



## **Study of Academic Achievement and Scientific Creativity in Relation to Gender**

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### **ABSTRACT**

Achievement tests are typically used to decide the level of dominance of subjects. Academic achievement is related to the acquisition of principles and generalizations and the ability to perform objectives, efficiently certain manipulations, symbols and ideas. Scientific creativity is the higher order intelligence that helps a person to translate ideas into practical actions. Scientific creativity enhances the problem solving capacity and critical thinking of learners. Scientific creativity includes processes that promote planning, producing and generating original scientific contributions. A sample of 100 secondary school students from Amritsar city were selected. Verbal Test of Scientific Creativity was used. This paper focusses on the relationship of academic achievement and scientific creativity in relation to gender. The results showed a significant relationship of academic achievement and scientific creativity in relation to gender.

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### **Introduction**

The term academic achievement is defined as the sum of achievements in all subjects. It is obtained by adding the results which are obtained by the students in all subjects during the final examination. Singh et al. (2007) found that "Academic achievement is related to the acquisition of principles and generalizations and the ability to perform objectives, efficiently certain manipulations, symbols and ideas." Achievement tests are typically used to decide the level of dominance of subjects. Scores on insight test helps to enhance mental capacity. It further helps to measure their achievement.

Factors affecting Students' Academic Achievement:

There are many obstacles and problems that students face during their school life. It is observed that academic achievement seems to be decline during the early years of adolescent. There are several measures and variables that influence pupils' academic achievement such as family, socio-demographics, student's belief about learning, goals of the learning, support of the parents, attitudes of peers, teacher student's interaction, and the content of curriculum (Leondari & Gialamas, 2002).

- Student's Age and Gender

Many researchers found that the students age and gender have positive association on academic achievement. It was also revealed in couple of the researches that girls achieve academically better than boys (Farooq et al., 2011; Jabbar et al., 2011). Udida et al. (2012) found that boys can achieve academically slightly better than girls.

- Educational level of parents, size of family and the Income of family

Another factor of the academic achievement is educational level of both parents, the family income and size of the family (Juma et al., 2012; Udida et al., 2012). Many researchers were supported that there was direct association of educational level of both parents, the family income and size of the family on academic achievement. While some researchers have found that poor academic achievement was reported in the students of large size family than small (Juma et al., 2012).

- Student's Beliefs about Learning & their Goal Orientation

The belief of the students also has direct association on the student's learning abilities. Student's beliefs help them to see the world and understand new encounters. Academic self-efficacy beliefs help students to concentrate and do well in school (Bandura, 1986). Schools have importance and helps students to achieve best and fulfill all their needs. The school administration and staff should foster positive attitude towards learning. Majority of the studies found that self-respect or self-worth and hopefulness had negative impact on academic achievement (Ciarrochi et al., 2007). Many educationalists and psychologists found that the student's educational progress also depends upon the achievement goals. This successful completion of the goals helps to motivate the people to do well in the future and enhance their capabilities.

- Parental Support of their Children's learning

Parent's support is considered as the most valuable part in assessing the achievement of the students. Family cohesion and family relations are found to be most important factors in assessing academic level of the students. Less parental support in the education will lead to less academic achievement (Boon, 2007). Findings of the many researches have supported that parenting style have great association with pupil's level of achievement. An authoritative style of parents found to have high academic achievement among students. Child rearing style is also found to have direct association with the academic achievement of the students. Negligence in child rearing practices lead to low academic achievement among students.

- Peers Attitudes towards Learning

Peer attitude towards learning also have direct impact on academic achievement of the students. Buote (2002) found that there was a positive relationship between academic accomplishment of the pupils and their companions. Rejection from their companions also lead to failure in the classes. There are various mechanisms such as reinforcement and direct teaching among the peers which motivate them for good academic achievement. It helps them to acquire social competencies. It makes them skillful and free from violence. Many researchers found that if peers are disruptive in school, then students become disruptive too. And if peers have high grades, students can also have high grades.

