Comparing the influence of critical thinking on the academic performance of two secondary education boards in Pakistan

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Abstract

The practise of critical thinking has superseded more traditional forms of learning, such as rote memorising. It is essential for 21st century students to involve in critical thinking with other skills such as to be creative, to work collaboratively, and to reflect and make decisions effectively. Students under different boards of education in Pakistan perform differently. The purpose of this research was to evaluate the academic performance of students from AKU-EB and the Board of Secondary Education, Karachi, who were able to demonstrate critical thinking skills. One hundred students were chosen at random from four different schools in Karachi, including representation from two AKU Board and two Karachi Secondary School Board institutions. The study utilised a causal-comparative research design, and the skill of critical thinking was the variable that was investigated for which questionnaires and interviews were utilised. Critical thinking skill was further subdivided into sub variables such as problem solving, decision-making, reflective-thinking, reasoning, and inquiry-learning skills, and the effects of these skills on students' academic performance were investigated. The data were subjected to statistical analysis. The Chi-Square test was applied to examine the validity of five different null hypotheses. It is hoped that this study would contribute to education by illuminating the ways in which various educational boards encourage or discourage the use of critical thinking among their students. Its goal was to contribute to the educational literature of Pakistan.

Keywords: *Critical thinking, Performance, Examination Board*

Introduction

Thinking is a cognitive activity directed to achieve some end or purpose. It works through mental exploration instead of motor exploration (Mangal, 2013).Thinking is utilizing mental representations of things and experiences to solve meaningful issues and entails internalizing external experiences and solving problems (Sah, 2022).Questioning common assumptions is an essential aspect of active learning because it leads students to new ideas that may improve the quality of their lives and, more crucially, inspire them to think at a higher level (Bean, & Melzer, 2021). Critical thinking is a kind of deliberate thinking in which individuals consistently and methodically put intellectual norms and standards onto their views. (Paul, as cited in Popil, 2011). Golding (2011) implies that the process of learning should be seen as more than verbal copying. The cultivation of students' critical thinking occurs when they attend to, explore, and investigate thought-provoking issues regarding pertinent nature of the content, and when they acquire a temperament toward their critical thinking activities. Ignatavicius (cited in Popil, 2011) informs that critical thinkers are "outcome driven, open to new ideas, flexible, willing to change, innovative, creative, analytical, communicators, assertive, persistent, caring, energetic, risk takers, knowledgeable, resourceful, observant, intuitive, and 'out of the box' thinkers" (p. 204). Researchers also feel that critical thinking abilities improve students' understanding of the subjects they are attempting to comprehend and, as a result, assist them in their educational pursuits. Instead of blindly accepting authority, an increasing number of individuals will be expected to arrive at logical conclusions via the use of analytical and deductive reasoning as time goes on. Therefore according to Miri, David, & Uri(2007) it is imperative that students should be prepared to question truisms, raise questions about uncertainties, investigate conditions, and explore alternatives (i.e., think critically), in the context of both schooling and daily life (Festa, 2009)For example in science class, students could use critical thinking to plan their group project. They decide who will do what when. They figure out how and where to work together after school so it can be implied that critical thinking makes people identify their own strengths and weaknesses, how to improve their thinking, decision making, and exploring information. The researcher is of the opinion that critical thinking is an essential academic skill for students to have in order to deal with any simple or complex problem that may arise in their lives. This may include analysing a situation or thinking about and making judgments regarding the credibility of information. Hafni, et al., (2020) inform that educating for critical thinking requires sophisticated

conceptions of learning and teaching and the learners must be provided with an educative environment where they can sharpen their critical skills, develop a critical character, and understand the nature of critical thinking and the subject matter they are considering. The researcher believes that students' lack of critical thinking abilities encourages rote learning, which undermines education's goals of comprehending and applying information. At every level, education aims to foster higher-order thinking abilities, especially critical thinking (CTS). Pakistan National Education Policy (1998-2010) also aims to build self-reliant, analytical, innovative, dynamic, creative, and truth-seeking persons (MoE, 2011). Since Pakistan denationalised private schools in 1977, private education has grown significantly (Iqbal, 2011). Over the last several decades, private educational boards have formed and worked alongside official examination boards around the country. Cambridge "O" and "A" levels from Cambridge International Examination (CIE) system schools in the UK or mainstream schools in Pakistan that use the Aga Khan University Examination Board to conduct globally recognised assessments have grown rapidly. Due to Pakistan's declining education standards and students' insufficient knowledge acquisition and processing, private examination boards were needed. This has raised student performance expectations and instructor obligations to enhance instructional procedures. Teachers must decide how to improve pupils' academic achievement via CTS development. The researcher wanted to explore how students' critical thinking changes under the city's parallel examination boards and how it affects their academic success. This study compares AKU-EB with BSE, Karachi secondary school students' critical thinking abilities and performance. Since there was little research on this topic, this study aimed to contribute to the literary background of education in Pakistan and benefit teachers, administrators, curriculum planners, and students. Pratt &Tynan (2019) also recommend that instructors must employ research findings from their memory in the classroom and integrate it into professional knowledge, storing practises and policy creation as professional experience.

