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Critical Thinking, Reasoning, and Logical Concluding' Abilities in relation to Academic Achievement among Indian Adolescent Students

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ABSTRACT

The aim of this study was to investigate relationship between critical thinking ability and its relevant elements such as reasoning ability and logical concluding ability in relation to academic achievement among adolescent students. Sample of this study was 625 students from high schools and pre university colleges in Mysore city of India. Data has collected by stratified random sampling. Pearson's Correlation Coefficient, One-Way ANOVA, and Spearman' rho Coefficient have applied to examine generated hypotheses. Results indicated significance and positive correlation between critical thinking ability, reasoning ability, and logical concluding ability. Findings indicate critical thinking ability and its elements can be considered as a key feature to enhance academic achievement.

Keywords: *Critical Thinking Ability, Reasoning Ability, logical Concluding Ability, Adolescence, Academic Achievement.*

New movement in educational systems is moving from teacher-centered into student-centered situation. In student-centered approach, students are not passive learner, they should involve in the process of learning, participate in class activities, think individually, discuss in class and argue to accept or reject any educational issue. Students in traditional classrooms, just passively listen and follow they teacher, they are discouraged to speak or company in class. In contrast, dynamic classes need active students with ability to think critically, communicated energetic, pose question, share their ideas, and finally create new knowledge. Active learning approaches involve activities such as discussion in class or thinking critically, these needs to share original ideas with classmates and teachers. Today's world has seen education as a powerful feature to achieve social and economic upward goals. Thus, educational systems must concentrate on student's abilities to stimulate then and motivated to be active individual in learning process. Based on literature, critical thinking, because of its nature considers as a facilitator to enhance students' abilities to be generator of new knowledge. The major elements of critical thinking is based on assessment, judgment and evaluate presented topics and issues, it needs also your

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reasoning evaluation. In process of thinking critically, individual starts with given logical reasons to analyze topic, later will give a logical conclusion based on evidences and its reasons. Therefore, critical thinker needs to have analysis ability as well as synthesis ability in respect to make logical conclusion (DeWaelsche, 2015).

Several studies demonstrate effectiveness of integrating instructional critical thinking programs with schools' curriculum. Paul and Binker (1990) collected 39 papers about importance of critical thinking and organized them in different sections of their book. They argued that it is necessary to consider critical thinking at heart of educational reform. Norris and Ennis (1989) analyzed different approaches to evaluate students' critical thinking on programmatic, school-based, and classroom levels. Findings of this book can establish wide aspect to consider critical thinking on educational programs. Gokhale (1995) based on the idea that improvement of critical thinking is essential element of educational programs, suggested some learning techniques such as collaborative learning will enhance students' critical thinking as well as academic achievement. Reasoning is a logical process of thinking to understand issues and topics in logical way with respect to make conclusion or judgment ("Definition of REASONING," n.d.). Reasoning ability as a major part of critical thinking shows its effect on general knowledge, therefore, it can be concluded focuses on reasoning ability will lead to improve critical thinking and as a results enhance cognitive ability and higher order thinking (Kyllonen & Christal, 1990). Concluding or making logical decision is the other part of thinking critically. and as we know, thinking is a complex process and entails to make logical decision or rational conclusion. Velea and Lache, (2015) asserted that the better conclusion or decision will make up when person used dedicated algorithms combined with the proposed selection method, and that means logical technique have more effect on concluding logically. Analysis of various studies indicated positive impacts of critical thinking on arising academic achievement (e.g., Wang, Pascarella, Laird, & Ribera, 2015; Tiruneh, Verburgh, & Elen , 2014; Chan, 2013; Boghossian ,2006; Fleming, Garcia, & Morning , 1995).

REVIEW OF LITERATURE

Richard W. Paul, the leading scholar in critical thinking, believed that critical thinking is "thinking about your thinking while you're thinking in order to make your thinking better" (DeWaelsche, 2015, p.5). The main focus of this definition is that critical thinking is a kind of thought that thinker is aware of process of thinking. Also, thinker tries to improve the quality of his thoughts while is thinking about any issue. Critical thinking is skill and like other skills can be thought or learnt. Research indicates students will get higher score on assessment of critical thinking when subject-matter courses include direct instruction in critical thinking (Beyer, 2008, as cited on DeWaelsche, 2015, p.5).

