# Effectiveness of 'STREAM based Learning Approach' on Achievement in Science of Elementary School Students

Kumari Sucheta
Research Scholar
Department of Teacher Education,
School of Education, CUSB, Gaya

**Abstract:- STREAM is the abbreviation of Science, Technology, Reading & (w)Riting, Engineering, Art and Mathematics. The purpose of this study is to determine the effect of the STREAM based learning approach on Achievement in Science. The study is based on quantitative research, in which the class seven students with two sections each with 40 students were selected. The Quasi Experimental design with the Non-Equivalent Control Group was used. From the obtained data, the mean, standard deviation, and critical ratio (t) were determined. There was a significant difference between the mean Achievement Test in Science scores of students who learnt using the traditional approach and students who learnt through the STREAM based learning approach, indicating that the study is valid. It can be stated that the STREAM based learning approach has a beneficial impact on academic achievement in science.**

*Keywords:- STEM, STEAM, STREAM, Achievement in Science.*

## I. INTRODUCTION

The world is constantly evolving, and so does its educational system, in order to meet the needs of students and the demands of society. The educational system in the twenty-first century has progressed from STEM to STEAM, and then to STREAM.

STEM, STEAM and STREAM education empower learners to be inventive pupils with critical thinking and problem-solving skills, which is crucial for future generations, from preschool to elementary school, middle school, and finally high school. STEM is an acronym for Science, Technology, Engineering, and Mathematics. STEAM is a combination of STEM with the letter A, which stands for Art. STREAM is a blend of STEAM and R, which comprises Reading and (w)Riting, with the goal of pupils having effective communication skills in order to tackle crucial challenges. The pool of information in today's rapidly changing society is far larger, the rate of its increase is faster, and social change is extraordinarily quick. The United States government legally coined the term STEM in 2001. In recent years, there has been a push to unite the letters 'A'-Arts to transform STEM into STEAM. The letters ``R'' for Reading and (w)Riting were then added to STEAM to encourage "STREAM". Reading, Writing, and the Arts all play an important role in the learning process. STEM is present in all aspects of a pupil's lives. Engineering is the basic design of buildings and structures and also faces the challenges of changing the world, as Science is present everywhere in the world and Technology is endlessly increasing into every aspect of life. Mathematics is a fascinating subject. Modified projects began with the purpose of better integrating Engineering and Technology with traditional Mathematics. The purpose of modified projects have been used to integrate Engineering and Technology into traditional Maths and Science curricula (National Science Board 2007). STEAM mixes "Arts" to STEM with the aspects to encourage students to think creatively, innovatively, and critically". STEAM-centered teaching and learning aims to educate students with the world's difficulties through inventive, creative, critical thinking, cooperation, and effective communication in light of new information" (Quigley & Herro, 2016). Arts education is unquestionably important for the development of the creativity that underpins innovation. "Innovation is required to develop advanced industries in the future, which provides a foundation for long-term economic prosperity" (Sochacka et al., 2016). STREAM is created by combining STEAM Reading and Writing with the assurance that students have mastered the skill of effective communication, which is an important aspect of social interactions. STREAM provides a well-rounded learning experience by incorporating these skills into the current STEAM education system by making Reading and Writing a core element of gaining new knowledge. Language is basic and important to Science. "Science literacy enables learners to build their knowledge of Science and to do and communicate science" (Yore et al., 2003). For example, knowing how to read and write scientific texts and diagrams aids learner's comprehension of challenging scientific topics and procedures. Even when the meaning of technical terminology is not well understood, reading is a crucial element of "doing science". Mallow (1991) suggested that evaluating scientists' texts and reading approaches might yield a lot of information. Writing, in other words, makes sense of our experience by connecting the three major senses of doing-hand, depicting-eye, and representing-brain" (Emig, 1977). Encouragement of "science learning is based on generating an informed and capable populace for participation in a democracy," according to De Boer, 2000, with critical thinking as the primary goal. achievement on Science education and positive attitudes toward Science constitutes a crucial challenge for formal education.