Research Question

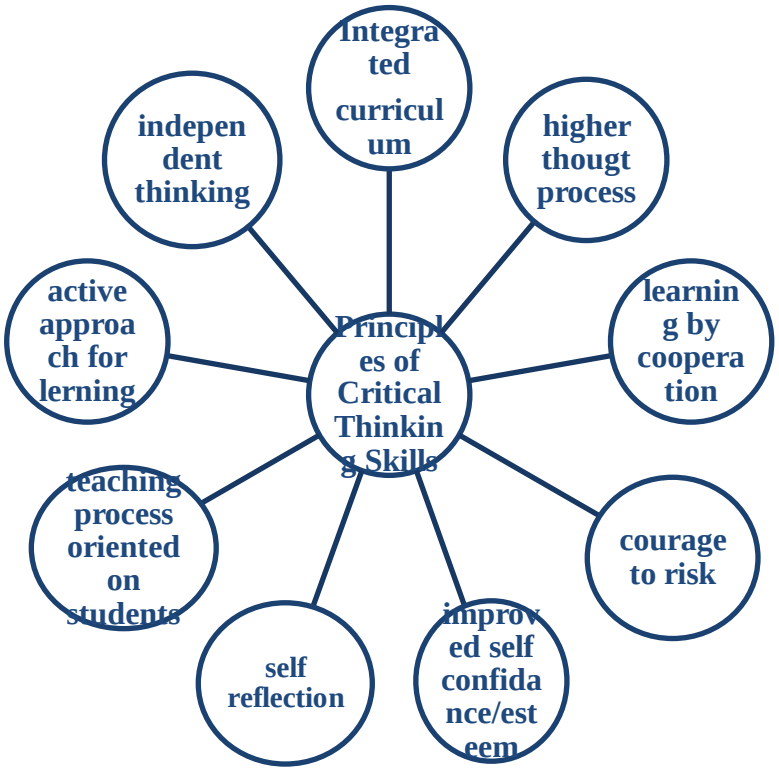
Are there any significant differences between the effectiveness of using Critical Thinking Skills on the Academic Performance of Secondary School Students in AKU Board versus Board of Secondary Education?

Literature Review

Many academics agree with Dewey that critical thinking (CT) starts with pupils' problem-solving. Critical thinking requires the ability to recognize questions worth exploring and the desire to direct one's own inquiries, questions via self-directed exploration and examination of information, a notion that knowledge is debatable, and being able to substantiate one's arguments with evidence. This means that CT may be characterized as Individual mental process that starts with the purpose of solving a problem or answering a question by studying available information and selecting the most suited and logical one (Alsaleh, 2020). Formulating questions, Deducting, comparing Reasoning, processing and inquiry (Milvain, 2008) are used to indicate a desire to teach processes of thinking and learning that can be applied in a wide range of real-life contexts. In the present state of changing world where rapid development of technology is taking place, the change in educational practices is also required as supported by Mason (2007) that critical thinking and collaborative knowledge construction have become essential competencies for people in the new information age and the global economy society. Educators have long been aware of the importance of thinking skills as an outcome of student learning and as the need of the challenging world for students to possess higher order, critical thinking and problem solving skills.Cognitive thinking focuses insightful learning and describes mental processes for critical thinking. It is necessary to understand it as cognitive activity and the principles on which these skills work. Primary task of cognitive Learning style is making sense from the information and interpreting it (Krause et al., 2010). This cognitive skill has been reinforced by traditional theories such as progressivism and idealism and more contemporary ones such as cognitive information processing and Bloom's Taxonomy (Thompson, 2011).Brookhart (2010) is of the opinion that critical thinking judgments are existing in all disciplines for example literature review involves both analysis of the work done on a particular topic and evaluating to what degree it accomplished writer's purpose. Similarly advertisers estimate the effects of advertising strategies on their audiences or students estimate effects of their arguments in pursuing their parents for agreeing on something. All of these involve critical judgments about purpose or assumptions. Critical thinking is a functioning example of higher order thinking, this is a skill of taking responsibility making choices on logical and reflective thinking. Critical thinking constructs students' ability of drawing conclusion. It helps in the development of Meta-cognitive understanding (Brookhart, 2010) where an individual possess the ability to think about thinking.

Valentová, & Brečka (2019) described following as principles of critical thinking that help in observing behaviours and improving quality of life.

Figure 1
Principles of critical thinking skills



(Adapted from Valentová, &Brečka, 2019)

Role of curriculum in promoting critical thinking skills (CTS)

Universally, learning goals of elementary, secondary, and tertiary education curricula emphasize the development of critically thinking. The critical thinking skills can be embedded in curriculum as a process of actively conceptualizing, applying, analyzing, synthesizing and or evaluating information gathered from, or generated by observation, experience, reflection, reasoning or communication (Thompson, 2011). Howarth (2011) informs that Critical thinking has an increasing importance in the curriculum that is evident in the organization of a framework for personal, learning and thinking skills. Shaw (2011) also emphasize that curriculum planning approaches require an effective means of instructional planning. Curriculum development or

changes in curriculum must be aimed to focus on higher-level outcomes, such as critical thinking and teamwork, with more personalized learning that help in overall development of Students. Wang et al., (2009) emphasize that educators who focus on content knowledge need to promote critical thinking skills as an integrated component of the learning process. A curriculum that promotes critical thinking will provide learners with the ability to evaluate various sources, consider multiple points of view, and learn to question established ideas and presumptions. Critical thinking-skill development should therefore be pivotal to students' process of creating their own awareness, practise different thinking styles, and become effective learners.

