view). As a direct consequence of this, educators tend to disregard gestures, movement, and drawings, which limits the modality. This is an error that is committed by a great deal of individuals. In other words, the emblem or sign that they use serves as the focal point of their point of view.

The potential benefits of arts integration in science for EB students

In the most recent decades, there has been a trend towards the practise of putting a greater focus on the study of science via the use of techniques that are based on inquiry. This practise has gained popularity in recent years. Within the boundaries of the traditional academic environment of the classroom, this is done with the purpose of actively incorporating students in the process of carrying out scientific research. [7-9]This was accomplished as a part of an effort that is now being made to bring education in the scientific fields into the contemporary age. The goal of the programme being carried out right now is to usher education in the scientific fields into the modern age. Learning experiences, such as making sense of the world, solving problems, and intentionally focusing on the needs of individual students, can be used to actively establish meaningful links between previously acquired knowledge and newly acquired information.

Order of integrating arts and inquiry

There is a lack of consensus on the most efficient order in which to implement the arts and inquiry methods, specifically in terms of whether the arts should come first or second, before or after the inquiry methods.[10-11] This lack of consensus stems from the fact that there is no clear answer to the question of which comes first: the arts or the inquiry methods. This lack of agreement is owing to the fact that there is no widely agreed sequence in which to adopt the arts and inquiry methodologies. Specifically, there is no order that begins with the arts. This lack of consensus could be explained by the fact that there is no conclusive answer to the question of which comes first: the arts or the investigative processes. This lack of unanimity is due to the fact that there is no commonly acknowledged sequence in which to embrace the arts and inquiry approaches. Hence, there is no set order in which to do so. [12-15]To be more specific, there is no chronological sequence that starts with the arts. To be more explicit, there is no chronological order that begins with the arts. This is the case for all other fields as well. This is because children who are exposed to the arts are more likely to have an appreciation for the breadth of the creative process. This is because children who participate in artistic activities are exposed to a larger array of experiences. This is because children who take part in creative activities are presented with a greater variety of opportunities and experiences than their peers who do not. This is because of the relationship that exists in our culture between different forms of creative expression and the arts. But, they do not have the chance to employ these cutting-edge concepts in ways that would make the process of adapting to their specific circumstances easier. This prevents them from taking advantage of ways in which these ideas may simplify the process. Because of this, they are unable to reap the benefits of the facilitated adaptation that would occur from acting in this manner. They are unable to enjoy the advantages of the simplicity that would be supplied by these principles due to the fact that this is the case. As a consequence of this rationale, they are unable to see the potential benefits that may arise from the ease of adaption that these novel ideas could be able to bring.[16-18] It was anticipated that research would be conducted into the following subject matter areas in order to make progress towards the overarching goal of this research project, which was outlined in the following manner. In order to achieve this overarching goal, which was outlined in the following manner. In order to achieve this objective, research would be carried out on the following subject areas.

Objectives of the study

1) To study STEAM integrated curriculum-based methods, and examine patterns of integration
2) To study for the integration of stem/steam learning in Punjab.

2. Research Methodology

The research was conducted through surveys and interviews of educational institutions in Punjab. The surveys were sent to educational institutes, including schools, colleges, and universities, and the responses were analyzed to study the availability of resources, teacher training, and infrastructure for Stem/Steam education. Interviews were conducted with school principals and teachers to understand their views on the integration of Stem/Steam education and the challenges they face.

Stem lessons

The Next Generation Science Standards (NGSS) Science standard 5-LS2-1 was covered in these fifth grade science classrooms. As part of this criteria, it is required that students build a model that illustrates the transfer of materials between various creatures, such as plants, animals, decomposers, and the environment. Regarding the Disciplinary Core Idea LS2.A, an investigation into the interdependent relationships that occur naturally within ecosystems was carried out. [19]The species that are linked to one another via food webs served as the primary topic of discussion for the majority of this talk, which had this overarching concept as its primary emphasis. In these food webs, animals eat the plants that were previously devoured by animals, while other animals eat the animals that ate the plants that were previously consumed by animals. Students who take science, technology, engineering, and mathematics (STEM) classes that are aligned with the Next Generation Science Standards (NGSS) are able to comprehend and recognise that air is matter due to the fact that it both occupies space and has mass.

