

Critical Thinking Skills among Ninth Standard Students in Relation to Gender, Intelligence and Study habits

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Abstract: Critical thinking skill is not an isolated skill but rather one with a wide applicability. It is a skill needed by all leaders, followers, professionals, businessmen, market women, young and old, men and women, in business thinking, teaching thinking, medical thinking, personal thinking, etc. Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing or evaluating information gathered from or generated by, observation, experience, reflection, reasoning as guide to belief and action. For teachers who are entrusted with producing future leaders and manpower for every nation, it is even quite essential. The present study aim to examine empirically the effect of Gender, Intelligence and study habits on the critical thinking skills of secondary school students. A sample of 140 students was selected randomly from ninth standard students of Bangalore city. 2x2x2 factorial design was employed with two levels of gender: boys and girls, two levels of intelligence: high and low and two levels of study habits high and low. The analysis was carried out by employing three way analysis of variance.

Key Words: Critical Thinking Skills, Intelligence, Study habits.

I. Introduction

One of the important qualities which schools should develop in the minds of children is the habit of thinking. It is the most important area which concerns cognitive psychologists. But, this quality is not put in practice. Traditional learning is a system of absorbing ideas as a sponge. On the other hand thinking is the only rational power for the upliftment of an individual. Children's activity should inspire inner thoughts because the clearer a person thinks the more refined and prudent will his actions be.

Thinking is the process of creating a structured series of connective transactions between items of perceived information. Thinking process starts when some stimuli are provided to the mind. A person uses different types of thinking in thinking process. Creativethinking, Criticalthinking, Divergent thinking is various types of thinking. But many times he doesn't know that which type of thinking he is doing. Whether he is adopting proper way of thinking for finding solution for the problem, takendecision, discovering new things, etc.

Critical thinking (CT), generally speaking is a universal exercise that man engages in at one point or the other depending on the Situation and decision he has to make. The skill(s) of doing so is however not universal as some individuals are more proficient in it than others. The skill(s) can however be taught and learnt.

Critical thinking has received a lot of attention from scholars and the literature is wide. In the process, it has generated many definitions. **Screven, 1996** defined it as " the intellectual disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing and or evaluating information gathered from or generated by observation, experience, reflection, reasoning, (Walker TRC, 2006, p.2). **Angelo, 1995** also conceived it as "the intentional application of rational, higher order thinking skills, such as analysis, synthesis, problem recognition and problems solving, inference and evaluation" (Walker TRC, 2006, p.2).

Schafersman, 1991 defines it as “correct thinking in the pursuit of relevant and reliable knowledge about the world” (p.1). According to the Centre for Critical Thinking, critical thinking is “thinking that assesses itself” while Beyer 1995, put it simply as “making reasoned judgment” (Walker TRC, 2006, p.2).

In short, critical thinking is self-directed, self-disciplined, self-monitored and self-corrected thinking. It is a process of determining the authenticity, accuracy or value of something: characterized by the ability to seek reasons and alternatives, perceive the total situation and change one’s view based on evidence.

Mathematics is an abstract subject and solving problems in mathematics is the framework of patterns within which critical thinking and reasoning takes place. Because mathematics is exact and true, it always demands originality for its learning. A broad, general finding from the researches reveals that all thinking skills, programmes and practices investigated were found to make a positive difference in the achievement levels of students.

Effective teaching of Mathematics helps in developing various abilities like thinking and reasoning to arrive generalization. Since the abilities vary from student to student, it is a general feeling that different abilities are more or less individualistic and are difficult to develop. Recently, Robert Ennis, Edward Debone and others believe that, the process of thinking is based on the subject matter and to develop proficiency in thinking through the subject involves a skill. Hence, thinking is more a skill than an ability.