Critical thinking and academic performance

Many researchers have given ample evidences that academic performance of a student is enhanced by critical thinking skills. Brookhart (2010) supports that students learn by constructing meaning and incorporating new knowledge in their existing mental representations therefore enhanced critical thinking will improve their ability to construct knowledge help in improving their overall performance. In order to elaborate further on this concept it is imperative to understand what overall academic performance means. The study conducted by Stupnisky, Critical thinking features prominently in academic and policy literature on education at all levels. Different definitions of critical thinking emphasize on reasoning skills of analysis and evaluation, problem solving or decision making (Moon as cited in Howarth, 2011)

Effect of decision-making skills in enhancing students' academic performance

Making a decision is a complicated thought process that aims to make the best choice. to choose the best possible options or solutions for an individual in a certain situation so that person can reach a desired goal(Abdulsalam et al., 2020).The researcher thinks that decision-making skills allow students to develop criteria in complex situations and independently formulate decisions. Tanglang, & Ibrahim, (2016) assert that it is essential for students to be able to make sound choices or decisions in order to achieve overall success in their endeavours, whether they academic or otherwise.

Effect of problem-solving skills in enhancing students' academic performance

Teaching children to ask and answer questions is critically important if they are to engage in reasoned argumentation and *problem-solving* (Gillies & Khan, 2009). Problem-solving enhances the academic performance of students because learning of flexible problem-solving skills needs to be based on known strengths and processing limitations of the human mind. Most cognitive processes involved in solving relatively novel problems require conscious effort and usually engage relevant information from the learner's knowledge base (Kalyuga & Hanham, 2010).

Effect of reflective-thinking skills in enhancing students' academic performance

Dewey (as cited in Lee, 2005) identified reflection as one of the modes of thought that includes "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of grounds that support it and the future conclusions to which it tends" (p. 700). Loka, et. al., (2019) reinforce that reflection is essential human activity in which individuals reclaim their identities, consider the occurrence, go over it and assess it. Reflection allows for the incorporation of new knowledge into old knowledge and skill that motivates individuals to participate to learn from their experiences.

Effect of reasoning-skills in enhancing students' academic performance

Reasoning skill is a basic component of any cognitive system. Reasoning in itself is a special form of inference at the conceptual level, where mental representation or conclusion is consciously produced along with previously held representations. The premises provide reasons to accept the conclusion (Mercier &Sperber, 2011). Heit and Rotello (2010) explain the relationship between induction and deduction and treat it as a psychological question. Induction judgments are influenced by quick heuristic processes that tap into associative context information, whereas deduction judgments are used in by slower analytic activities that require collegial and typically more accurate reasoning. According to the study, if instructors effectively use both of these talents, academic performance will improve.

Effect of inquiry-skills in enhancing students' academic performance

Inquiry is a comprehensive activity that involves making observations. Harlen, (2014) informs that children are playing an active role in the development of their knowledge and learning skills

by investigating questions or solving issues that interest their attention and thought. Evidence collection and using it in the process of making sense of the many facets of the world is essential for inquiry skills. If they carefully and methodically observe, predict, plan, and carry out investigations, interpret data, etc. in a way that is consistent with how science works, ideas that don't fit the evidence will be thrown out. Siburian et al., (2019) highlight that students are able to develop these skills when they participate actively in the process of developing and enhancing their cognitive abilities Thus, the inquiry skills may provide more meaningful and effective learning in the areas of critical and creative thinking leading to better academic achievements.

Statement of hypotheses:

Hypotheses are educated guesses suggesting the outcome of the study. They are stated in the form of a statement showing the relationship between dependent and independent variables within the topic of research to be studied. The purpose of stating hypothesis is not to prove the hypothesis but to collect data to study whether is it supported or not. In light of the literature review the following hypotheses were formulated for the research problem and because of statistical analysis, they were stated in null form.

Ho^1

There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *decision-making skills.*

Ho^2

There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *problem-solving skills.*

Ho^3

There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *reflective-thinking skills*.

Ho^4

There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *reasoning-skills*

Ho^5

There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *inquiry-skills.*

Definition of key terms

The terms included in the definition of terms can be only those that would have a specific meaning or interpretation in the study being conducted. It is an important because if a term has more than one definition and it is critical to the understanding of the study, it is defined in this section to make the reader understand the context in which it is used in the study.

a) **Critical thinking:** Critical thinking is ‘‘reasonable reflective thinking that is focused on deciding what to believe and do” (Ennis, as cited in Ku &Ho, 2010). It enables the learner to reason effectively, evaluate information and consider different views so as to arrive at a decision (Ku &Ho, 2010).
b) **Performance:** Business dictionary (n. d.) defines the term performance as the measurement of achievement against already known standards of accuracy, completeness and speed. It is the way in which someone or something function, for any kind of accomplishment.
c) **Examination Board:** Cambridge online dictionary (n. d.) defines examination board as “an official organisation that creates examinations and judges their results”. It is a regulatory body, which supervises and monitors overall assessment system in educational organisations, mainly schools and colleges.

Research Methodology

The goal of research is to answer questions by investigating a topic in an organised and methodical manner. Since the purpose of this research is to find a solution to a problem in the educational system, we may appropriately refer to this research as educational research. Data is collected through questionnaires and interviews hence it is mixed method approach.

Study Design

The *retrospective* causal-comparative research design *which starts with effects and investigates possible causes* is used because it entails categorising two groups that differ on a behaviour and the researcher strived to find out the causes or reasons for existing differences in the behaviour of groups or individuals (Gay et al., 2012). The retrospective causal-comparative research design which started with effects and investigates possible causes was used for two groups for studying any problem. The two groups selected for this study were students examined under AKU-EB versus BSE-K. Gay, Mills and Airasian (2012) define independent variable (IV) or the cause as “a behaviour or characteristic under the control of the researcher and believed to influence some

other behaviour or characteristic" (p. 627). The independent variable in this study was critical thinking skills, which was further divided into its sub-variables such as decision-making skills, discovery-learning skills, problem-solving skills, reflective-thinking skills, reasoning-skills and inquiry-skills. The dependent variable (DV) or the effect was "the change or difference in a behaviour that occurred as a result of the independent variable" (Gay, Mills and Airasian., 2012, p. 625). The dependent variable in this study was the academic performance of the students examined under AKU-EB and BSE-K.