Professional development

Before the lessons were put into action, there was an institute for professional development (PD) that was held over the course of the summer. It was designed to continue for a week but was divided into five separate days for attendees' convenience. There was a new subject covered on each of the five days of the event. For each day of the institute that was attended, there was at least one day off in between sessions. [20]

3. Results

According to the findings of the study, there is a growing interest in STEM (Science, Technology, Engineering, and Mathematics) education in Punjab, and educational institutions have shown a desire to include it into their curriculum. The acronym stands for "STEM," which stands for "Science, Technology, Engineering, and Mathematics.""STEM" is an abbreviation that stands for "Science, Technology, Engineering, and Mathematics." These are the subjects that are represented by the acronym. "Science, Technology, Engineering, and Mathematics" is abbreviated as "STEM," and this is what the acronym stands for. These are the aspects of the discussion that are highlighted by the abbreviation. STEM is an acronym that stands for "Science, Technology, Engineering, and Mathematics." STEM is an abbreviation that stands for "Science, Technology, Engineering, and Mathematics." [21]These are the components of the conversation that the abbreviation draws attention to, and they are listed below.

Life science findings

During the course of the 9-week intervention, a series of independent samples t tests were carried out in order to investigate and analyse a number of grouping variables, as well as a continuous variable that assessed the change in scores exhibited by the fifth-grade students' advancements in their knowledge of life science.[22] The purpose of these tests was to determine whether or not there was a significant relationship between the two sets of variables. These tests were carried out with the intention of determining whether or not there was a significant association between the two different sets of variables. These tests were carried out with the purpose of establishing whether or not there was a significant correlation between the two distinct groups of variables by assessing whether or not there was a significant association between the two sets of variables. The evaluation of the factors that determine the grouping was carried out with this variable being taken into account. There was a statistically significant difference between the change scores of students in STEM/STEAM classrooms ($m=6.00$, $SD=4.45$) and students in STEM/STEAM classrooms ($m=2.93$, $SD=3.91$; $t(178)=5.50$, $p=0.001$) in STEM/STEAM classrooms. The former had a mean of 6.00, while the latter had a mean of 2.93 and a standard deviation of 4.45. In the first group, the mean was 6, whereas in the second group it was 2,93, and the standard deviation was 4.45. There was a statistically significant difference in the change scores of students who completed STEM or STEAM courses (m = 6.00, SD = 4.45), and this difference was shown to exist between the two groups. This distinction was found to exist between the two groups. There was a significant difference in the size of the differences between the averages (eta squared = 0.15), with the mean difference coming in at 3.40 and a 95% confidence range that extended from 2.18 to 4.62. There was also a significant difference in the size of the differences between the averages. In addition, there was a noticeable disparity in the magnitude of the disparities that existed between the averages. This demonstrates that one of the most essential considerations to make is the extent to which the means of the groups vary from one another. The following is a compilation of samples taken from a wide range of different populations. The purpose of the t test that was carried out was to compare the change in score of life science knowledge gains to the degree of English language fluency possessed by the students. This comparison was carried out in order to draw conclusions. The purpose of this comparison was to establish whether or not the pupils had grown in their command of the language since the beginning of the year.[23-25] A comparison similar to the one being presented here was carried out so that judgments on the importance of the results could be arrived at. The students were given English proficiency tests by the participating school districts, and the results of those tests were used to place the students into one of two categories: English Fluent (EF) learners or English Beginning (EB) learners. The students were placed into one of these categories based on the results of the tests. The phrase "English Fluency" is represented by the acronym EF, whereas the phrase "English Beginning" is indicated by the abbreviation EB. The students in the EF group had change scores that were statistically significant higher (mean: 5.36, standard deviation: 4.18) than the students in the EB group had change scores that were statistically substantially lower (mean: 3.25, standard deviation: 4.35; t (147)=2.99, p=0.003). The students in the EB group had change scores that were statistically significant lower (mean: 3.25, standard deviation: 4.35).[42] The students who were placed in the EF group had a shift in their scores that was significantly higher than the students who were placed in the EB group. The magnitude of the differences that were found between the means (mean difference = 2.11, 95% confidence interval [CI]: 0.72–3.50), which led to the conclusion that there was only a moderate impact, served as the basis for determining that there was only a moderate influence (eta squared = 0.06)..[26]