According to previous research, some methods are very useful to establish and cultivate new knowledge and skills, in this regard Blooms taxonomy of Knowledge-based and skills-based can

be appreciated as a beneficial method to improve critical thinking skill ("Bloom's Taxonomy of Educational Objectives | The Center for Teaching and Learning | UNC Charlotte," n.d.).

An overview of elements of thinking critically indicates that critical thinker should have ability of analysis, synthesis, as well as ability to make judgment about issues. The outcome of critical thinking phenomenon is to make logical conclusion and make best decision about "what to do". Therefore, acquiring reasoning ability and concluding ability are essential parts of thinking critically. In this study, the interest is to investigate about relationship between critical thinking and academic achievement as well to find out the effectiveness of some parts of thinking critically such as reasoning ability and concluding ability (make last logical decision about issue).

Some studies demonstrated positive effect of reasoning and its relation to academic achievement. For example, involving fluid reasoning may provide foundation for academic achievement when students are in early education stages (Pasnak et al., 2015). Another study indicated proportional reasoning strategies can be suitable instruction to influence academic achievement (Kwean, 2011). In a study by Wilkinson, (1993) stated that boys showed strengths visual-spatial reasoning ability compare with girls, and girls showed strengths sequential and social reasoning ability in compassion with boys, regarding to functions of academic achievement.

What do you understand from the concept of critical thinking? In one aspect, critical thinking is analysis ability to determine validity of statements and information. Also, it can translate given information to fill gaps in personal knowledge. This type of thinking is desirable for students because of its nature; teaching critical thinking can be a basic function of education: it equips students intellectually and emotionally. The terminal goal of education is to develop intellectual skills. Above statements could be summarized in the claim that students must have "ability to think critically, systematically and independently" (Jegede & Noordink, 1993).

What is the relative importance of empirical research in relation to current situation of critical thinking? A large number of research investigations just focused on general concept of these skills, and only few studies have practical strived to make clarification in this issue. Miller and Wild (1979, as cited in Jegede & Noordink, 1993, p.4) stated about importance of analytical reasoning ability and its relation to academic achievement. Such findings indicated the need to focus on empirical investigations on critical thinking and its elements to develop and improve it. Jegede and Noordink (1993) conducted a study and based on factor analysis' results concluded reasoning skills is a supportive skill in relation to different areas of critical thinking (p. 9).

In some studies stated skills of thinking critically include (a) ability to explain ideas very clear and reasonable, (b) ability to analyze information and reflect it critically, (c) ability to congregate facts with respect to establish valid arguments, and (d) ability to design logical inferences by

considering gathered information. By respect to above explanations, one can conclude, thinking critically requires to have ability of analysis as well, ability to conclude, and lastly ability to draw logical inferences and make a proper decision.

From another angle, critical thinking can be defined as a type of independent thinking with respect to promote reasonable judgments and apply logic and creativity to innovate resolution for challenging issues and turbulence topics. And educational systems aim to produce well informed, analytical, and creative learners to engage in social movements and civilization ("Critical Thinking and Education," n.d.).

Research Questions

1- Is there a relationship between Critical Thinking and Academic Achievement among Adolescent Students in Mysore City?
2- Is there a difference between students' academic achievement and critical thinking among adolescent students?
3- Is there a relationship between Reasoning Ability and Academic Achievement among Adolescent Students in Mysore City?
4- Is there a relationship between Concluding Ability and Academic Achievement among Adolescent Students in Mysore City?

OBJECTIVES

1- To study adolescent students' academic achievement in relation to critical thinking ability among adolescent students.
2- To study difference between students' academic achievement and critical thinking among adolescent students.
3- To study adolescent students' academic achievement in relation to reasoning ability among adolescent students.
4- To study adolescent students' academic achievement in relation to concluding ability among adolescent students.

Hypotheses

1- There is significant relationship between critical thinking ability and academic achievement among adolescent students.
2- There are differences between students' academic achievement and critical thinking among adolescent students.
3- There is significant relationship between reasoning ability and academic achievement among adolescent students.
4- There is significant relationship between concluding ability and academic achievement among adolescent students.

