

Do Critical Thinking Skills Among Secondary Students Vary Across Three External Examination Boards? An Ex Post Facto Study

Nadira Dayo^a, Syed Asad Abbas Rizvi^a, Noor-Ul-Ain Bhellar^a, Muhammad Waqaruddin Shaikh^b

The Begum Nusrat Bhutto Women University, Sukkur, Pakistan^a

Sukkur IBA University, Pakistan^b

Highlights

- Critical thinking skills foster learners to engage in extensive reflection, critical analysis, logical reasoning, and effective planning.
- It has been found that students who appear on the BISE examination board have lower critical thinking skills than AKU-EB and CIE students.
- Critical thinking skills need to be assessed in examinations because by changing examination patterns, critical thinking pedagogies can be encouraged in classrooms.
- A uniform curriculum that fosters critical thinking skills can be adopted to assess various skills in external examinations.

Abstract

The study focuses on identifying the difference in critical thinking skills of secondary school students across three distinct examination boards e.g. AKU-EB, CIE, and BISE using an ex post facto research design. 30 students from each board were participants in the study and data was collected by using a researcher-developed questionnaire on critical thinking skills. The data were analyzed by using SPSS 23. The average scores (means) were compared of all three groups by using the one-way ANOVA technique. Notably, the mean critical thinking skill score for BISE students is 2.53, whereas values for AKU-EB and CIE students are 3.45 and 3.46, respectively. Significant discrepancies among boards suggest a notable disparity in the students' critical

thinking skills. The eta-squared effect size is 0.61, which indicates a moderate influence of examination boards on critical thinking abilities. These findings potentially support the development of a standardized curriculum that fosters critical thinking skills and prompts curriculum designers, examination boards, and legislators to rethink their approaches to enhancing critical thinking skills among secondary school students.

Keywords: Critical thinking skills, external exams, secondary/o-level students, and ex post facto research.

1. Introduction

Examination plays a vital role in defining how students should be taught (Rehmani, 2003) this is more similar to the notion of “teaching to the test” (Phelps, 2016) and “test effects” which argue that if exams require students to use higher order thinking skills then their conceptual knowledge also develops (Jensen et al., 2014). The development of critical thinking skills is of utmost significance in the field of education because it enables students to infer, reason, analyze, and evaluate data. This also empowers them to make informed decisions and interact with the world more productively. The value of encouraging critical thinking skills in secondary students has been acknowledged by educational systems all over the world, including those in Sukkur, Sindh. As a result, several test boards have been created to administer and evaluate students' academic progress. There are three different examination boards in Pakistan: The local/provincial examinations board, the Board of Intermediate and Secondary Education (BISE), the Agha Khan University examinations board (AKU-EB), Cambridge International Examinations (CIE) board. The local board works under the National Curriculum of Pakistan with significant concerns about a lack of fairness and unfavorable learning experiences (Abdullah et al., 2020). On the other hand, the AKU-EB and CIE are considered better and preferred examination systems (Carroll et al., 2008). The CIE is international, and it is afforded by elitists mostly and is superior because of its fair assessment (Eilam, 2022). Whereas AKU-EB is an alternative to the CIE, which was established in 2002, its cost is one-third of CIE's cost for checking one subject's paper. AKU-EB and Cambridge boards are considered to follow a similar quality of syllabus and are fairer than local examination boards (Burdett & Everett, 2015; Chawla, 2017).

Curriculum, pedagogy, and examination system make up the triangle phenomena known as the educational system. These three elements are essential and mutually dependent on the

examination system's role as a washback impact on the entire educational system in various ways and phases. In general, learning methods and instructional materials are aligned between students and teachers with the subject matter being evaluated. The educational experiences of students are significantly shaped by the examination boards, whose curriculum frameworks and assessment procedures may have an impact on how students develop their critical thinking skills. To pass the Boards of Intermediate and Secondary Education (BISE) exam, only a textbook is referred for studying. However, the other two boards leave it up to the school to choose the learning material. The BISE always follows one examination format with an agreed number of MCQs, short questions and answers, essays, and practical marks in a few subjects, while in O levels a choice of items varies from subject to subject (Christie, 2012). Furthermore, there is inconsistency in the pattern of outcomes of the candidates of all these examination boards, and research shows that when examinations are taken in any format, then teachers also use examination-oriented pedagogies to prepare students to qualify for exams and have standards of the exams. There is a close association among examination, pedagogies, syllabus, and curriculum (Chisholm, 2019; Malik et al., 2017). When the exams are taken from a concept and reasoning-based curriculum, learners are expected to advance their critical thinking skills.