## II. RATIONALE OF THE STUDY

Science education is vital since it is crucial in motivating pupils to pursue technology occupations that are regarded as necessary in modern cultures in order to meet scientific development issues. STEAM is the merger of five disciplines (Science, Technology, Engineering, Arts, and Mathematics), in which Science is the acquisition of knowledge via observation and experimentation (Martinez, 2017). According to Awang et al., (2020), Science teaches students to be investigators who seek out and analyze information. According to several academics, Science teaches children to be sensitive as well as critical and creative thinkers (Awang et al., 2020; Martinez, 2017; Munawar et al., 2019). STREAM with the combination of 'R' focuses on Reading & Writing. Writing to learn gives opportunity for learners to reason and reflect critically about the significance of data collected in laboratory activity," according to Keys (1999). "It was advised that students write laboratory reports in their own language and style to boost their own knowledge growth and contribute to positive attitudes toward the assignment" (Lazarowitz & Tamir, 1994, cited in Hofstein & Mamlok-Naaman, 2007). Writing is "not only evidence of student learning, knowledge, and engagement with scientific inquiry, but also represents the means by which students communicate with various readerships, their understanding of, and commitment to this form of inquiry" (Hand, Prain, Lawrence, & Yore, 1999, cited in Hohenshell, 2004).Norris and Phillips (2003) referred to Reading and Writing about Science content as the "fundamental sense," and being knowledgeable about Science as the "derived sense" of scientific literacy, emphasizing the role of "language development beyond memorization of the science vocabulary" in their conception. Similarly, the National Science Education Standards emphasize knowledge and comprehension of science and technology as it relates to the natural world, so that learners can apply what they've learned to their own lives. Hand, Prain, Lawrence, & Yore, 1999; NRC, 1996; Rutherford & Ahlgren, 1990 cited from Hohenshell, 2004) have pointed to a focus on students' ability to think critically about multiple scientific processes and make inferences about results obtained from actively participating in investigations.

## III. OBJECTIVE AND HYPOTHESIS

The STREAM based learning approach is being researched on a global scale, but these topics need to be investigated in the Indian educational system. As a result, the study question that needs to be answered is: Does the STREAM based learning approach affect Achievement in Science of Elementary School students? The objective of this study is to see how the STREAM based learning approach effects on Achievement in Science of Elementary School students To accomplish this objective, the research hypothesis was written as follows: "There is an influence of STREAM based learning approach on Academic Achievement in Science of Elementary School students." Because it is unable to evaluate the research hypothesis statistically, the null hypothesis was formulated as follows:

The STREAM based learning approach has no effect on Achievement in Science of Elementary School Students. An intervention programme based on the STREAM based learning approach for class VII in Science was prepared to achieve this objective.

## IV. RESEARCH METHODOLOGY

Quantitative research is the type of investigation proposed. The Quasi-Experimental Design uses a Non-Equivalent Control Group Design. One experimental group and one control group were used in a non-equivalent control group design. The experimental group received instruction using the STEAM based learning approach, while the control group received instruction using the traditional approach.

| Experimental Group | Control Group |
|---|---|
| O1 X O2 | O3 C O4 |

Table 1: The pre-test post-test non-equivalent groups design:

Where,
O1 and O3= Pre-test Scores         O2 and O4 = Post-test Scores
X: Experimental Group         C: Control Group.

Government Middle School in Tekari, Gaya, Bihar was chosen for this study since it was convenient. For data collection, all seventh-grade students were divided into two parts, one of which was assigned as an experimental group and the other as a control group at random. The information was gathered using the self-developed tool 'Achievement in Science Test' for Academic Achievement in Science. Before being utilized for data collection, this test was evaluated for reliability and validity. The intervention programme for class VII was prepared using the STREAM based learning approach and consists primarily of STREAM-based projects. Each project is based on real-world problems that students have solved. Students developed projects based on these answers, tested their viability, and finally gave their presentations in classrooms.

## V. CONCLUSION AND DISCUSSION

The experimental group was given three STREAM based learning approaches, whereas the control group was taught using a traditional approach. To overcome the different dilemmas posed in rural areas, students prepared Garden in school campus in the first project. In the second project, students created various models of clay by determining the water absorption of soil which was affecting the growth of the plants in the garden prepared by them. To combat the problem of boredom after a pandemic situation a picnic trip was arranged for which different bags were prepared from waste materials to carry the snacks for the picnic.

| t-Test | | |
|---|---|---|
| **Achievement in Science** | **Post Test- Control Group** | **Post Test- Experimental Group** |
| **Mean** | 9.5 | 34.55 |
| **Variance** | 9.487179487 | 75.22820513 |
| **Observations** | 40 | 40 |
| **Hypothesised Mean Difference** | 0 | |
| **df** | 48 | |
| **t Stat** | -17.21300054 | |
| **P(T<=t) one-tail** | 0 | |
| **t Critical one-tail** | 1.677224138 | |
| **P(T<=t) two-tail** | 0 | |
| **t Critical two-tail** | 2.010634722 | |