Population

The target population for this study were all the secondary school students of Karachi studying under Secondary School Boards.

Sample

The accessible population or the sample selected for the research study was nine schools comprising three each from AKU and BSE, Karachi Boards. Among these schools, there were two girl and two boy; school from each board so as to ensure the uniformity of results regardless of gender constraints. A sample of 100 students was used for data collection and approximately 25 students from each school were selected. The sampling technique used for selecting school is *convnience* sampling which according to Burns (2000) is when the research is carried out on conveniently accessible groups due to constraints of finances, permission or because of less option available to researchers.

Data Collection

The data gathering for this research was carried out by designing, checklists and questionnaire. Questionnaires are easy to administer and will gather great variety of data (Swann & Pratt, 2007). However, interview of one teacher from each school was also taken to check the authenticity of the data gathered from the students. The data gathered through questionnaires containing 12 options on a likert scale for each statement and participants were asked to choose options according to the level of their opinion. The total time required for collection of data from the participants was approximately 1 Hour.

Data Analyses

Since the research is designed to compare the effects of using different critical thinking skills on academic performance of students, a chi square test of significance was used to compare the effects on students studying under three different Educational Boards. The data collected for the

research study was analysed to determine whether the use of CTS are affecting the academic performances of students or not. The research problem for the current study was formulated by the researcher in the light of experience gained while working and teaching AKU EB and BSE, Karachi board students and researcher's perception about difference in their thinking abilities. The researcher formulated five hypotheses for the present study in the light of literature reviewed. The hypotheses were converted into null form in order to make them statistically testable. The hypothesis also helped the researcher to construct the data gathering tools for the research.

Table 1

PARTICIPANTS	Male students		Female Students		Total	
	Number Male	Average	Number Female	Average	Total Number	Average
AKU-EB	25	25%	25	25%	50	100%
BSE-KHI	25	25%	25	25%	50	100%
TOTAL	50	50%	50	50%	100	100%

Table showing gender wise distribution of sample

Based on the literature review the current study adopted the following critical thinking skills to develop and state the hypothesis.

1. Decision-Making Skills,
2. Problem-Solving Skills,
3. Reflective-Thinking Skills,
4. Reasoning Skills And
5. Inquiry-Skills

For testing this hypothesis with chi square, the responses were distributed in two levels of agreements, that is high level agreement responses and low level agreement responses under AKU-EB and BSE-K thus making up a 2x2 table of chi square. Initially the distribution of responses was made into three levels, which are high, moderate and low levels, but because of very low frequencies in certain levels, the moderate level was deleted and only high and low levels were kept. This is in accordance to the rule given by Burns (2000) that in two dimensional table, all cells should have 5 or more than 5 cases. Therefore 2x2 tables was used in all the five hypothesis due to which the df value calculated was 1, hence Yates correction was applied in all

5 hypotheses. Participants gaining points between 31 to 50 were grouped as high level of agreement and those was having points between 10 to 30 as low level of agreement toward the specific hypothesis.

Table 2

Participants ↓	High Level of Agreement (31 to 50)		Low Level of Agreement (10 to 30)		Row Total
BSE - K	45	*90%*	5	*10%*	50
AKU-EB	44	*88%*	6	*12%*	50
Column Total	89	*89%*	11	*11%*	100

Table shows the level of agreements of students studying under AKU-EB's and BSE-K's regarding the effect of decision making skills on their academic performance
$\chi 2 = 0.20$ df=1 p=0.05

Interpretation for Hypothesis One: Since the calculated chi square value for hypothesis one was 0.20 that was smaller than the tabled value of 3.841 at p=0.05 level of significance where df=1, therefore the null hypothesis is not rejected, that is retained while the research hypothesis is rejected.

Table 3
Tabulation of Responses for Each Statement of Hypothesis One

S. No	The behavioural outcomes of the students can be enhanced in the class if I:	Rank	BSE KHI			Total	Rank	AKU-EB			**Total**
			SA +A	U	D+S D			SA +A	U	D+S D	
1	try to understand my own ideas first and then ideas of others	1	44 88 %	2 4%	4 8%	50 100 %	1	44 88 %	5 10 %	1 2%	**50** **100 %**
2	give importance to each method assigned by the teacher to solve a problem	5	33 66 %	9 18 %	8 16%	50 100 %	1	44 88 %	3 6%	3 6%	**50** **100 %**
3	can relate two different concepts with their component parts	6	30 60 %	14 28 %	6 12%	50 100 %	5	27 54 %	21 42 %	2 4%	**50** **100 %**
4	figure out things on my own	4	37 74 %	12 24 %	1 2%	50 100 %	3	32 64 %	12 24 %	6 12%	**50** **100 %**
5	find a number of ways of explaining my view point to others	4	37 74 %	5 10 %	8 16%	50 100 %	5	27 54 %	9 18 %	14 28%	**50** **100 %**
6		5	33	6	11	50	6	24	7	19	**50**

	ask others before deciding the way to complete task		66 %	12 %	22%	100 %		48 %	14 %	38%	**100 %**
7	avoid making decision if it is not very necessary	8	19 38 %	16 32 %	15 30%	50 100 %	7	20 40 %	13 26 %	17 34%	**50** **100 %**
8	need help from my classmates or teacher to make the correct choice about starting my work	7	25 50 %	11 22 %	14 28%	50 100 %	4	28 56 %	11 22 %	11 22%	**50** **100 %**
9	can identify difficulties that I have to deal with	3	38 76 %	6 12 %	6 12%	50 100 %	2	39 78 %	5 10 %	6 12%	**50** **100 %**
10	am confident and know very well what I am doing	2	41 82 %	7 14 %	2 4%	50 100 %	2	39 78 %	4 8%	7 14%	**50** **100 %**