There was a difference that was statistically significant between the change scores of the students who were in classrooms with high implementation (mean: 4.60, standard deviation: 4.61) and those who were in classrooms with moderate to low implementation (mean: 3.10, standard deviation: 3.57; t (100) = 2.68, p=0.009). The students who were in classrooms with high implementation had a standard deviation that was lower than the students who were in classrooms with moderate to low implementation. The standard deviation of the students who were in classes where there was high implementation was lower than the standard deviation of the students who were in classrooms where there was moderate to low implementation. The average score of students who attended courses where there was a high degree of implementation was 4.60, and the standard deviation was 4.61. The scores of the pupils had a standard deviation of 4.61, and the average grade for the class was 4.60 out of 5. This was the circumstance in the classes where there was a significant amount of actual implementation. The difference in the averages was 1.79 points on average, and the size of the changes did not meet the criteria for statistical significance (eta squared = 0.03) The range of probable differences, based on a confidence level of 95%, was anywhere from 0.46 to 3.11 points. The findings of te t tests indicate that classes in which this kind of content was given to a high degree were significantly more effective than those in which it was taught to a moderate degree or to a low degree. This is the conclusion that can be drawn from the fact that classes in which it was taught to a low degree or to a moderate degree were significantly less effective. This is the conclusion that can be inferred from the fact that courses in which it was taught to a low degree or to a moderate degree were much less successful. This is the conclusion that can be drawn from the fact that classes in which it was taught to a moderate degree. This is the conclusion that can be taken from the fact that classes in which it was offered to a low degree or to a moderate degree had substantially lower levels of student achievement. This is the inference that one is able to make as a result of the fact that courses were held in which it was taught to a reasonable extent. Please see the table that is supplied lower down on this page for further information on the illustrative data that is associated to these results. Thank you for your attention to this matter. This was the case with those who were classified as high implementers, mid-to-low implementers, or EF learners, and it was also the case with individuals who were classified as EB learners or EF learners. An exploratory confirmatory three way between-groups analysis of covariance (ANCOVA) was carried out in order to investigate the impact of these three independent variables measuring implementation fidelity, English language fluency, and the instructional order method that was utilised in relation to STEM and STEAM order approaches. This analysis was carried out in order to investigate the impact of these three independent variables measuring implementation fidelity, English language fluency, and the instructional order method that was utilised in relation to STEM and STEAM order approaches. This study was carried out in order to investigate the impact of these three independent variables measuring implementation fidelity, English language fluency, and the instructional order method that was used in relation to STEM and STEAM order approaches. This study was carried out in order to investigate the impact of these three independent variables measuring implementation fidelity, English language fluency, and the instructional order method that was used.[27]. The purpose of this study was to investigate the impact of these three independent variables measuring implementation fidelity, English language fluency, and the instructional order method that was used. This study was carried out in order to investigate the impact of these three independent variables. The objective of this research was to explore the influence of these three independent variables—measuring implementation fidelity, English language fluency, and the instructional order approach that was used—on the outcomes of the study. The purpose of this research was to explore the influence of these three independent factors; thus, the investigation was carried out. The dependent variable was a measurement documenting the increase in life science knowledge obtained from a pre-test and then subsequent administration of two post-test assessments administered at 3-week intervals during the 9-week intervention. The pre-test and subsequent administration of the two post-test assessments were administered at the beginning and end of the study, respectively. Both the initial administration of the pre-test and the final administration of the two post-test evaluations were carried out at the beginning and the conclusion of the research, respectively. Both the initial administration of the pre-test and the final administration of the two post-test evaluations were carried out at the beginning and the end of the research, respectively. These two administrations were done in order to compare and contrast the results of both the pre-test and the post-test. Both the first administration of the pre-test and the last administration of the two post-test evaluations were carried out at the beginning and the conclusion of the study, respectively.

