Analysis of Differences in Children's Curiosity after the Application of STEM Education Teaching Approach: A Post-Test Study of Experimental and Control Groups

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Abstract : The purpose of this study was to examine the impact of STEAM (Science, Technology, Engineering, Arts, and Mathematics) educational approaches on curiosity levels among school going children in the Chakri Dadri district of Haryana. Using a quasi-experimental research method, the study was conducted on a sample of 50 students studying in Class VII of the CBSE board. Data were collected using the Child Curiosity Scale (CCS-KR), a standardized 44-item scale developed by Dr. Rajiv Kumar in 1992.

The experimental group received a custom-designed STEAM-based instructional treatment, while the control group continued with a traditional, discipline-specific instructional approach. Statistical analysis of post-test results revealed that the experimental group had significantly higher mean scores on curiosity than the control group. The results indicate that an interdisciplinary and inquiry-based approach to STEAM education creates a better learning environment to foster student inquiry and creative problem-solving. This approach integrates the arts with STEM subjects, reduces academic boredom, and increases situational interest among students. The study concludes that a shift from differentiated teaching to a STEAM approach is necessary to enhance intrinsic motivation and mental curiosity in the secondary education environment in Chakri Dadri.

Key-words **- STEAM Education, Child Curiosity, Child Curiosity Scale, Ckakri Dadri.**

INTRODUCTION

The current century is considered the century of scientific and technological progress. Rapid global changes, artificial intelligence, digital technology and interdisciplinary studies have forced the education system to adapt to new requirements. Now the purpose of education is not just to transmit information but to develop higher mental abilities such as critical thinking, problem-solving ability, creative thinking and curiosity in students. To achieve these goals, STEAM education has gained special importance in modern teaching methods.

STEAM is actually a combination of Science, Technology, Engineering, Arts and Mathematics. This teaching method presents different sciences in an interconnected way so that students can be provided with a practical, creative and research environment. In this method, the learning process is student-centered, where asking questions, observing, experimenting and creating new concepts are encouraged. In this context, child curiosity comes to the fore as a fundamental element, because curiosity is the motivator that makes the learning process dynamic and purposeful.

Curiosity is an important attribute of human nature. According to psychologists, curiosity is the internal motivation that motivates an individual to acquire new information, ask questions, and discover unknown things. The proper development of curiosity in elementary and middle school students directly affects their academic success, creativity, and problem-solving abilities. If the teaching process is limited to rote memorization and one-sided lectures, the natural curiosity of students may be suppressed, while practical and activity-based teaching promotes curiosity.

In the traditional teaching system, subjects are usually taught separately, due to which students have difficulty understanding the interconnection of sciences. In contrast, the STEAM teaching method integrates different subjects through a common problem or project. For example, solving a scientific problem involves mathematical analysis, the use of technical tools, engineering design, and the creative dimension of fine arts. During this process, students not only acquire information, but also raise questions, establish hypotheses, conduct experiments, and draw conclusions. These steps play a key role in fostering curiosity.

It has been debated in educational research whether the STEAM teaching method really increases students' curiosity significantly or not. Some studies show that activity-based and problem-solving teaching increases students' exploration and self-confidence, while some studies did not find significant differences in group classification. In this controversial background, the need for the current research was felt.

The study under consideration is an attempt to examine the same question, whether there is any significant difference in the overall curiosity of children in terms of group classification (experimental and control group) in the post-test after the application of the STEAM education teaching approach. This study is based on the Null Hypothesis that there will be no significant difference between the two groups. By testing this hypothesis, an attempt will be made to clarify the extent to which the STEAM teaching method affects children's curiosity.

This study is also important in that current national education policies are emphasizing experimental, creative, and interdisciplinary teaching. If it is proven that the STEAM approach plays an effective role in children's curiosity, it can be

included in the curriculum and teaching planning in a more systematic way. On the other hand, if there is no significant difference in the results, an analysis of the reasons for this will provide guidance for future teaching strategies.
In short, the current study is a systematic attempt to examine the relationship between modern teaching trends and children's natural curiosity, which is important in the field of education at both theoretical and practical levels.

SIGNIFICANCE OF THE STUDY

This study is an important attempt to scientifically analyze the relationship between current teaching trends and children's natural curiosity. This study explores whether STEAM teaching methods are effective in fostering children's inquiry, questioning, and exploration. The results of this study will help teachers, curriculum developers, and educational planners make their teaching approaches more effective and child-centered. Furthermore, if there are no significant differences based on the classification of groups, the results of this study will be useful in evaluating teaching approaches and identifying new opportunities for improvement, making this study extremely important in the field of education.