Studies which looked into the achievement over a time found that thinking skills integrated with instruction accelerated the learning gains of students found generally in experimental studies at a significant degree. This indicates that thinking skills instruction enhance academic achievement. Reports with such findings include **Babra and Merchant1990, Bass and perkins1984, Freseman1990, Crump, Schlichter and Palk 1988.** Mathematics is an abstract subject and solving problems in mathematics is the framework of patterns within which critical thinking and reasoning takes place. Because mathematics is exact and true, it always demands originality for its learning. A broad, general finding from the researches reveals that all thinking skills, programmes and practices investigated were found to make a positive difference in the achievement levels of students.

Critical thinking is very important in the teaching of mathematics at school level, because it helps for better information analysis and evaluation which in turn may help the achievement of the students. In the area of critical thinking skills, few studies are available related to mathematics teaching at the secondary level. If the mathematics teacher really wants to modify the behaviour of students in the classroom, it is necessary to process the critical thinking skills. Since studies are not available in the mathematics area, the researcher has felt this as a need at present and hence the study.

II. Purpose of the Study

The purpose of this study is:

- To investigate the impact of Gender, Intelligence and Study habits on Critical Thinking Skills.
- To study the interaction effects of Gender&Intelligence, Gender&Studyhabits and Intelligence &Study habits on Critical Thinking Skills.
- To study the interaction effect of Gender, Intelligence and Study habits on Critical Thinking Skills.

III. Hypotheses

The following hypotheses were formulated for verification in this study:

- There will be significant difference between boys and girls on their critical thinking skills
- There will be significant difference between high and low intelligence students on their critical thinking skills
- There will be significant difference between high and low study habits students on their critical thinking skills
- There will be significant interaction effect between gender and intelligence on their critical thinking skills
- There will be significant interaction effect between gender and study habits on their critical thinking skills
- There will be significant interaction effect between intelligence and study habits on their critical thinking skills
- There will be significant interaction among gender, intelligence and study habits on their critical thinking skills

IV. Sample of the Study

A sample of 140 students (90Boys+50Girls) studying in ninth standard was selected randomly from private aided school in Bangalore city. The age range of the sample was 14+. The sample includes students from urban area only.

V. Tools Used for the Study

The following tools were used for collecting data:

Critical thinking skills: The researcher prepared the tool based on the selected components of critical thinking skills in mathematics. Under each of the components ten items were prepared and given to experts and collected their opinion, and then it was further modified. The modified tool was used for the pilot study and refinement done accordingly. The final version was used on a group of 50 students and the reliability value was calculated using Spearman-Brown prophecy formula. The final tool consists of five items under each component and totally there were 30 items. All the items are open ended.

Study habits: Study habits refer to the behaviour of an individual, related to his studies. Styles of studying are known as study habits. In the process of learning, habitual ways of exercising and practising their abilities for learning are considered to be study habits of learners. It is designed to measure study habits of students pertaining to various aspects. In the present study, the researcher adopted study habits inventory developed by Mukhopadhyaya and Sansanwal. This consists of 51 items which reveal students personality in action at their studies.

Intelligence: In the present study, Raven's progressive matrices (RPM) test of intelligence was used to measure the intelligence of students. It is a non-verbal culture free test of intelligence. It can be used for both high school and college students. The test consists of five sub tests namely A, B, C, D and E. Under each sub test, there are twelve figures. Against each incomplete pattern six possible figures are given. Among these, one will be the most suitable figure to complete the large figure. The complexity of a test increases from test A to E. This test has high reliability (0.71) and validity.

Data collection and scoring: All the tools mentioned above i.e. critical thinking skills, study habits and intelligence were administered to the students individually in their classroom. Before the administration of the tests, proper rapport was established with the students. They were

requested to extend their cooperation by answering all the items. Thereafter, they were explained the procedure for recording their answers for each test. On completion, all the tests were collected and scored according to the scoring procedure mentioned in the manual.

Design of the study: To ascertain the main and interaction effects of gender, study habits and intelligence on critical thinking skills. 2x2x2 factorial design was employed. The independent variables varied into two levels. Gender is a dichotomous variable, whereas, study habits and intelligence were classified into two groups (high and low for both the cases).

VI. Analysis and Interpretation of Data

2x2x2 factorial design was employed for analyzing the data of the present study. The F-value computed for different main and interaction effects have been shown in table-1.