Hypothesis Two: The statement of second hypothesis stated that 'There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *problem solving skills'.*

Table 4
Showing level of agreement of students regarding the use of problem solving Skills

Participants ↓	High Level of Agreement (31 to 50)		Low Level of Agreement(10 to 30)		Row Total
BSE KHI Students	45	*90%*	5	*10%*	50
AKU EB Students	42	*84%*	8	*16%*	50
Column Total	87	*87%*	13	*13%*	100

$\chi 2 = 0.88$ **df=1** **p=0.05**

Interpretation for Hypothesis Two: Since the calculated chi square value for hypothesis one was 0.88 that was smaller than the tabled value of 3.841 at p=0.05 level of significance where df=1. Therefore the null hypothesis that" There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *Problem solving skills",* is retained while the research hypothesis that "The students examined under AKU-EB are expected to show higher academic performance regarding the effect of using problem solving skills than those who are examined under BSE-K.", is rejected or not supported.

The trend of similarities in the high level of agreement can be observed from the table of responses below for example statement number 1 is highly ranked by students both categories

that shows that logical and independent thinking is exhibited by students studying in both educational boards at higher priority levels. This high level of agreement by both type of students resulted in the support or retention of the null hypothesis that 'There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *Problem solving skills'.*

Table 5
Showing the tabulation of Responses for Each Statement of Hypothesis

S.No	**The behavioural outcomes of the students can be enhanced in the class if I:**	**Rank**	**BSE KHI**			**Total**	**Rank**	**AKU EB**			**Total**
			SA+A	**U**	**D+SD**			**SA+A**	**U**	**D+SD**	
1	think independently and logically	**1**	**47** 94%	**1** 2%	**2** 4%	**50** 100%	**1**	**44** 88%	**5** 10%	**1** 2%	**50** 100%
2	feel that searching information for completing my work is unnecessary and takes a lot of time	**10**	**11** 22%	**19** 38%	**20** 40%	**50** 100%	**10**	**9** 18%	**4** 8%	**37** 74%	**50** 100%
3	study all the key points in a topic and put them in a systematic order	**7**	**30** 60%	**10** 20%	**10** 20%	**50** 100%	**4**	**36** 72%	**8** 16%	**6** 12%	**50** 100%
4	solve the problem quickly without wasting a lot of time on details	**6**	**31** 62%	**10** 20%	**9** 18%	**50** 100%	**7**	**27** 54%	**10** 20%	**13** 26%	**50** 100%
5	prefer to deal with new challenges first	**5**	**32** 64%	**4** 8%	**14** 28%	**50** 100%	**6**	**30** 60%	**13** 26%	**7** 14%	**50** 100%
6	do not let the problem upset me, no matter how difficult it is	**2**	**41** 82%	**6** 12%	**3** 6%	**50** 100%	**5**	**33** 66%	**4** 8%	**13** 26%	**50** 100%
7	do not feel comfortable trying out new ways of solving problems in class	**8**	**19** 38%	**15** 30%	**16** 32%	**50** 100%	**8**	**19** 38%	**12** 24%	**19** 38%	**50** 100%
8	enjoy solving new problems	**3**	**40** 80%	**2** 4%	**8** 16%	**50** 100%	**2**	**42** 84%	**6** 12%	**2** 4%	**50** 100%
9	suggest solution of problems to others	**4**	**37** 74%	**9** 18%	**4** 8%	**50** 100%	**3**	**38** 76%	**9** 18%	**3** 6%	**50** 100%
10	usually think that I don't have enough information to deal with the problem.	**9**	**12** 24%	**19** 38%	**19** 38%	**50** 100%	**9**	**13** 26%	**15** 30%	**22** 44%	**50** 100%

Hypothesis Three: The statement of second hypothesis stated that 'There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *Reflective thinking skills'.*

Table 6

Participants ↓	High Level of Agreement (31 to 50)		Low Level of Agreement (10 to 30)		Row Total
BSE KHI STUDENTS	45	*90%*	5	*10%*	50
AKU EB STUDENTS	44	*88%*	6	*12%*	50
Column Total	89	*89%*	11	*11%*	100

$\chi 2 = 0.20$ df=1 p=0.05

Shows level of agreement of students regarding the use of Reflective thinking skills in Table 6.

Interpretation for Hypothesis Three: Since the calculated chi square value for hypothesis one was 0.20 that was smaller than the tabled value of 3.841 at p=0.05 level of significance where df=1. Therefore the null hypothesis that" There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *Reflective thinking skills",* is retained while the research hypothesis that "The students examined under AKU-EB are expected to show higher academic performance regarding the effect of using problem solving skills than those who are examined under BSE-K.", is rejected or not supported.

Tabulation of Responses Verifying Hypothesis Three: Table 6 shows the level of agreement and trend of similarities in the responses shown by students in both categories. Students from BSE –K's and AKU-EB have highly agreed that they review and rethink on their actions and strive to improve their future performances. This can be regarded as one of the reason that the null hypothesis that 'There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *Reflective thinking skills',* is retained or supported.