METHODOLOGY

Population

In this study favorite population was adolescent students who have age of 14 up to 18(early adolescence and late adolescence) that they are studying in English Medium institutions, including Government and Private High Schools and Pre University Colleges during academic year of 2015-2116. Students who have enrolled in 9^{th}, 10^{th}, 11^{th} and 12^{th} were selected for this study and that have approximately age of 14 up to 18 years (48,974 Students from 417 Schools). The list of selected high schools and PU Colleges has taken from Deputy District Pre University (DDPU) office and Deputy District Public Institutions (DDPI), of Mysore City, Karnataka, India.

Sample and Sampling Frame

To select sample for this study stratified random sampling method has used. Considered sample of this study was 625 students in English Medium institutions, including Government and Private High Schools and Pre University Colleges during academic year of 2015-2116. Students who have enrolled in 9^{th}, 10^{th}, 11^{th} and 12^{th} were selected for this study and that have approximately age of 14 up to 18 years (625 Students).

Tools

(a) Critical Thinking Scale

Critical Thinking Ability Scale has designed by C. G. Venkatesha Murthy (2014). The foundation to construct this scale was based on a model of critical thinking ability and its elements to analyze situation from different angles by given reasons (process of thinking) and ability to conclude about situations by given conclusion (product of thoughts), in order to assess adolescence' critical thinking level in class. Validity of the scale was subjected to Content validity. 10 subject experts from Psychology and Educational Psychology validated the items, scoring pattern, Process and Product categories. Reliability of the scale: The reliability measures were calculated on a sample of 1219 students with age range of 14 up to 18.. Reliability was calculated using Cronbach's alpha (Cronbach's alpha= 0 .752).

(b) Academic Achievement

In this study Academic achievement has taken from authorized staffs of schools based on the percentage of previous annual examination marks.

Methods and Statistical Techniques

This study is descriptive research to investigate about current situation of critical thinking ability and subsets of that as well as academic achievement among adolescent students of Mysore City in India.

Table 1, Descriptive: Secondary Schools & Senior Secondary School Students

		Frequency	Percent
Valid	secondary school	375	60.0
	senior secondary school	250	40.0
	Total	625	100.0

Table 1 shows frequency of students that out of 625 participants, 375 students were in secondary schools (60 %), and 250 were in senior secondary schools (40 %).

Table 2, Descriptive: Percentage Of Previous Annual Examination

N	Valid	625
Mean		75.51
Median		78.00
Std. Deviation		13.636
Variance		185.932
Skewness		-.416
Std. Error of Skewness		.098
Minimum		35
Maximum		98

Table 2 shows percentage of previous annual examination (Academic Achievement). In this table characteristics of dependent variables illustrated by (M= 75.51, SD= 13.636, Min= 35, Max= 98). Skewness p-value= -0.416, < - 0.5 & + 0.5>, and that means distribution is approximately symmetric.

H1) There is significant relationship between critical thinking ability and academic achievement among adolescent students.

To examine above hypothesis a Spearman's Correlations has used to determine existing relationship between critical thinking ability and academic achievement.

Table 3, Spearman's rho Correlations

			Percentage Of Previous Annual Examination	Critical Thinker Ability
Spearman's rho	**Percentage Of Previous Annual Examination**	Correlation Coefficient	1.000	.340
		Sig. (2-tailed)	.	.000
		N	625	625
	Critical Thinker Ability	Correlation Coefficient	.340	1.000
		Sig. (2-tailed)	.000	.
		N	625	625

Table 3 presents result of Spearman's rho Correlations = 0.340, p= 0.000 < 0.05. this result indicates there is significance positive correlation exists between critical thinking and academic achievement, but correlation is weak.

H2) There is differences between students' academic achievement and critical thinking among adolescent students.

To test above hypothesis a One-Way ANOVA has been applied to examine proposed claim about correlation between critical thinking ability and academic achievement (SPSS, 20).

Table 4, One Way ANOVA Percentage Of Previous Annual Examination

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10417.533	2	5208.766	30.679	.000
Within Groups	105604.284	622	169.782		
Total	116021.817	624			

Table 4 shows the result of One Way ANOVA is significant. F(2,622)= 30.679, p= 0.000 < 0.05, and it indicates there is significant relationship between critical thinking and academic achievement.