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## Scientific Creativity

The creativity is the ability to go beyond the given facts to generate original and thought-provoking ideas. Thus, creativity is the higher order intelligence that helps a person to translate ideas into practical actions. Guilford (1956) presented the intellectual factors of creativity on his investigations. These are:

- Fluency (word fluency, ideational fluency, associational fluency and expressional fluency)
- Flexibility
- Originality
- Elaboration
- Redefinition
- Sensitivity to problems

Thus, many factors of intelligence and creativity overlap each other and these are interdependent also. Scientific Creativity thus has emerged as an independent field of creativity research. Creative people in science are problem searchers and problem solvers. Scientific creativity enhances the problem solving capacity and critical thinking of learners. Scientific creativity includes processes that promote planning, producing and generating original scientific contributions.

Characteristics of academic achievement and scientific creative people:

- Ability to keep many ideas in focus at a time.
- Independence of judgment.
- Preference for complex phenomena.
- Self-assertiveness.
- High energy level.
- Lack of inhibitions and freedom of fantasy.
- Curious in nature.
- Willing to risk.
- Unwilling to accept things as they appear.
- Visionary and optimistic.
- Make use of intuitiveness

Scientific creativity can be investigated through five basic cognitive and computational concepts. These are:

- 1) Motivation for scientific research.
- 2) Ability to correctly formulate research problems within a body of knowledge.
- 3) Ability to create a comprehensive arch space for the solution of a scientific problem.
- 4) Ability to assemble (induce) and implement of heuristics to reduce the search space.

5) Patience and stamina for the exhaustive search for solving the scientific problem within the constrained search space.

Duman (2010) investigated the effects of Brain-based learning (BBL) on the academic achievement of 68 students with different learning styles. Data were collected by using academic achievement tests and the Kolb's Experiential Learning Style questionnaire. The findings of the study revealed that the BBL approach used in the experimental group was more effective in increasing student achievement than the traditional approach used in the control group. Farooq et al. (2011) conducted a study to examine different factors influencing the academic achievement among secondary school students in a metropolitan city of Pakistan. A sample consisted of 10th grade students (300 male & 300 female). The results revealed that socioeconomic status (SES) and parents' education had a significant effect on students' overall academic achievement as well as achievement in the subjects of Mathematics and English. It was found that girls perform better than the male students. Abdi (2014) conducted the study in order to investigate the effects of inquiry-based learning method on student's academic achievement in sciences lesson. A total of 40 fifth grade students from two different classes were involved in the study. They were selected through purposive sampling method. The results showed that students who were instructed through inquiry-based learning were achieved higher score than the ones which were instructed through the traditional method. Kizkapan and Bektas (2017) studied the effect of project-based learning approach on seventh grade student's academic achievement in the structure and properties of matter. In the study, according to the characteristics of quantitative research methods, pretest-posttest control group quasi-experimental design was used to test the effect of project-based learning and traditional methods on seventh grade 38 students for academic achievement. The results showed that there was no significant difference between the experimental and control groups' scores which was obtained from their Achievement test post-test performance. Wu et al. (2021) studied the relationship between teacher's judgments of student's academic achievement and student's actual academic achievement. The effect sizes were moderated by use of informed versus uninformed teacher judgments, with use of informed judgments leading to a higher correspondence between teacher's judgments and student's academic achievement. Sharma (2011) studied the effect of school and home environments on creativity of children. A sample of 200 ninth class adolescents students from 100 government and 100 private schools was drawn from Chandigarh city of India. The study revealed that government school students of Chandigarh city have higher creativity except in elaboration as compared to private school students. The mean scores also show that the girls as compared to boys have higher level of creativity. Hu et al. (2013) conducted study on 107 students who were selected from secondary school. The scientific creativity test for secondary school students was used. The results indicated that there was long-lasting development of scientific creativity among secondary school students. Usta and Akkanat (2015) investigated the relationship between student's scientific creativity and views of nature of science and attitude towards science and technology among elementary seventh grade students. The total number of participants consisted of 300 in Tokat. They were selected with stratified sampling method. Creativity in Science Test which was developed by the researcher to determine the scientific creativity level, was used. It was found that there was a meaningful difference between students' scientific creativity level and their view of nature of science. Yukang et al. (2020) studied the effectiveness of scientific creativity among 123 Chinese middle school students. The results indicated that there were numerous factors such as culture, type of extrinsic motivation, grade that had effect on scientific creativity. Sun et al. (2022) conducted the study among secondary school students engage in scientific creativity tasks with the support of technology. The participants were 24 Grade 11 students from a high school, who worked on a set of scientific creativity tasks in 6 groups. Epistemic network analysis of group conversations reveals that constructing a mind map helped students to retain ideas for elaboration and evaluation, stimulate new threads of discussion, and regulate task progression. These findings had implications for the design of technology-supported educational interventions intended to promote and improve group creativity in science education.

### ***Delimitations of the study***

1. The study was delimited to 10th class Science secondary school students.
2. The study was delimited to classifying variable i.e., gender.

### ***Objectives of the study***

1. To study the difference in scientific creativity among secondary school students in relation to gender.
2. To study the difference of academic achievement among secondary school students in relation to gender.
3. To study the relationship between scientific creativity and academic achievement among secondary school students.

### ***Hypothesis of the study***

1. There exists no significant difference in scientific creativity among boys and girls of secondary school students.
2. There exists no significant difference in academic achievement among boys and girls of secondary school students.
3. There exists no significant relationship between scientific creativity and academic achievement among secondary school students.

### ***Tools used***

For the present study of investigator used

- Verbal Test of Scientific Creativity by Sharma and Shukla (2011)

- To know the academic achievement of 10<sup>th</sup> class students, the result of 9<sup>th</sup> standard was taken from the teachers of respective class.

### Hypothesis 1

“There exists no significant difference in scientific creativity among boys and girls of secondary school students.”

#### ANALYSIS OF SCIENTIFIC CREATIVITY WITH RESPECT TO GENDER

For the comparison of boys and girls on the variable scientific creativity, mean, S.D, SED and „t“ value are computed to find out significant differences between two groups.

Analysis of descriptive statistics

The scores of the boys and girls students are subjected to descriptive statistics such as mean and S.D. The obtained scores on scientific creativity are given in the Table 1:

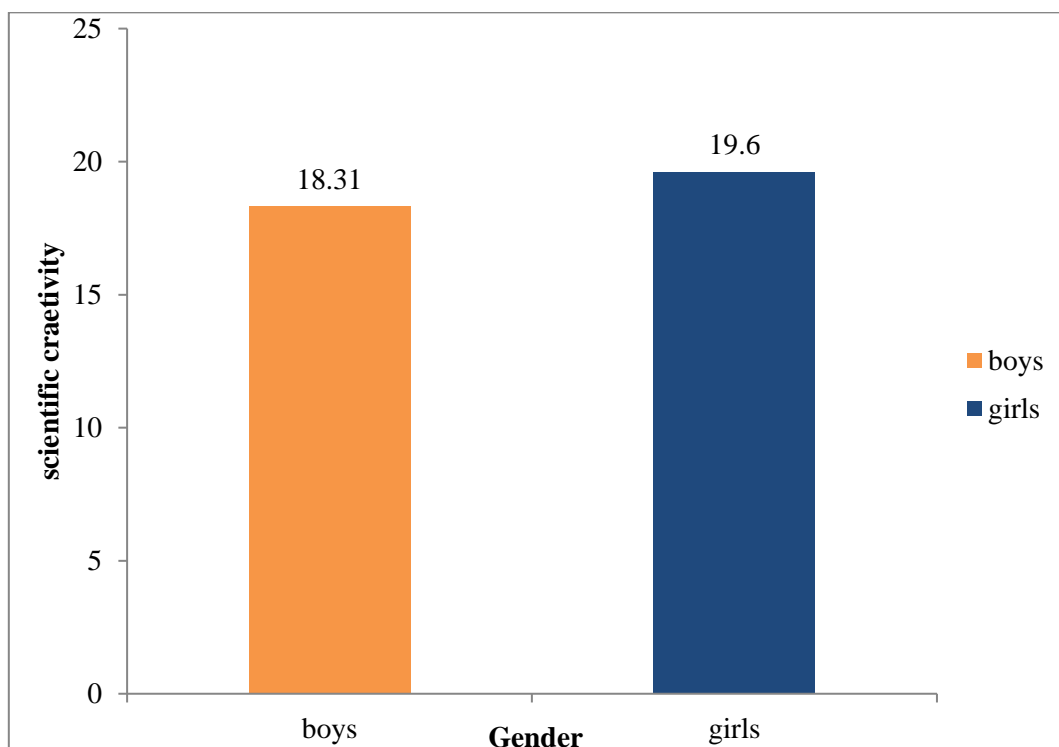
**TABLE 1**

**SHOWING MEAN, SD, SED AND T-VALUE OF SCIENTIFIC CREATIVITY OF BOYS AND GIRLS OF SECONDARY SCHOOLS.**

Group	N	Mean	SD	SE <sub>D</sub>	t-value
Boys	100	18.31	7.45	1.21	1.07*
Girls	100	19.60	9.54		

\* significant at 0.05 level of confidence (Critical Value 1.96 at 0.05 and 2.58 at 0.01 levels, df 198)

From the Table 1 indicates that the mean score of boys is 18.31, which is slightly lower than the corresponding mean score 19.60 of girls of secondary schools. The t-value testing the significance of mean difference between scientific creativity of boys and girls of secondary school students is 1.07, which in comparison to the table value has not been found to be significant even at 0.05 level of significance. Therefore, hypothesis H<sub>1</sub> stating “There exists no significant difference in scientific creativity of boys and girls of secondary schools” is accepted. The result indicates that boys and girls of secondary schools are equally scientific creative. A bar diagram is drawn to depict the mean score of boys and girls students on scientific creativity in Figure 1 below:



**Figure 1: Bar diagram showing the comparison of mean scores of boys and girls secondary school students on scientific creativity**

### Hypothesis 2

“There exists no significant difference in academic achievement among boys and girls of secondary school students.”

Analysis of Achievement in science with respect to gender

For the comparison of boys and girls students on the variable academic achievement, mean, S.D, S.E.<sub>D</sub> and 't' value are computed to find out significant differences between two groups.

Analysis of Descriptive statistics

The scores of boys and girls students are subjected to descriptive statistics such as mean and S.D.