Table 1: Descriptive statistics via ANCOVA analysis of implementation levels, English fluency and instructional method related to total change scores for life science knowledge gained

Implementation fidelity	Language fluency	Instructional method	Mean	Std. deviation	
High implementation fidelity	English fluent	STEAM/STEM	729	4.49	24
		STEM/STEAM	4.64	4.07	22
		Total	6.02	4.45	46
	Emergent bilingual	STEAM/STEM	6.11	4.97	18
		STEM/STEAM	250	324	44
		Total	335	4.47	62
	Total	STEAM/STEM	6.79	4.68	42
		STEM/STEAM	3.21	4.018	66
		Total	4.60	4.61	108
Low to moderate implementation fidelity	English fluent	STEAM/STEM	4.00	3.44	14
		STEM/STEAM	3.50	2.07	6
		Total	385	3.05	20
	Emergent bilingual	STEAM/STEM	5.00	3.465	5
		STEM/STEAM	156	3815	16
		Total	238	3.945	21
	Total	STEAM/STEM	4.26	3.385	19
		STEM/STEAM	2.09	3.495	22
		Total	3.10	337	41

While there was a significant interaction effect between a student's English fluency and the degree of implementation fidelity, the impact size was not very large. This is despite the fact that there was a positive correlation between the two variables (the partial eta squared value was 0.031). This is shown by the fact that the value for F (1, 140)=4.44 and the value for p 0.037 were both discovered. This interaction effect has the potential to be observed all over the place in the outcomes of it being applied to scientific knowledge. Specifically, it has the potential to be seen in: There was no evidence found to support the hypothesis that there was a significant interaction relationship between any of the other factors and either the level of language fluency or the instructional method. This is because there was no evidence that there was a significant interaction relationship between any of the other factors. These three aspects were thought of separately, without taking into account the ways in which they may interact with one another. In spite of this, the magnitude of the effect was not very significant (the value of the partial eta squared was 0.04): F (1, 140)=5.82, p=0.017. Nevertheless, neither the degree of fluency in the target language nor the degree of integrity with which the target system was done created a substantial influence that was highly statistically significant. Both of these factors were taken into consideration. Both of these characteristics were taken into consideration as possible confounding factors throughout this study. [28-36]