Table-1: Summary of 2x2x2 ANOVA for main and interaction effects on Critical Thinking Skills

Source of Variance	Type III sum of Squares	df	Mean Square	F_value	Result
Corrected Model	1218.65 ^a	7	174.09	1.82	
MAIN EFFECTS					
Gender(A)	700.88	1	700.88	7.33	Significant
Study habits(B)	124.03	1	124.03	1.29	Not Significant
Intelligence(C)	98.24	1	98.24	1.02	Not Significant
TWO FACTOR INTERACTIONS					
A * B	8.00	1	8.00	.08	Not Significant
A* C	135.62	1	135.62	1.42	Not Significant
B* C	31.47	1	31.47	.33	Not Significant
THREE FACTOR INTERACTIONS					
A * B * C	5.95	1	5.95	.06	Not Significant
Error	12608.34	132	95.51		
Total	67023.00	140			
Corrected Total	13826.99	139			

Main effects: The following three main effects have been analysed and are presented in table-1.

Gender (A): The main effect of gender was analysed, the F-value for gender (A) was found to be significant at 0.01 level of confidence ($F=7.33$ & $df=1$ and 140). It means that gender has significant main effect on critical thinking skills. It indicates that the mean scores of boys and girls differed significantly. The mean score of boys was 21.8 and girls was 16.46. Obviously, the mean score of boys is higher than the girls. It means that boys were better in critical thinking skills than their

counterparts girls. Thus, the research hypothesis stating that, ‘There will be significant difference between boys and girls on their critical thinking skills’ has been accepted in this study.

Study habits (B):The main effect of study habits was analysed at two levels each of gender (A) and Intelligence(C),The F-value for study habits came out to be 1.29 which is not significant at any level for $df=1$ and 140.It indicates that study habits has no effect on critical thinking skills, as such, there is no significant difference in the mean scores of high and low study habits on critical thinking skills.Thus,the research hypothesis stating that, ‘‘There will be significant difference between high and low study habits students on their critical thinking skills’’ has been rejected in this study.

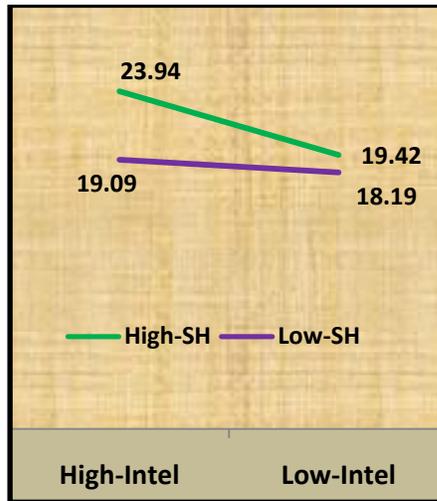
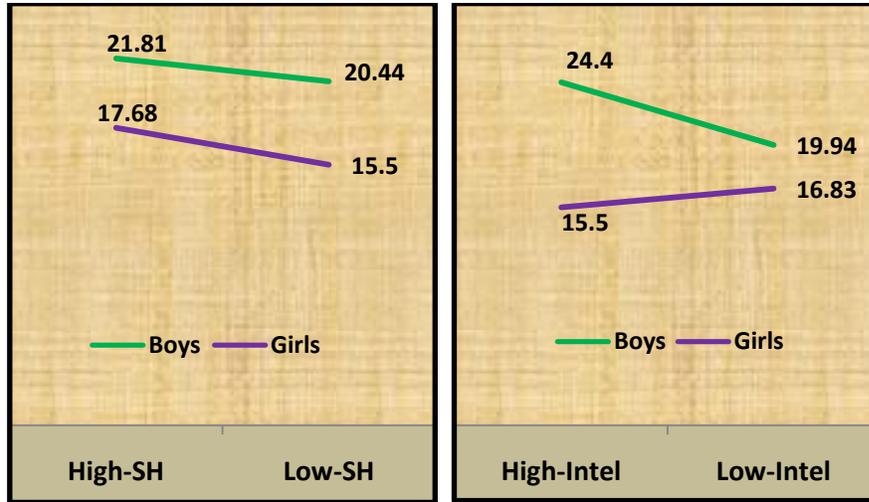
Intelligence(C): The main effect of intelligence was analysed at two levels each of gender (A) and Study habits(B),The F-value for intelligence came out to be 1.29 which is not significant at any level for $df=1$ and 140.It indicates that intelligence has no effect on critical thinking skills, as such, there is no significant difference in the mean scores of high and low intelligence on critical thinking skills.Thus,the research hypothesis stating that, ‘‘There will be significant difference between high and low intelligence students on their critical thinking skills’’ has been rejected in this study.