Table 6
Tabulation of Responses for Each Statement of Hypothesis Three

S.No	When I am working on an activity in the classroom/lab, I:	Rank	BSE KHI			Total	Rank	AKU EB			Total
			SA+A	U	D+SD			SA+A	U	D+SD	
1	do it without thinking about what I am doing	**10**	**14** 28%	**5** 10%	**31** 62%	**50** 100%	**10**	**8** 16%	**9** 18%	**33** 66%	**50** 100%
2	question the way other students do and try to think of a better way	**2**	**40** 80%	**7** 14%	**3** 6%	**50** 100%	**7**	**28** 56%	**12** 24%	**10** 20%	**50** 100%
3	consider alternative ways to solve the problem and complete the activity	**5**	**32** 64%	**12** 24%	**6** 12%	**50** 100%	**3**	**35** 70%	**9** 18%	**6** 12%	**50** 100%
4	recall almost everything while writing	**8**	**27** 54%	**11** 22%	**12** 24%	**50** 100%	**2**	**37** 74%	**5** 10%	**8** 16%	**50** 100%
5	understand the concepts quicker just by recalling	**6**	**31** 62%	**10** 20%	**9** 18%	**50** 100%	**5**	**32** 64%	**12** 24%	**6** 12%	**50** 100%
6	re-think on my actions to see whether I could improve further on what I did before	**1**	**45** 90%	**2** 4%	**3** 6%	**50** 100%	**4**	**34** 68%	**11** 22%	**5** 10%	**50** 100%
7	change my normal way of doing things	**7**	**28** 56%	**10** 20%	**12** 24%	**50** 100%	**9**	**18** 36%	**13** 26%	**19** 38%	**50** 100%
8	follow what the teacher says and do not think too much on my own	**9**	**20** 40%	**15** 30%	**15** 30%	**50** 100%	**8**	**23** 46%	**9** 18%	**18** 36%	**50** 100%
9	re-view my experience so that I can improve in my next performance	**4**	**36** 72%	**8** 16%	**6** 12%	**50** 100%	**1**	**38** 76%	**2** 4%	**10** 20%	**50** 100%
10	I usually think and plan ahead	**3**	**38** 76%	**9** 18%	**3** 6%	**50** 100%	**6**	**31** 62%	**6** 12%	**13** 26%	**50** 100%

Hypothesis Four: The statement of second hypothesis stated that 'There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *Reasoning skills'.*

Table 7

Participants ↓	High Level of Agreement (31 to 50)		Low Level of Agreement (10 to 30)		Row Total
BSE KHI STUDENTS	45	*90%*	5	*10%*	50
AKU EB STUDENTS	43	*86%*	7	*14%*	50
Column Total	88	*88%*	12	*12%*	100

Shows agreement of students regarding the use of reasoning skills and its effect on academic Performance

$\chi 2 = 0.47$ df=1 p=0.05

Interpretation for Hypothesis Four: Since the calculated chi square value for hypothesis one was 0.47 that was smaller than the tabled value of 3.841 at p=0.05 level of significance where df=1. Therefore the null hypothesis that" There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *Reflective thinking skills",* is retained while the research hypothesis that "The students examined under AKU-EB are expected to show higher academic performance regarding the effect of using problem solving skills than those who are examined under BSE-K.", is rejected or not supported.

Tabulation of Responses Verifying Hypothesis Four: The trend of similarities in the responses marked by students in both categories is shown in table 4.8. Students from BSE-K's have shown high agreement that they focus highly on the questions asked by teachers whereas AKU-EB students highly agree to highlight important issues by giving explanation about them where as focus on teachers questions is ranked 2 by them . This can be regarded as one of the reason that the null hypothesis that 'There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *Reasoning skills',* is retained or supported whereas the research hypothesis that" The students examined under AKU-EB are expected to show higher academic performance regarding the

effect of using reasoning skills than those who are examined under BSE-K" is rejected or not supported.

Table 8

S. No	While answering questions for a task given by the teacher, I can :	Rank	BSE KHI			Total	Rank	AKU EB			Total
			SA+A	U	D+SD			SA+A	U	D+SD	
1	think in detail about the questions asked by the teacher	**1**	**40** 80 %	**6** 12 %	**4** 8%	**50** 100 %	**2**	**40** 80%	**7** 14 %	**3** 6%	**50** 100 %
2	draw conclusions by reading from the text only one time	**10**	**24** 48 %	**16** 32 %	**10** 20%	**50** 100 %	**8**	**28** 56%	**14** 28 %	**8** 16%	**50** 100 %
3	make prediction based on my observations	**3**	**38** 76 %	**10** 20 %	**2** 4%	**50** 100 %	**6**	**34** 68%	**11** 22 %	**5** 10%	**50** 100 %
4	apply a single rule to solve different types of problems	**8**	**32** 64 %	**14** 28 %	**4** 8%	**50** 100 %	**10**	**19** 38%	**6** 12 %	**25** 50%	**50** 100 %
5	apply my previously learned methods directly to understand new concepts	**5**	**35** 70 %	**10** 20 %	**5** 10%	**50** 100 %	**7**	**33** 66%	**9** 18 %	**8** 16%	**50** 100 %
6	observe the end-results after applying a rule and draw out main points from it	**7**	**33** 66 %	**10** 20 %	**7** 14%	**50** 100 %	**9**	**25** 50%	**16** 32 %	**9** 18%	**50** 100 %
7	highlight important and related issues by giving explanation	**9**	**31** 62 %	**11** 22 %	**8** 16%	**50** 100 %	**1**	**40** 80%	**8** 16 %	**2** 4%	**50** 100 %
8	give reasons to obtain logical conclusions or solutions	**2**	**39** 78 %	**8** 16 %	**3** 6%	**50** 100 %	**4**	**34** 68%	**9** 18 %	**7** 14%	**50** 100 %
9	explain my point of view based on reasons	**4**	**36** 72 %	**6** 12 %	**8** 16%	**50** 100 %	**3**	**36** 72%	**4** 8%	**10** 20%	**50** 100 %
10	give related statements to prove or support an argument	**6**	**34** 68 %	**7** 14 %	**9** 18%	**50** 100 %	**5**	**35** 70%	**8** 16 %	**7** 14%	**50** 100 %