Table 5, Multiple Comparisons, Dependent variable: Percentage Of Previous Annual Examination, Tukey HSD

(I) Critical Thinking Level	(J) Critical Thinking Level	Mean Difference (I-J)	Std. Error	Sig.
Poor	**Average**	-3.228	1.438	.065
	High	-9.299*	1.187	.000
Average	**Poor**	3.228	1.438	.065
	High	-6.071*	1.558	.000
High	**Poor**	9.299*	1.187	.000
	Average	6.071*	1.558	.000

Table 5 highlights that there is significant difference between Poor and High students (p= .000 < .05), Average and High (p= .000 < .05).

Table 6, Homogenous Subsets, Percentage Of Previous Annual Examination Tukey HSD

Critical Thinking Level	N	Subset for alpha = 0.05	
		1	2
Poor	323	72.08	
Average	110	75.31	
High	192		81.38
Sig.		.056	1.000

Table 6 indicates the Mean of percentage of previous annual examination (Academic Achievement) for the High students category (M= 81.38) is greater compare with the Poor and Average students categories.

H3) There is significant relationship between reasoning ability and academic achievement among adolescent students.

To find out relationship between reasoning ability (Critical Thinking Process), a Pearson Correlation coefficient has used to analyze data.

Table 7, Pearson Correlations

		Percentage Of Previous Annual Examination	Critical Thinking Process
Percentage Of Previous Annual Examination	Pearson Correlation	1	.226
	Sig. (2-tailed)		.000
	N	625	625
Critical Thinking Process	Pearson Correlation	.226	1
	Sig. (2-tailed)	.000	
	N	625	625

Table 7 demonstrates significance and positive relationship between ability of reasoning and academic achievement [r(623)= .226, p = .000 < .05]. But the power of correlation is weak (less than .4).

H4) There is significant relationship between concluding ability and academic achievement among adolescent students.

Table 8, Spearman's rho Correlations

			Percentage Of Previous Annual Examination	**Critical Thinking Product**
Spearman's rho	**Percentage Of Previous Annual Examination**	Correlation Coefficient	1.000	.335
		Sig. (2-tailed)	.	.000
		N	625	625
	Critical Thinking Product	Correlation Coefficient	.335	1.000
		Sig. (2-tailed)	.000	.
		N	625	625

Table 8 shows the result of Spearman's rho and it demonstrates significance and positive correlation between concluding ability (product of Critical Thinking) and academic achievement. However, this result is weak.

RESULTS AND DISCUSSIONS

Based on the previous researches, has raised curiosity to investigate about current situation between critical thinking and academic achievement among students. Results of Spearman's rho Correlations (r = .34) demonstrate *significance and positive* correlation between these two variables. Therefore, it will be favorable to focus on enhancing critical thinking ability in respect to arise academic achievement of students in educational systems.

The second question of this study was to investigate students' academic achievement with different level of critical thinking ability. Results of One-Way ANOVA, clarified a significant relationship as well demonstrate students with *high level of critical thinking* ability had *greater academic achievement*. Reasoning ability as a major part of critical thinking ability has shown significance and positive relationship between this ability and academic achievement. To examine relationship between reasoning ability and academic achievement Pearson Correlation Coefficient has applied r(623)= .226. Results were statistically significance.

The ultimate goal of critical thinking is to conclude logically and make rational decision. To test about existing relationship between concluding logically and its relation with academic achievement Spearman rho Correlations has applied to test assumed hypothesis. Results was statistically significance (rho = .335).

From above results demonstrate positive correlation between critical thinking ability and its sub elements. This ability as a key feature to enhance academic achievement can be teach, learnt and improve in educational systems. To equip our students with these abilities, basic changes need in traditional classrooms.

CONCLUSIONS AND IMPLICATIONS

By respect to the nature of this study, researcher suggests major changes in traditional classrooms and move towards active classrooms. This study has shown significant statistical results; either this relationship is positive, but it is weak. India, as old and historical country, needs empower its students with high levels of essential abilities to improve and moving faster and faster with this competitive world. Based on relevant literature Critical Thinking Ability and its elements can be applicable technique to change classrooms and make reasonable, logical, and active students to create new knowledge in global' information.

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