Educators agree that critical thinking skills are vital for both personal success and national needs. While there is growing research that favors critical thinking skills, there is a need for additional research on the level of critical thinking skills, which is developed among secondary/o-level students of different examination boards (Rind et al., 2019). Consistent with this need, the current study compared the critical thinking skills of the students of the BISE, AKU-EB, and ICE board of the secondary school and O level.

1.1. Statement of the problem

There is a general assumption that students are supposed to learn critical thinking skills at school. Secondary and O levels are important grades from where children are required to develop critical thinking skills to become rational people who make wise and informed decisions. However, due to the existence of different curricula and examination boards that inculcate different thinking skills, conducts, and behaviors among students, it is unknown whether the critical thinking skills of students of the various boards are the same or different. The purpose of this research study was to investigate if there is any significant difference in the level of critical thinking skills of the students who study other curricula and appear in different examination boards within their secondary/o- level education.

1.2. Purpose of the study

The primary purpose of the study was to identify a difference in the level of critical thinking skills of students of secondary/o-level who study different curricula and appear on different examination boards. The research first examines the mean scores of critical thinking skills of students who study in BISE, AKU-EB, and CIE examination boards; after that, the study seeks to understand if there is any difference in the mean scores of critical thinking skills of BISE, AKU-EB, and CIE examination board students.

1.3. Research Questions

RQ1: What are the mean scores of critical thinking skills of the secondary/o-level students of BISE, AKU-EB, and CIE board examinations?

RQ2: Is there a difference in the critical thinking skills of BISE, AKU-EB, and CIE examination board secondary/o-level students?

1.4. Hypotheses

H₀: There is no statistically significant difference in the critical thinking skills of the secondary/o-level students of BISE, AKU-EB, and CIE board examination.

H₁: There is a statistically significant difference in the critical thinking skills of the secondary/o-level students of BISE, AKU-EB, and CIE board examinations.

1.5. Significance of the study

The current research study was conducted to provide evidence that supports the need for a uniform curriculum that promotes critical thinking skills and establishes one standardized assessment system for the entire nation. A critical thinking-based curriculum will instill teachers to use student-centered pedagogies and teach students to apply learned concepts and include necessary thinking skills and active learning strategies in their teaching. This study supports the need to have a curriculum that is based on critical thinking instead of having a traditional curriculum of rote memorization and content matter only. If the external examination is taken based on critical thinking, teachers will also integrate critical thinking skills into their pedagogy. Resultantly, students' critical thinking knowledge, skills, and disposition will be improved, and they will demonstrate those abilities and skills in the workplace.

2. Literature Review

Examinations have various advantages and disadvantages, and they are most criticized for promoting examination-oriented pedagogies, and teachers only teach students to qualify for the exam, not for learning. If the examinations are based on lower-order thinking skills such as remembering and understanding, then students and teachers also prepare on that pattern; however, if the examination is based on higher-order thinking skills like reasoning, evaluation, decision-

making, and other higher-order skills, then students are more likely to emphasis on these skills (Rind et al., 2019).

To conduct external examinations, three different examination boards are working in Pakistan: Local examination boards, AKU-EB, and Cambridge International examination board. The characteristics of each of these examination boards are described below:

2.1. Three different examination boards

2.1.1. Local Examination boards

There are almost 30 boards of intermediate and secondary education (BISE) in Pakistan. These boards administer the national assessment certificates and mainly operate on a regional basis; that is why they are also referred to as the local boards. The findings of Rind (2017) suggest that BISE examinations emphasize lower-order learning levels, and generally, their assessment is intended to check students' memory and understanding skills only. Hardly any analytical and critical thinking items are included in any subject. Other than this, these local boards are criticized for using unfair means to pass students (Khan et al., 2022). To pass the exams, students are only referred to study Sindh Textbooks of all subjects.