Table I: Critical Ratio (t) Table for scoring Academic Achievement in Science

After the collection of data from the sample, it was analyzed through Mean, Standard Deviation, and the Critical ratio (t). The collected data has been put in tabular form in table I. With reference to Objective and Null Hypothesis (H0), it was found with df= 48 ,the calculated value of t is 17.21 which is greater than the table value (1.99) at 0.05 level of significance. So the test statistic t is significant at 0.05 level. Hence the null hypothesis is rejected and the research hypothesis is accepted. Thus it can be concluded that there is a significant difference between the mean scores of Achievement in Science of the learners learnt by traditional method and learners learnt by STREAM based learning approach which is clearly shown in graph in Figure below . It was found that the learners learned by STREAM based learning approach scored higher marks in the Achievement Test in Science .Therefore it is concluded that the STREAM based learning approach enhances Achievement in Science of learners.

## VI. TRADITIONAL VS STREAM
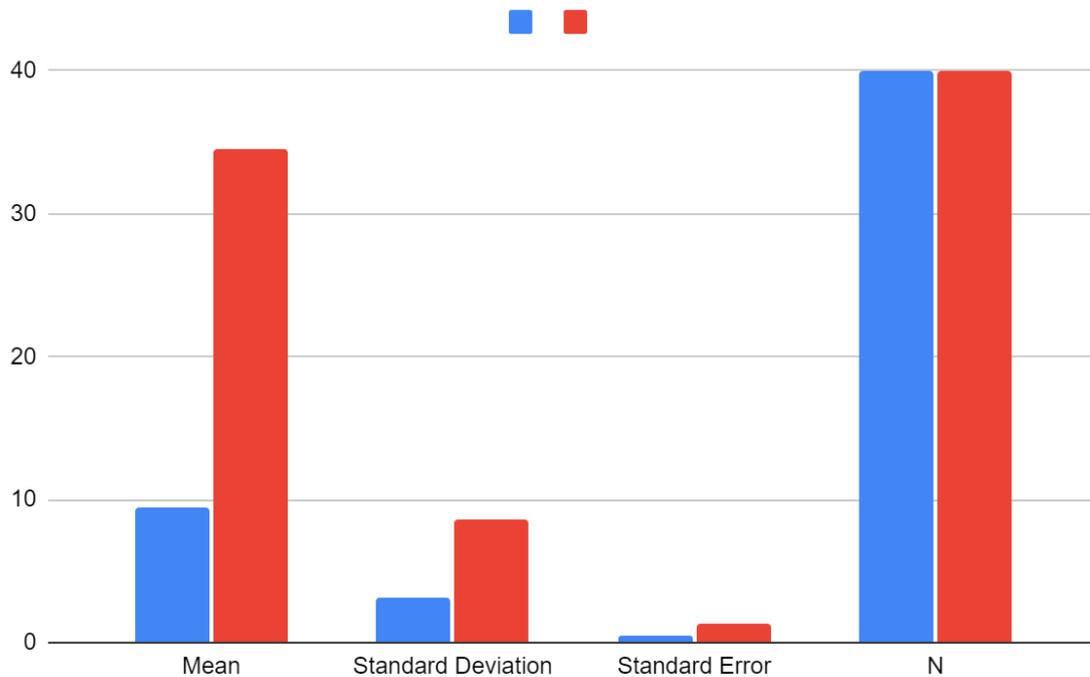


Graph 1

## VII. CONCLUSION

The study findings clearly suggest that the STREAM based learning approach may be applied in the teaching-learning process at the Elementary level. The students become active participants in the learning process as a result of project-based learning, and they realize that Science underpins everything we do in our daily lives. It encourages students to be inquisitive, creative, and critical thinkers, as well as problem solvers, excellent communicators, and collaborators. It also offers learners a positive picture of this learning technique and encourages them to be responsible, tolerant, sensitive, and environmentally conscious. This research provides teachers with information on how to implement this learning strategy. However, because this study was conducted on a limited scale, more research on a larger size is required.

## REFERENCES

[1.] 12 Ways to Integrate Science and Art. (2015, July 17). Art Class Curator. https://artclasscurator.com/12-ways-to-integrate-science-and- art- activities/

[2.] admin. (n.d.-b). What is STREAM Education? – Durian Square. from https://duriansquare.com/what-is- stream-education/

[3.] Anoop. (2019, August 12). What makes STREAM based education vital in today's world? Vidsancharterhouse. https://vidsancharterhouse.com/what-makes-stream-based-education-vital-in-today's-world/

[4.] Art-integrated science lessons make some students 'learn at 105%', new study finds. (n.d.) from https://www.zmescience.com/science/art integrated-science-lessons- make-some-students-learn-at-105-new-study-finds/

[5.] Ata Aktürk, A., &Demircan, O. (2017). A Review of Studies on STEM and STEAM Education in Early Childhood. Journal of Kırsehir Education Faculty (JKEF 18, 757–776).