Tabulation of Responses for Each Statement of Hypothesis Four

Hypothesis Five: The statement of second hypothesis stated that 'There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *inquiry skills'.*

Table 9

Participants ↓	High Level of Agreement (31 to 50)		Low Level of Agreement (10 to 30)		Row Total
BSE KHI STUDENTS	45	*90%*	5	*10%*	50
AKU EB STUDENTS	45	*90%*	5	*10%*	50
Column Total	90	*90%*	10	*10%*	100

$\chi 2 = 0.11$ df=1 p=0.05

Shows agreement of students regarding the use of inquiry skills and its effect on academic Performance.

Interpretation for Hypothesis Five: Since the calculated chi square value for hypothesis one was 0.11 that was smaller than the tabled value of 3.841 at p=0.05 level of significance where df=1. Therefore the null hypothesis that" There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *inquiry skills",* is retained while the research hypothesis that "The students examined under AKU-EB are expected to show higher academic performance regarding the effect of using inquiry skills than those who are examined under BSE-K.", is rejected or not supported.

Tabulation of Responses Verifying Hypothesis Five: Table 10 shows the level of agreement and trend of similarities in the responses selected by students in both categories. Students from BSE-K's and AKU-EB have highly agreed that they examine the best way to present information gathered after analyzing different point of views about it. This similar trend can be considered as one of the reason that the null hypothesis that 'There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *Reasoning skills',* is retained or supported whereas the research hypothesis that" The students examined under AKU-EB are expected to show higher academic performance regarding

the effect of using reasoning skills than those who are examined under BSE-K" is rejected or not supported.

Table 10

S. No	When completing independently a task after listening just to the introduction by the teacher, I can:	Rank	BSE KHI			Total	Rank	AKU EB			Total
			SA +A	U	D+ SD			SA+ A	U	D+ SD	
1	examine and deal with puzzling situations within the topic	3	39 78 %	9 18 %	2 4%	50 100%	5	35 70%	9 18 %	6 12 %	50 100%
2	use my previously learned knowledge to understand the topic	1	40 80 %	7 14 %	3 6%	50 100%	3	38 76%	6 12 %	6 12 %	50 100%
3	make predictions about the solution of the topic	4	35 70 %	9 18 %	6 12 %	50 100%	8	28 56%	9 18 %	13 26 %	50 100%
4	do the task without help from different sources such as media, news papers, internet, etc. on the topic	10	21 42 %	15 30 %	14 28 %	50 100%	10	12 24%	9 18 %	29 58 %	50 100%
;'	learn on my own through activities and gain experience on the concept	8	28 56 %	14 28 %	8 16 %	50 100%	4	37 74%	10 20 %	3 6%	50 100%
6	check and verify from different points of view about the concept	7	31 62 %	16 32 %	3 6%	50 100%	2	41 82%	6 12 %	3 6%	50 100%
7	learn and investigate things in a variety of ways	5	34 68 %	4 8%	12 24 %	50 100%	7	31 62%	8 16 %	11 22 %	50 100%
8	imagine and create new and unusual uses of the information obtained	9	26 52 %	13 26 %	11 22 %	50 100%	9	25 50%	17 34 %	8 16 %	50 100%
9	examine and decide the best way to present the information gathered	2	40 80 %	10 20 %	0 0%	50 100%	1	44 88%	5 10 %	1 2%	50 100%
10	investigate and make sure that there is sufficient information collected	6	32 64 %	7 14 %	11 22 %	50 100%	6	33 66%	9 18 %	8 16 %	50 100%

Tabulation of Responses for Each Statement of Hypothesis Five

Interview Schedule Responses from Teachers

To cross validate the findings of the research study one teacher from every participating school was interviewed through interview schedule.

Showing interview Schedule responses from Teachers in AKU-EB

The graphs 11 and 12 show the level of responses from teachers working in BSE Karachi and AKU EB affiliated schools.

Discussion

The intention of this study was to investigate the effects of critical thinking skills on the academic performance of students examined under Board of Secondary Education Karachi and Agha Khan University-Examination Board. Five null hypotheses were developed and tested through the chi square test. All five of the null hypotheses were tested at p=0.05 and df =1 and all five of the null hypotheses were accepted or retained while the research hypotheses were not supported or were rejected. Critical thinking skills are essential in today's job market. Children who are taught to think critically are more likely to find original solutions to everyday problems. Finding the best methods for teaching critical thinking across the board in higher education can be a daunting task, but research can help educators narrow in on the best practises. Research is needed to help guide and smooth out opportunities to think critically. In order to involve students in the process of developing critical thinking skills, teachers should promote, applaud, and support the implementation of student suggestions. Instructional delivery modes including class presentations, individual inquiry tasks, and cooperative-learning activities have proven to improve students' ability to think critically, but assessment methods alone are not as effective. The academic importance of this study with causal comparative design was to provide information for schools that want to improve critical thinking skills among their students. This research may be used to promote the need for future studies. Future research studies may be both qualitative and quantitative to establish an understanding of the relationship between critical thinking skills development and academic performance.