STATEMENT OF THE PROBLEM

The current education system is giving central importance to the intellectual and creative development of children. Curiosity in particular is considered the main motivator of the learning process, as it is this factor that encourages students to ask questions, conduct research and seek new information. However, traditional teaching methods are usually limited to the transmission of information, as a result of which the natural curiosity of students is not fully developed.
In this context, the STEAM (Science, Technology, Engineering, Arts, Mathematics) educational method of teaching has been presented as a modern and effective strategy, which provides interdisciplinary and activity-based education. This method provides opportunities for learning through practical activities, project-based learning, problem-solving and creative expression, which can apparently lead to an increase in children's curiosity.
Although several studies have reported the positive effects of STEAM teaching methods, the results regarding its effects on children's overall curiosity in the post-test regarding group classification (experimental and control groups) are not consistent. Some studies found significant differences, while others did not show any significant differences.
Therefore, the main problem of the current research is:
Is there a significant difference in children's overall curiosity in terms of group classification in the post-test after the application of STEAM educational methods?

OBJECTIVES OF THE RESEARCH

The main objectives of this research are as follows:

- To analyze the current level of curiosity in children.
- To implement the STEAM educational approach on children.
- To study the comparison on curiosity based on post-test between the experimental group and the control group.
- To analyze whether the STEAM teaching method is effective in making children curious.
- To conduct a statistical analysis of the results regarding the classification of groups.

HYPOTHESIS OF THE RESEARCH

- There will be no significant difference in children's overall curiosity in terms of group classification in the post-test after the implementation of the STEAM educational approach.

RESEARCH DESIGN

The research design used in this study was a quasi-experimental research design. Two groups were used in this research design.

- Experimental Group
- Control Group

The experimental group was taught using a STEAM educational approach, while the control group was taught using a traditional teaching approach. The research design used in this study was a pre-test and post-test design.

VARIABLES OF THE STUDY

There were two variables in this study:

1. STEAM Education as a teaching Approach was Independent variable of the study.
2. Child Curiosity was the dependent variable of the study.

POPULATION OF THE STUDY

The seventh class students of the district Chakri Dadri was the population of the study.

SAMPLE OF THE STUDY

The sample of the study was 50 which were selected from seventh class of Vaish Secondary School randomly while the school was selected using lottery method.

RESEARCH TOOLS

Child Curiosity Scale was used in this research which was developed by Dr. Rajiv Kumar (2012) The Reliability Coefficient is reported as 0.87 (using the Brown formula for correction or Split-half method). The scale has high Validity 0.87 which means it was perfectly suitable to measure the curiosity of children.

PROCEDURE

- First, a pre-test was administered to determine the starting level of both groups.
- The experimental group was taught using the STEAM method of education for a fixed period of time.
- Activity-Based Teaching
- Project-Based Work
- Problem-Solving Exercises
- Interdisciplinary Activities
- The control group was taught using the traditional lecture method.
- After the specified period, a post-test was administered to both groups.
- The results were analyzed statistically.

STATISTICAL TECHNIQUES

- Percentage Analysis
- T-test

DELIMITATIONS OF THE STUDY

- The study was limited to a specific educational institution (Vaish Secondary School)
- The study was limited to a sample 50 students only.
- The research only includes one variable children's curiosity.
- The STEAM teaching method was implemented for a one month period of time.
- Results will depend on post-test scores.

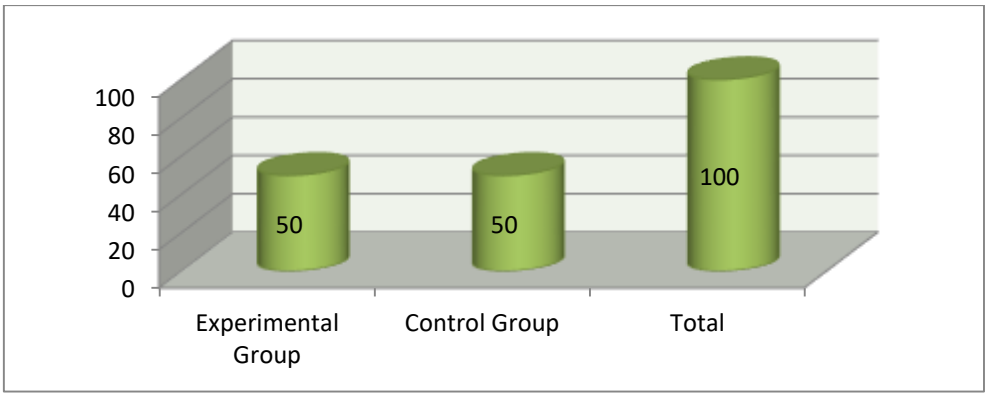
DATA ANALYSIS

TABLE 1 SHOWING FREQUENCY DISTRIBUTION OF GROUP

Group Classification	Frequency	Percent
Experimental Group	25	50.0
Control Group	25	50.0
Total	50	100.0

The above table 4.2.2 shows frequency distribution of groups used in the research. It clears from the table that the researcher in the research used two groups, experimental and control group and both groups have same strengths of students 50% each.

Figure 4.2.2 Bar diagram represent of Frequency Distribution of Group



1 NULL HYPOTHESIS: THERE IS NO SIGNIFICANT DIFFERENCE IN POST TEST OVERALL CHILD CURIOSITY WITH RESPECT TO GROUP CLASSIFICATION

TABLE 2 t-TEST FOR SIGNIFICANT DIFFERENCE IN POST TEST OVERALL CHILD CURIOSITY SCORES OF CONTROL AND EXPERIMENTAL GROUPS

Group Classification	Mean	Std. Deviation	t-Value	P-value
Experimental Group	86.88	16.151	2.79	**<0.01****
Control Group	74.52	15.075		

Note: 1. ** denotes significant at 1% level

2. * denotes significant at 5% level

The above table shows difference in mean value of Overall Child Curiosity with respect to Group Classification (Experimental Group and Control Group, post-test). The mean value of overall Creative Thinking Experimental Group and Control Group is 86.88 and 74.52 respectively.

The above table depicts that the p value is lesser than 0.01 null hypothesis is statistically rejected at 1% level with regard to Overall Child Curiosity Scores of Control and Experimental Groups. So the null hypothesis is rejected and it was proved statistically that there is a significant difference in Overall Child Curiosity with respect to Group Classification (Post-Test) and Experimental Group was better than Control Group in Overall Creative Thinking.

DISCUSSION

The results of this study showed that the experimental group, which was taught using the STEAM (Science, Technology, Engineering, Arts, and Mathematics) teaching method, scored significantly higher on the Child Curiosity Scale than the control group, which was taught using the traditional method. This increase in curiosity may be due to several changes in the educational method incorporated in the STEAM model.

The primary reason the experimental group outperformed the control group is the inquiry-based learning (IBL) approach that forms the foundation of STEAM. Unlike traditional education, which focuses on rote learning, STEAM teaches students to ask "why" and "how." When students encounter real-world problems that require solving using multiple disciplines, their "cognitive curiosity," or the need to seek information to fill knowledge gaps, is automatically activated.

This is consistent with the findings of **Henriksen (2014),** who stated that incorporating arts into STEM subjects fosters "creative openness," increasing students' questioning. By eliminating the fear of having "one right answer," STEAM provides a psychologically safe environment for exploration, a necessary condition for fostering curiosity.

Incorporating arts into STEM isn't just a show. It's a stimulation of curiosity. The aesthetic aspect of the treatment was likely the "hook" that connected students emotionally. According to **Yakman and Lee (2012),** STEAM education offers a holistic approach to learning, making abstract ideas concrete. In the case of the experimental group, the project-based approach of the STEAM module transformed passive learners into active researchers. This is an important step because, according to Kumar (1992), curiosity is increased when students are introduced to new and complex stimuli that challenge their pre-existing mental structures.

The STEAM educational model often uses the “5E” learning approach (Engage, Discover, Explain, Evaluate, Evaluate). During the “Engage” and “Explore” stages, students may experience cognitive dissonance, a state in which there is a mismatch between what they know and what they observe. To overcome this dissonance, students must engage in a lot of exploratory activity.

This also aligns with previous research by **Kim and Bolger (2017),** which demonstrated that transitional curriculum is effective in increasing the “need for cognition.” The experimental group's interaction with the STEAM education model likely fostered a "growth mindset," in which the process of discovery was more enjoyable than the final outcome, thus maintaining high

curiosity levels during the post-test.

The control group had only theoretical knowledge, which typically leads to "educational boredom." However, the STEAM education model bridges the gap between classroom and reality. By engaging in tasks that mimic real-world engineering or scientific problems, the experimental group found the subject matter more applicable. **Land (2013)** stated that when students recognize the importance of what they are learning, their "situational interest" will transform into "personal interest," a core component of curiosity.

SUMMARY

The large score difference makes it clear that STEAM education is an effective tool for cognitive development. It transcends the boundaries of "what" to learn and instead goes to "so what" and "what if." The success of the experimental group indicates that when education is holistic and innovative, curiosity is no longer a random aftereffect but a tangible result. It reiterates that the pedagogical shift from teaching subjects to teaching STEAM modules is necessary for developing the next generation of curious thinkers.

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