[6.] Bertrand, M. G. (n.d.). STEAM Education in Ontario, Canada: A Case Study on the Curriculum and Instructional Models of Four K-8 STEAM Programs.

[7.] Corlu, S., Capraro, R., & Capraro, M. (2014). Introducing STEM Education: Implications for Educating Our Teachers for the Age of Innovation. Eğitimve Bilim, 39, 74–85.

[8.] Creswell, J. W. (2014). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (4th ed.). Thousand Oaks, CA: Sage.

[9.] Danah Henriksen(2014) Full STEAM Ahead: Creativity in Excellent STEM TeachingPractices.(n.d.).from https://www.researchgate.net/publication

[10.] DeBoer, G.E. (2000). Scientific literacy: Another look at its historical and contemporary meanings and its relationship to science education reform https://web.nmsu.edu/~susanbro/eced440/docs/scientific_literacy_another_look.pdf

[11.] Debroy, A. (n.d.). What is STREAM Education & Why is It Gaining Popularity? EdTech Review. Retrieved April 18, 2020, from https://edtechreview.in/trends-insights/insights/2968-what-is-stream- education

[12.] Emig, J. (1977). Writing as a Mode of Learning. College Composition and Communication, 28(2), 122–128. https://doi.org/10.2307/356095

[13.] Ewing, R. (n.d.). The difference between STEM, STEAM and STREA education | Bricks 4 Kidz—Kids Franchise. Retrieved January 20, 2021, from https://www.bricks4kidz.com/blog/beyond-stem-integrating-a-multidisciplinary-approach/

[14.] From STEM to STEAM to STREAM: WRiting as an Essential Component of Science Education. (n.d.). Psychology Today. Retrieved April 20, 2020, from http://www.psychologytoday.com/blog/imagine/201103/stem-steam- stream-writing-essential-component-science-education

[15.] Galbraith, D. (1999). Writing as a knowledge-constituting process. Division of Psychology, Staffordshire University, UK

[16.] Herro, D., & Quigley, C. (2016). On the Horizon Innovating with STEAM in middle school classrooms: Remixing education Article information: For Authors. *On the Horizon*, *24*. https://doi.org/10.1108/OTH-03-2016-0008

[17.] Hohenshell, L. M. (2004). Enhancing science literacy through implementation of writing-to-learn strategies: Exploratory studies in high school biology (p.6090673) [Doctor of Philosophy, Iowa State University, Digital Repository]. https://doi.org/10.31274/rtd-180813-8816

[18.] Holliday, W., Yore, L., & Alvermann, D. (1994).The Reading-Science Learning-Writing Connection: Breakthroughs, barrier promises. Journal of Research in Science Teaching, 31, 877-893. https://doi.org/10.1002/tea.3660310905

[19.] International Conference on Integration of STEAM in School Education 2021. (n.d.). *MY SCIENCE MY SOCIETY*. Retrieved April 8, 2021, from http://www.mysciencevision.com/2021/01/international- conference-on-integration.html

[20.] Innovates, D. (2019, October 11). STEM, STEAM, STREAM: 'The World Doesn't Work Without Technology Anymore, Nothing Does.' » Dallas Innovates. Dallas Innovates. https://dallasinnovates.com/stem-steam-stream-the-world-doesnt-work-without-technology-anymore-nothing-does/Introduction to STREAM (Science, Technology, Reading, Engineering, Art, and Math) education | San Diego STEM Ecosystem. (n.d.). Retrieved April 20, 2020, from https://www.sdstemecosystem.org/find-opportunities/introduction-stream-science-technology-reading-engineering-art-and-math

[21.] Kelley, T., & Knowles, J. (2016). A conceptual framework for integrated STEM education. International Journal of STEM

Education, 3. https://doi.org/10.1186/s40594-016-0046-z

[22.] Kim and Chae—2016—The Development and Application of a STEAM Program.pdf. (n.d.). Retrieved April 2, 2021, from https://www.ejmste.com/download/the-development-and-application-of-a-steam-program-based-on-traditional-korean-culture-4581.pdf

[23.] Klucevsek, K. (2017). The Intersection of Information and Science Literacy. Communications in Information Literacy, 11(2), 354–365. https://doi.org/10.15760/comminfolit.2017.11.2.7

[24.] Literacy in Science | Minnesota STEM Teacher Center. (n.d.). Retrieved January 27, 2021, from https://stemtc.scimathmn.org/literacy- science

[25.] Liu—Beyond Science Literacy Science and the Public.pdf. (n.d.). Retrieved April 2, 2021, from https://files.eric.ed.gov/fulltext/EJ884399.pdf

[26.] Mallow, J.V. (1991). Reading science. Journal of Reading, 34(5), 324-338.