Hypothesis One - Ho^1

There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *decision-making skills.*

This hypothesis was not accepted which shows that the there was no significant difference found between the two groups of students. The results of the hypothesis, as shown in table 1 indicates that the categories of BSE Karachi students have response ration 90% where as AKU EB students' response ratio is 88%.

This response ratio of both the categories show that they have similar perception about the use of decision making skills and its effects academic performance of students. The research supports the notion that decision-making skills help students in locating information using them logically for personal decision making (Parker and Fischhoff, 2005). However the responses obtained from teachers working in BSE Karachi and AKU EB through Interview Schedule showed low level of agreement for decision making skills among the learners as shown in graph 14 and 15.

Hypothesis Two - Ho^2

There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *problem solving skills.*

There was no significant difference found between the two groups of students after testing the hypothesis through chi square test. The results of the hypothesis, as shown in table 1 indicates that the categories of BSE Karachi students have response ration 90% where as AKU EB students' response ratio is 84%.

This response ratio of both the categories shows that they have similar perception about the use of problem solving skills and their effects on academic performance of students. The research findings indicated that there is no significant difference amongst the reflective thinking skills of students in BSE Karachi and AKU EB. Woolfolk and Margetts (2010)that identifying and clarifying problems; drawing conclusion from the ample amount of information collected is achieved through problem solving approaches. However there is vital difference in statement 6 in section B of the questionnaire as shown in Graph 5 indicate wide difference in students' responses. It can be observed that the respondents' bias for providing socially acceptable answers can be the reason for the high level agreement of this response.

Hypothesis Three - Ho^3

There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *reflective thinking skills.*

This hypothesis was not accepted which shows that the there was no significant difference found between the two groups of students. The results of the hypothesis, as shown in table 5 indicates

that the categories of BSE Karachi students have response ration 90% where as AKU EB students' response ratio is 88%.

The level of agreement for both categories shows that they have similar perception about the use of reflective thinking skills and its effects onacademic performance of students. The statement 6 in section B of the questionnaire as shown in Graph 7 indicate major difference in students' responses about re-thinking on actions to improve future action is highly marked by AKU-EB students. It can be noted that the statement clearly indicted the tendency of reflective thinking.

Hypothesis Four - Ho[4]

There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *reasoning skills.*

This hypothesis was not accepted which shows that the there was no significant difference found between the two groups of students. The results of the hypothesis, as shown in table 7 indicates that the categories of BSE Karachi students have high level response ratio 90% where as AKU EB students' response ratio is 86%.

This response ratio of both the categories show that they have similar perception about the use of decision making skills and its effects academic achievements of students.

Hypothesis Five - Ho[5]

There is no significant difference between the academic performance of students examined under AKU-EB's and BSE-K's regarding the effect of using *inquiry skills.*

This hypothesis was not accepted which shows that the there was no significant difference found between the two groups of students about the use of inquiry skills. The results of the hypothesis, as shown in table 9 indicate that both categories of students have equally high level response ratio of 90%. This response ratio of both the categories shows that they have similar perception about the use of inquiry skills. However BSE Karachi student have showed low level of agreement for using different source to collect information during the inquiry learning activities in class. This statement contradict with their high level of agreement of using inquiry learning as however Kuhlthau, Caspari, &Maniotes (2007) informs that students need to use resources through guided inquiry for learning in and beyond the information age.

This research study provides information that can be practical to Teachers who have committed to fostering critical thinking skills in their students, especially when considering gender as a factor. Even though the null hypotheses were supported or retained but there is still a need to

utilize the research findings to delve further for study in the similar area. Respondents' level of agreement on critical thinking did not differ largely between groups, but the groups had differences in how they were made up. for example the analysis of demographic information shows the difference in the trends exhibited by male and female students in similar and different examination Boards, so these factors can be analyzed in depth, in future studies where as this study could also be helpful in future studies by changing the dependent variables.

Recommendations

For Further Study: In view of the finding of the current research some recommendation are offered for the effect of using Critical thinking skills. This was a non-random selection process used which can be changed to obtain results for generalization to larger population. More research can conducted with additional samples included to determine if there really is a pattern of differences between the uses of critical thinking skills in BSE Karachi versus AKU-EB students. Both instructional delivery modes and pedagogy can be studied further as to their relationship with critical thinking development.

For school administrations: The current study recommends that administration of schools show flexibility and provide opportunities and resources to teachers so that they can apply different teaching strategies to develop and foster critical thinking skills among students. Students should be awarded for exhibiting or showing critical thinking Skills among their classroom activities. Schools must provide opportunities to teachers for practicing and teaching reflective thinking, problem solving, inductive and deductive reasoning skills, decision making and inquiry skills among their students.

Outcome of the research: The study aimed to analyze the difference in the perception of students in different boards about the use of critical thinking skills. Further studies can also be done to analyze the effect of different assessment practices and use of different curricula by students studying in parallel examination boards in Pakistan.

Conclusion: The development of students Critical thinking skills is an imperative learning goal and responsibility. It is also fundamentally important that critical thinking skills must be developed in early school years to compete in rapidly moving world of technology. This study provides one piece in the puzzle of academic performance related to critical thinking and points the way to further research for this key aspect of learning especially in Pakistan which is facing large scale discrepancies between planned and performed actions in education sector. Critical

thinking skill development is paramount to producing an effective workforce. Students must learn to examine their thought processes and develop academic tools that promote the ability to analyze, to evaluate, and to reason. Educators must be able to evaluate each student and set a course of action for critical thinking growth development. Regardless of the instructional delivery mode used, educators should teach students to use critical thinking skills. By developing a questioning mentality, students are inconstant search of acquiring academic knowledge to meet the needs of an ever-changing society.

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