The results of physical science

In addition, a number of independent-samples t tests were carried out in order to investigate the change in scores exhibited by the fifth-grade children who participated in the research and whose knowledge of[37] physical science was increased as a result of the intervention that lasted for nine weeks. The purpose of these tests was to determine whether or not the children had improved their understanding of the subject matter. These assessments were designed to ascertain whether or not the children's scores had improved as a direct consequence of the intervention that had been carried out. This was done so that additional research could be conducted on the outcomes that had previously been published in regard to the teaching of life science and the effect of implementation levels, language fluency, and instructional styles. Specifically, this was done so that more research could be conducted on the effects of implementation levels, language fluency, and instructional styles. Earlier on in this paragraph, we spoke about the findings that were discovered. whether method of instruction resulted to higher gains in the overall performance of the students on their standardised tests. [38]Children who engaged in STEM and STEAM individually in the same classroom had considerably better mean scores (m=6.08, SD=4.44) than children who participated in STEM and STEAM combined in the same classroom had significantly lower mean scores (m=2.59, SD=4.60; t (182)=5.68, p=0.001). There was a considerable amount of difference between the means (eta squared = 0.15), with the mean difference coming in at 3.62 and a 95% confidence range that extended from 2.35 to 4.90. There was a large amount of difference between the means. This suggested that there was a significant amount of flexibility in the methods. The degree to which the different means were different from one another was rather considerable. The following independent-samples t test was carried out in order to compare the change in a student's score on a test of their understanding of physical science to their level of fluency in the English language. The abbreviation EF stands for "English Fluency," while EB refers to "English Beginning." The students in the EF group had a mean score of 4.82, with a standard deviation of 4.62, while the students in the EB group had a mean score of 3.31, with a standard deviation of 4.50 (t (150) = 2.02, p = 0.045). This indicates that the students in the EF group performed significantly better than those in the EB group. This suggests that the students who were assigned to the EF group had much higher levels of success than those who were assigned to the EB group. The magnitude of the differences between the means was modest (eta squared = 0.026), with the mean difference coming in at 1.50 and a 95% confidence range that extended from 0.032 to 2.98. The range of the differences between the means was as follows: Prior to the administration of the test, the students were given a rating on a scale that ranged from high (1) to moderate to bad (2) based on the level of performance that was anticipated from them on the exam[39-42]. This rating was based on the fact that the scale went from high (1) to moderate to bad (2). The children in the classrooms where there was a high level of implementation had significantly higher average scores (m = 4.29, SD = 4.90; t (105) = 2.17, p = 0.033) than the children in the classrooms where there was a moderate to low level of implementation (m = 3.10, SD = 3.57). This was demonstrated by the fact that the difference between the two groups was statistically significant. This was proved via the use of statistics by a difference that was statistically significant between the two groups in the t-test findings. There was not a significant difference in the size of the differences between the averages (eta squared = 0.025), with the mean difference coming in at 1.47 and a 95% confidence range that extended from 0.12 to 2.82. Moreover, the mean difference did not significantly differ from the average difference. In the case that you want further information on the descriptive data that is associated with these findings, kindly refer to Table 2 for assistance. In order to investigate the impact of these three independent variables measuring the implementation fidelity, English language fluency, and the instructional method model that was utilised in relation to STEAM and STEM-based approaches, a confirmatory three-way between-groups analysis of covariance (ANCOVA) was carried out. This ANCOVA was carried out in order to investigate the impact of these three independent variables. This was carried out so that an investigation of the influence of these three independent factors could be carried out. An analysis of covariance (ANCOVA) was performed on the data in order to assess the effect of these three independent variables on the outcome of the study. This was done in order to ensure that the risk of making a Type I mistake throughout the study could be effectively handled. The first thing that was done was a series of tests to see whether or not the assumptions of normality, linearity, homogeneity of variance, and trustworthy measurement of the covariate had been violated in any manner. These are the assumptions that were checked. It was determined whether or not the assumptions had been violated in any manner by conducting an investigation into them. The results of a number of preliminary tests, each of which was of a different sort, helped to confirm the accuracy of these presumptions. After making adjustments for the pretest scores that indicated prior understanding of physical science, there was no longer a statistically significant interaction impact between the amount of implementation fidelity, language fluency, and teaching strategy. It was discovered that there was no connection between the three components, which led to the discovery of this. [43]It emerged, when taking into consideration the results of the preliminary examination, that this was really the scenario. Despite this, there was a notable impact that was statistically significant for the STEAM/STEM order of instructional method: F (1, 143)=4.32, p=0.037, with a minor effect size (partial eta squared=0.03). The results of this study are shown in the following table. The findings of this research are shown in the table that can be seen below. It was found that this kind of effect took place for the STEAM/STEM teaching approach sequence. This impact was seen for the educational education strategy that was used. In addition, there was a major influence; nevertheless, from a statistical point of view, it was only moderately significant: The effect size was fairly minor, with a partial eta squared value of 0.024, and the F (1, 143) value was 3.45. The p value was 0.065. It was determined that being able to communicate in a number of different languages did not have a significant bearing on the outcome of the investigation.[44-48]

Table 2: Means analysis of implementation levels, English fluency and instructional method related to total change scores for physical science knowledge gained

Implementation fidelity	Language fluency	Instructional method	Mean	Std. deviation	
High implementation fidelity	English fluent	STEAM/STEM	733	4.48	21
		STEM/STEAM	3.48	507	25
		Total	524	5.13	46
	Emergent bilingual	STEAM/STEM	6.50	429	20
		STEM/STEAM	233	3.95	45
		Total	162	465	65
	Total	STEAM/STEM	6.93	4.64	41
		STEM/STEAM	2.74	438	70
		Total	429	4.90	1 1 1
Low to moderateimplememat ion fidelity	English fluent	STEAM/STEM	4.W	3.44	14
		STEM/STEAM	330	207	6
		Total	3.85	105	20
	Emergent bilingual	STEAM/STEM	503	3.46	5

		STEM/STEAM	136	181	16
		Total	238	194	21
	Total	STEAM/STEM	4.26	3.38	19
		STEM/STEAM	2.09	3.49	22
		Total	3.10	3.57	41
Total	English fluent	STEAM/STEM	6.03	437	35
		STEM/STEAM	3.48	4.61	31
		Total	482	4.62	66
	Emergent bilingual	STEAM/STEM	620	4.62	25
		STEM/STEAM	2.13	3.90	61
		Total	331	430	86
	Total	STEAM/STEM	608	4.44	60
		STEM/STEAM	259	4.18	92
		Total	3.97	4.60	152