[27.] Margot, K. C., & Kettler, T. (2019). Teachers' perception of STEM integration and education: A systematic literature review. International Journal of STEM Education, 6(1), 2. https://doi.org/10.1186/s40594-018-0151-2

[28.] Martin Jennifer :Why I use STEM, not STEAM or STREAM in Education? (n.d.). Retrieved April 20, 2020, from https://www.linkedin.com/pulse/why-i-use-stem-steam- stream- education

[29.] Martinez, J. E. (2017). The Search for Method in STEAM Education. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-319-55822-6

[30.] Munawar, M., Roshayanti, F., & Sugiyanti, S. (2019). Implementation of STEAM-based Early Childhood Education Learning in Semarang City. CERIA, 2(5), 276-285. https://doi.org/10.22460/ceria.v2i5.p276-285

[31.] Norris, S. P., & Phillips, L. M. (2003). How literacy in its fundamental sense is central to scientific literacy. Science Education, 224–240. https://doi.org/10.1002/sce.10066

[32.] Prain, V., & Waldrip, B. (2010). Representing Science Literacies: An Introduction. Research in Science Education, 40(1), 1-3. https://doi.org/10.1007/s11165-009-9153-x

[33.] Reading and Science | Reading to Learn in Science. (n.d.). Retrieved January 26, 2021, from https://www.serpinstitute.org/reading-science/reading-and- science-education

[34.] Reading and Writing in the STEM Subjects. (n.d.). A-State Online. Retrieved January 27, 2021, from https://degree.astate.edu/articles/k-12-education/reading-and-writing-stem-subjects.aspx

[35.] Reading, Writing, and Comprehending-Encouraging Active Reading in the Science Classroom.pdf. (n.d.). Retrieved January 27, 2021, from https://www.caboces.org/sites/default/files/mst/Reading%20in%20Science/Reading,%20Writing,%20and%20Comprehending-

%20Active%20Reading%20in%20the%20Science%20Classroom.pdf

[36.] Response: Ways to Integrate Writing into Science Classes (Opinion). (n.d.). Retrieved January 27, 2021, from https://www.edweek.org/teaching-learning/opinion-response-ways-to-integrate-writing-into-science-classes/2018/04

[37.] Root-bernstein, R., & Root-bernstein, M. (n.d.). Intuitive Tools for Innovative Thinking.

[38.] Sahin, A., Ayar, M., & Adiguzel, T. (2014). STEM Related After-School Program Activities and Associated Outcomes on Student Learning. Educational Sciences: Theory and Practice, 14, 309–322. https://doi.org/10.12738/estp.2014.1.1876

[39.] Sanders.istem.ed.ttt.istem.ed.def.pdf.(n.d.-a).Retrieved April 2, 2021, https://www.teachmeteamwork.com/files/sanders.istem.ed.ttt.istem.ed.def.pdf

[40.] Strauss, V. (2012, June 14). How to integrate literacy with STEM. Washington Post. https://www.washingtonpost.com/blogs/answer-sheet/post/how-to-integrate-literacy-with-stem/2012/06/13/gJQAX2DGbV_blog.html

[41.] STREAM Education. (n.d.-b). Blessed Sacrament School. Retrieved April 19, 2020, from http://school.blessedsacrament.org/stream-education Pietrowski Amy The Differences of STEM vs. STEAM Education (and the Rise of STREAM) | EdTech Magazine. (n.d.). Retrieved April 20, 2020, from https://edtechmagazine.com/k12/article/2017/08/history-stem-vs-steam- education-and-rise-stream

[42.] Trends in learning: STEM, STEAM, STREAM... A battle of acronyms? (2018, July 30). CApStAn. https://www.capstan.be/trends-in-learning-stem-steam-stream-a-battle-of-acronyms/

[43.] What Is STEM Education ? (AND STEAM, and STREAM? ) - Tinker.ly. (2019, December6). Tinkerly. https://tinker.ly/the-difference-between-stem-steam-and-stream/

[44.] Yakman, G. (2008). STEAM Education: An overview of creating a model of integrative education.

[45.] Yore, L., & Treagust, D. (2006). Current Realities and Future Possibilities: Language and science literacy—empowering research and informing instruction. International Journal of Science Education, 28, 291-314020291. https://doi.org/10.1080/09500690500336973