Two factor interaction effects: Three interaction effects of two factors were analysed and are presented in table-1.

Gender (A) X Study habits (B): The table-1 depicts the F-value for AxB interaction came out to be 0.08 which is not significant at any level. From this, it may be inferred that there was no significant interaction between gender and study habits. Thus, it may be concluded that critical thinking skills are not the joint contribution of gender and study habits. Thus, the research hypothesis stating that, ‘‘There will be significant interaction effect between gender and study habits on their critical thinking skills’’ has been rejected in this study.

Gender (A) X Intelligence (C): The table-1 depicts the F-value for AxC interaction came out to be 1.42 which is not significant at any level. From this, it may be inferred that there was no significant interaction between gender and intelligence. Thus, it may be concluded that critical thinking skills are not the joint contribution of gender and intelligence. Thus, the research hypothesis stating that, ‘‘There will be significant interaction effect between gender and intelligence on their critical thinking skills’’ has been rejected in this study.

Study habits (B) X Intelligence (C): The table-1 depicts the F-value for BxC interaction came out to be 0.33 which is not significant at any level. From this, it may be inferred that there was no significant interaction between study habits and intelligence. Thus, it may be concluded that critical thinking skills are not the joint contribution of Study habits and intelligence. Thus, the research hypothesis stating that, ‘‘There will be significant interaction effect between study habits and intelligence on their critical thinking skills’’ has been rejected in this study.



AXB Interaction

AXC Interaction

BXC

InteractionFigure-1: Showing the mean scores interaction of boys- girls, high-low study habits, high-low intelligence on critical thinking skills among ninth standard students

Three factor interaction effects: Three factor interaction effects was analysed and has been presented in table-1.

Gender (A) X Study habits (B) X Intelligence(C): The table-1 depicts the F-value for AxBxC interaction came out to be 0.06 which is not significant at any level. Thus, it can be concluded that there is no significant interaction between gender, study habits and intelligence. It means that AxB interaction for separate levels of C and AxC interaction for separate levels of B and BxC interaction for separate levels of A are in same form and do not differ each other. It can be therefore concluded that the different levels of ABC do not interact significantly in producing satisfaction among ninth standard students. Thus, the research hypothesis stating that, “There will be significant interaction effect between gender, study habits and intelligence on their critical thinking skills” has been rejected in this study.

VII. Findings of the Study

The following findings were drawn on the basis of analysis of data.

- Gender of the students has significant influence on critical thinking skills. Boys and Girls students have yielded unequal outcome on the scores of critical thinking skills.
- Study habits of the students does not influence on critical thinking skills. High and Low study habits students have yielded equal outcome on the scores of critical thinking skills.
- Intelligence of the students does not influence on critical thinking skills. High and Low intelligence students have yielded equal outcome on the scores of critical thinking skills.
- Gender and study habits, Gender and intelligence and study habits and intelligence do not interact to yield significant results on critical thinking skills.
- Gender, study habits and intelligence do not interact to yield significant results on critical thinking skills.

VIII. Conclusions

The study reveals that the boys and girls differ significantly in their critical thinking skills. This means boys shown better performance than girls in the critical thinking skills on mathematics. On the other hand different levels of study habits and intelligence does not influence on the critical thinking skills among ninth standard students in mathematics learning.

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