2.1.2. Agha Khan University Examination Board (AKU-EB)

The Agha Khan University Examination Board was established in Pakistan in 2002, and it is considered an alternative to CIE. The first and only private examination board was established after seeing the unhappy actions, level of corruption, and low quality of the examinations in the BISE local examination boards. AKU-EB bases its syllabus and assessment on the National Curriculum of Pakistan. Courses designed by AKU-EB aim to encourage the development of higher-order thinking skills of students, such as critical thinking, evaluation, reasoning, decision-

making, problem-solving, and assessments, which are also designed to test these skills rather than memory only. To ensure transparency, the evaluation of AKU-EB papers is done by the e-marking system. Furthermore, no specific textbooks are recommended; however, a syllabus is provided by AKU-EB from which teachers teach. The topics from the syllabus are broken down into students' learning outcomes (SLOs), and students also know their syllabus (Burdett & Everett, 2017).

2.1.3. Cambridge International Examinations (CIE)

CIE examinations are expensive, and the affluent class of society mostly affords them. CIE-qualified students get validation from society and assert one's social status (Imran, 2013). The CIE is different from BISE in terms of syllabus, choice of subjects, exams, paper format, reliability, and credibility (Naqvi, 2002).

Suppose the performance of these examination boards is compared. In that case, it would not be wrong to say that most people respect and prefer AKU-EB and Cambridge International because of their credibility, fairness, and reliability in assessments. However, these boards are not affordable for everyone. In contrast, BISE/local boards are cheap and affordable for most people.

2.2. Modification of curricula and teaching to prepare for different examination boards

Teaching and learning can be improved if the assessment system is improved (Carlucci et al., 2018; Havnes, 2004). The influence that a test has on the way students are taught is known as the backwash effect (Jamila & Kabir, 2020). Furthermore, students' learning outcomes are determined by the examination mostly. Examinations motivate learners to drill and study a few specific contents and subjects of the referred curriculum for the examination (Sultana, 2014). If the exams are taken based on critical thinking skills, then students are more likely to practice those skills. This

general practice indicates that assessments or exams motivate students to study or learn something. Since students' promotion to the next grade is decided by their achievement in exams; therefore, the exams are called a high stake (McLoud, 2019). According to Madaus (as cited in Sultana, 2014), high-stakes tests affect the instructive framework. For instance, if high-stakes tests emphasize specific skills, then schools, students, teachers, and other stakeholders will equip students with those skills. The education system will adjust its curriculum to bring excellent scores for its students. The educational system will modify its curriculum and instructional practices, and students will adjust their learning methodologies and objectives, to enhance the scores on the tests used to assess instructive results, and this happens when the tests are high stakes (Sultana, 2014). Hence, keeping the critical thinking level items in examinations will significantly bring improvement in students' critical thinking skills.

2.3. Conceptualizing critical thinking skills

According to Paul and Elder (2004), critical thinking is the process of reasoning (about any subject, content, or issue). The individual enhances the nature of reason by skillfully assuming the structures' responsibility and assigning standards to them. Furthermore, Paul and Elder (2006) characterize critical thinking as the way toward breaking down and surveying thinking with a perspective of enhancing it. The main element of the creative side of critical thinking is analyzing and effectively assessing thinking, which results in reformed thinking. Researchers include different core elements of critical thinking skills such as communication, analysis, problem-solving, synthesis, reflection, and creativity. However, in this research, the studied core elements of critical thinking were: reasoning, problem-solving, evaluation, analysis, and decision-making.

These core elements were chosen because they were recurring in most of the studies.

2.4. Importance of critical thinking skills

One of the most prominent benefits of having critical thinking skills is controlling learning and having empathy and tolerance for others' points of view. It involves effective communication, critical thinking capacities, and a promise to conquer our local self-centered nature and the sense of superiority over the social group (Hunaepi et al., 2019; