Zakariya Journal of Education, Humanities & Social Sciences (ZJEHSS)

ISSN Print: 3008-1556
ISSN Online: 3008-1564
Volume 3, Number 1, 2025, Pages 35 – 41
Journal Home Page
https://journals.airsd.org/index.php/zjehss/index

Interplay of Grade 8th Students' Critical Thinking and Academic Achievement in the Subject of General Science

Fayyaz Ahmad[1], Muhammad Mazhar Saeed[2] & Najam Abbas[3]

[1]*Ex-M.Phil. Scholar, NCBA & E Sub Campus Multan, Email: fa167715@gmail.com*
[2]*Ex-M.Phil. Scholar, NCBA & E Sub Campus Multan, Email: mazharsaeedbukhari@gmail.com*
[3]*Ex-M.Phil. Scholar, NCBA & E Sub Campus Multan, Email: najam3397@gmail.com*

ARTICLE INFO

Article History:

Received:	*February*	*26, 2025*
Revised:	*April*	*20, 2025*
Accepted:	*April*	*28, 2025*
Available Online:	*May*	*12, 2025*

Keywords:

Grade 8th Student,s Critical Thinking, Academic Achievement, General Science

ABSTRACT

This study examines relationship between critical thinking and academic performance in science subject at elementary level. The primary objectives were to investigate the association between science critical thinking and academic performance at elementary level, to assess students' critical thinking at elementary level and to assess elementary level students' academic achievement. The research design is correlational and descriptive. The study population consisted of 20172 students of 8th grade in District Muzaffar Garh. Sample size was determined through Raosoft calculator results to 377 students. Adopted Critical thinking test and Achievement tests were administered at the end of academic session 2024-2025 for data collection. Critical thinking test and achievement test were adopted to gather data from students. Data was analyzed by calculating the mean and standard deviation as well as using Pearson's correlation coefficient (r) test. The findings of the study found that there is a positive relationship between critical thinking and academic performance in science subject at elementary level. Future research should take place on higher levels and other subjects except science.

Corresponding Author's Email: fa167715@gmail.com

Introduction

A permanent change brought into students through latest strategies to improve specific skills, attitudes and scientific laws is known as learning process. When teacher transfer knowledge to the students, this is called pedagogy. Several elements like determination of learning goals, planning of instructional approaches and how to implement them to obtain desired outcomes (Raza et al., 2025). Engagement of intellectual activities such as to identify and to analyze the information is known as critical thinking. This is the ability to communicate in effective manner and to explain observations and to obtain and utilize significant data (Fayyaz et al., 2025).

Critical thinking process involves assessing own views and it helps in development of cognitive skills, self-control, awareness and adjustment in the society (Mutakinati et al., 2018). Critical thinking skills attainment involves usage of higher order skills to think deeply, to find the problem, to analyze the problem and make a decision to solve the problem (Karakoc, 2016). The most important educational goal is to improve critical thinking skills that are essential to participation in society effectively. Fundamental observation, collaborative group work, presenting observed phenomena, experimentation-based testing, and temporarily acknowledging are techniques used to increase students' critical thinking's. Having gifted critical thinking ability, one can analyze and understand scientific study data effectively (Yuliati et al., (2018).

Decision making and to solve problems are benefits of critical thinking's (Siahaan et al., 2023). The Indonesian Ministry of Education has introduced new educational programs since 2013 and critical thinking a fundamental higher-order skill is a compulsory part of it (Firdaus & Mukhtar, 2020). Critical thinking is a multidimensional ability that contains logical reasoning, reflective judgment and impulses relevant to emotions. It involves careful and controlled examination of information's (Hyytinen et al., 2019; Assad, 2025).

Critical thinking plays a vital role in modern education and is necessary for success for students in practical life. The applicants should have higher levels of critical thinking's to comprehend conditions, to make rational decisions and to recover and implement evidences. Development of critical thinking ability is very important because it is helpful for academic performance and students' academic achievements and for their reasoning abilities in practical life situations (Elmouhtarim 2018).

Critical thinking skills are compulsory for students' education to shine in 21st century (Özgenel and Çetin (2018). Decisive goal in education for the year 2050 according to the International Commission on the Futures of Education indicated in 2021 is critical thinking skills. It aimed to enhance problem solving skills specifically in real life and in educational field. This should be implemented in elementary, secondary, higher secondary and undergraduate levels so as to improve academic performance and achievements (Dwyer et al., 2011).

Performance based outcomes that show the levels to which a person is expert to gain specific goals in school, college, and university are known as academic achievement. GPA (grade point average) and standardized assessments tests are used to measure academic achievement. When one student can take part in higher education and what he attains may include educational degrees or appreciation letter or certificates all are included in academic achievement (Steinmayr, 2014). All the competencies and skills including communication, scientific, mathematics, social sciences and critical thinking skills due to which students are able to successful in their schools and societies are known as Academic achievement. This cannot be easily assessed. Teachers and researcher usually used standardized test to assess it at different levels (Lindholm-Leary, 2006).

A meta-analysis was performed in order to examine the relationship between critical thinking and academic success. Two researchers read the literature and the meta-analysis of 47 individual studies was performed. Using random effects model, mean effect size value (0.428) was obtained. This value implies a moderate relationship between critical thinking and academic success. The size of the effect varied according to area, self-control, and the type of consequence (Orhan, 2022).

The study was carried out to determine the influence of laboratory method concerning innovative and critical thinking on potential primary teachers' science process skills and examination results. The sample was made up of 94 elementary teachers who were present in two different classes in education department in spring semester. Laboratory demonstration that involved engagement in thinking artistically and critique was carried out in the experimental group while the control group had traditional applications in laboratories. From the study findings, it was evident that the experimental group had been more successful than the control group as far as science skills and academic achievement were concerned (Koray, 2007).

Objectives of study

The study objectives were

1. To examine the correlation between critical thinking and academic achievement in science at elementary level.
2. To determine students' critical thinking at elementary level.
3. To measure the students' academic achievements at elementary level.

Hypotheses

Following were hypothesis of the study

H_0: There is no significant statistical relationship between the of critical thinking and the academic achievement of elementary students in science.

H_1 There is a significant statistical relationship between critical thinking and academic success of elementary science students.

Significance of Study

This research study may be useful for educators teaching science. They can create higher critical thinking skills to achieve higher achievement scores. This can also help teachers to develop plans to promote critical thinking skills in science subjects. This study may have practical implications i.e., professional institutions and curriculum planners can get benefits from this study to redefine their objectives and mission statements. The policy makers can make critical thinking skills as part of syllabus so as to improve students' performance in achieving higher scores in subject of science at elementary levels.

Research Methodology

The design of research study is correlational and descriptive in nature. The population for the study was all 20172 students enrolled in 8th grades in District Muzaffar Garh.

Table 1: Population of the study

Sr. No	Gender	Students	Percentage
1	Male	11256	60.74%
2	Female	7916	39.23 %

Source: https://sis.punjab.gov.pk

There were 11256 male and 7916 female students enrolled in Mazaffar Garh Dsitrict. Sample size was calculated through Raosoft calculator comes to be 377 students.

Table 2: Sample of study

Total Population	Sample Size (Raosoft calculator)
20172	**377**

Critical thinking test was adopted from Shaheen (2022) and Achievement test was adopted from PEC. Both the tests were taken at the end of academic session 2024-2025. Adopted critical thinking test and achievement test were used to collect data from students. Data analysis was carried out by estimating means and standard deviation as well as using Pearson's correlation coefficient (r) test.

Data Analysis

Both descriptive and inferential statistics were applied to analyze the data. Descriptive statistics was conducted by computing value of mean and standard deviations.

Table 3: Mean, Standard deviations in critical thinking test and achievement test

Test nature	Mean	Standard Deviation
Critical thinking test	18.84	4.08
Achievement test	20.15	2.65

The following table illustrates the mean score and standard deviation of the critical thinking test and the achievement test are 18.84 and 4.08 respectively and achievement test are 20.15 and 2.65 respectively. Inferential statistics was performed using the determination of the value of Person Correlation Coefficient (r).

Table 4: Pearson Correlation Coefficient (r)

Sample size	Pearson Correlation Coefficient (r)
377	**0.815**

The above table shows that Pearson correlation coefficient is 0.815. This indicates a positive relation between critical thinking's and academic achievement.

Conclusion

Statistical analysis of data shows very high positive value of correlation 0.815. This indicated a positive relationship between skills in critical thinking and the academic success of the students.

Discussion

Statistical analysis of data shows very high positive value of correlation 0.815. This indicated a positive relationship between skills in critical thinking and the academic success of the students.

A research on "Impact of critical thinking skills on the academic success of senior high school students" was conducted in High School. The major goals were to measure critical thinking and academic success, scrutinize the significant statistical correlation between critical thinking abilities and academic success. Quantitative research, specifically quantitative-correlational research study design was used. The sample consisted of 213 students of Grade 11. Data analysis was done by determining mean, Spear-man, and finding out multiple regressions. The findings of the study indicated high level of critical thinking skills and the academic achievement. This is the way that illustrates critical thinking skills are significant in academic achievement (Borbon et al., 2025).

Learning process, decision making, problem solving and academic success all are connected to such skills as critical thinking's. Current study was done to explore relationship between critical thinking based instructional practices and critical thinking skills, critical thinking dispositions, and academic achievement among undergraduate students of physics, chemistry and biological sciences. A sample of 320 final year science students of BS programs in 3 universities was used and questionnaire administered. The results showed that there exist high perceived levels of CTIPs, CTS and academic achievement among female students. Physics students performed better in CTS and chemistry students did well in academics. Critical thinking's instructional practices were often employed by the chemistry teachers. Study's results revealed that science students displayed critical thinking's in their performances while undergraduate students were academically brilliant because of better critical thinking's (Ali and Awan, 2021).

A research has been conducted in order to measure critical thinking's among intermediate female students in Mecca and also to determine its correlation with achievement. The design of study was descriptive in nature. Watson & Glaser test was used to measure the critical thinking's. The findings of the study revealed that the critical thinking skills to interpret, deduct and evaluate things are poor. Positive association between critical thinking and achievement was identified through the findings as well. From the results, the researcher suggested that critical thinking should form part of course in a better way to develop thinking skills, analyze things and enhance them at elementary levels (AL-Zahrani, 2023).

Future Recommendations

1. The researcher should undertake study to establish relation between critical thinking to academic achievement in other subjects.
2. The researcher should conduct research study in secondary and higher secondary levels.

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