**TABLE 2**

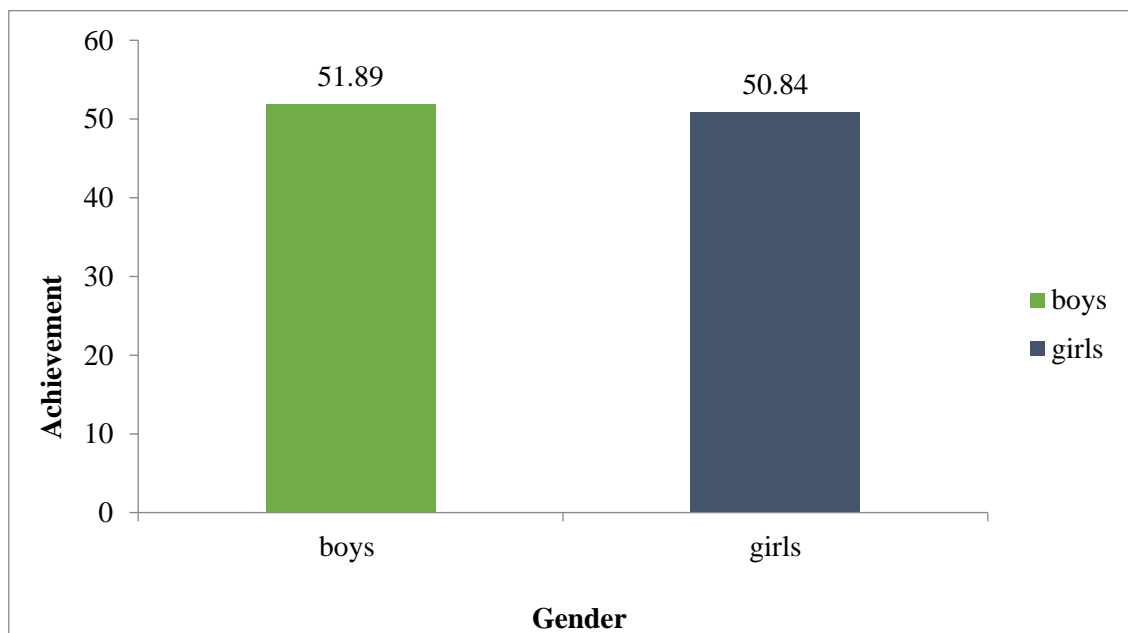
**SHOWING MEAN, SD, SE<sub>D</sub> AND T-VALUE OF ACHIEVEMENT IN SCIENCE OF BOYS AND GIRLS OF SECONDARY SCHOOLS.**

Group	N	Mean	SD	SE <sub>D</sub>	t-value
Boys	100	51.89	15.41	1.94	0.07*
Girls	100	50.84	11.83		

\*significant at 0.05 level of confidence (Critical Value 1.96 at 0.05 and 2.58 at 0.01 levels, df 198)

From the table 2 indicates that the mean score of achievement in science of boys is 51.89, which is slightly greater than the corresponding mean score 50.84 of girls of secondary schools. The t-value testing the significance of mean difference between achievement in science of boys and girls of secondary school students is 0.07, which in comparison to the table value has not been found to be significant even at level 0.05 level of significance.

Therefore, the hypothesis H<sub>2</sub> stating, "There was no significant difference in achievement in science of boys and girls of secondary schools" is accepted. The result indicates that boys and girls do not differ in achievement in science. A bar diagram is drawn to depict the mean score of boys and girls students on academic achievement in science in Figure 2 below:



**Figure 2: Bar diagram showing the comparison of mean scores of boys and girls of secondary schools students on academic achievement in science**

### Hypothesis 3

"There exists no significant relationship between scientific creativity and academic achievement among secondary school students."

Correlation of scientific creativity and achievement in science of secondary school students

**TABLE 3**

**SHOWING THE CORRELATION COEFFICIENT OF SCIENTIFIC CREATIVITY AND ACHIEVEMENT IN SCIENCE OF SECONDARY SCHOOL STUDENTS (TOTAL SAMPLE)**

Variable	N	R
Scientific Creativity	200	0.31**
Achievement in Science		

\*\* significant at 0.01 level of confidence

Table 3 indicates the co-relation between scientific creativity and achievement in science of secondary school students. The calculated value of Karl Pearson's coefficient of correlation (r) is found to be 0.31, which is positive and significant at 0.01 level of significance. This indicated that an increase or decrease in the scientific creativity scores corresponds to an increase or decrease in the scores of achievement in science of secondary school students. Therefore, hypothesis H<sub>3</sub> stating, "There exists no significant relationship between scientific creativity and achievement in science of secondary school students" is rejected. It is therefore concluded that correlation exists between scientific creativity and achievement in science of secondary school students.

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## Findings And Conclusions

The present study was conducted to study the scientific creativity and achievement in science among secondary school students. Following were the findings of the study:

1. There was no significant difference in scientific creativity of boys and girls of secondary school students.
2. There was no significant difference in academic achievement of boys and girls of secondary school students.
3. There was significant relationship between scientific creativity and academic achievement of secondary school students.

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