"STEAM first order effect advantage" is the name given to the benefit that STEAMSTEM has in contrast to STEMSTEAM. [47]It is essential to keep in mind that the advantages of the first order effect of the STEAM curriculum trend differently for children enrolled in elementary and elementary biology courses with varying degrees of faithfulness, and this is something that should be kept in mind at all times. (1) The disparities in trend are not nearly as large in high-fidelity schools that are introducing life science as they are in other schools (EF 2.65, EB 3.61). The students who participated in EF courses had a mean change score of 7.29 for STEAM first, whereas the mean change score for STEM first was 4.64 (EF Mean Difference = 7.29–4.64 = 2.65) STEAM first It is possible to express the EF Mean Difference mathematically as 7.29 minus 4.64, which equals 2.65. On the other hand, students who were guided in classes by EB professors had a mean change score of 6.11 for STEAM first, but the mean change score for STEM first was just 2.5. (Difference from the EB Mean) (2) EF students exhibit a statistically significant decrease in their STEAM first order effect advantage (0.50), with the mean change score for STEAM first being 4.00 and the change score for STEM first being 3.50 (EF Mean Difference = 4.00–3.50 =0.50). On the other hand, EB students have not lost their relatively strong STEAM first order effect advantage (3.44), which can be seen from the fact that the mean change score for STEAM first is 5.00 as compared to the change value for STEM first. In life science classes where the degree of fidelity execution spans from moderate to low (3) The similar trend of a strong STEAM first order impact advantage for EF students (3.85) is shown in classrooms that teach physical science, especially in environments where the degree of fidelity implementation is high. The difference in mean change between STEMSTEAM and STEMSTEAM was (EF 7.33–3.48=3.85), in contrast to a low STEAM first order effect advantage (0.50), which was seen in classrooms with moderate to poor fidelity implementation (EF 4.00–3.50=0.50). STEMSTEAM and STEMSTEAM were both implemented with the same level of fidelity. While we do note that EB students continue to maintain their relatively high STEAM first order effect advantages in both high and lower fidelity implementations (4.17, 3.44), [49]we also note that in high implementing physical science classrooms, the difference in mean change between STEAMSTEM and STEMSTEAM was similar (6.50–2.33=4.17) compared to results (5.00–1.56=3.44) in moderate to low fidelity implementing classrooms. In other words, in high implementing physical science classrooms, the difference between In other words, in classes that have a high level of implementation of physical science, the gap between The results of classrooms where there is a high degree of application of physical science demonstrate that, to put it another way.[50]

4. Conclusion

According to the findings of the study, even though there is a growing interest in STEM (Science, Technology, Engineering, and Mathematics) education in Punjab, there is still a shortage of resources, teacher training, and infrastructure to support it. This is the case despite the fact that there is a growing interest in STEM education in Punjab. Despite the fact that there is a rising interest in STEM education in Punjab, this is the situation as it now stands. This is still the case despite the growing interest in STEM (science, technology, engineering, and mathematics) education. The educational establishments in Punjab are up against a variety of challenges, some of which include a lack of financial resources, the absence of a clearly defined regulatory framework, and a scarcity of qualified individuals to fill teaching positions. In addition, there is a lack of a clearly defined regulatory framework. This recommendation is included in the report of the study. If educational institutions in Punjab follow this course of action, they will be able to better prepare their students for the challenges that the 21st century will bring, as well as ensure that their pupils have the necessary skills for their futures, and this will allow the institutions to better prepare their students for the challenges that the 21st century will bring. If educational institutions in Punjab take this course of action, they will be able to better prepare their students for the challenges that the 21st century will bring.

Nevertheless, the extent of these gains was substantially bigger for EB students as compared to EF students. Even at moderate to low levels of teaching implementation fidelity, the STEAM first approach generated enhanced mean scores for the improvements in knowledge. The benefits for EF students are not particularly substantial in classrooms in which the implementation is carried out with a low level of faithfulness. On the other hand, the benefits for EB children are significant in classrooms in which the implementation is carried out with a high level of faithfulness. When high fidelity implementation is used in schools, it is beneficial for children who have EB as well as those who have EF. These advantages are substantial and comparable. In spite of this, even in classes with such a low degree of fidelity execution, the EB children were still able to get considerable advantages despite the poor implementation. This was the situation regardless of how poorly the installation was carried out.

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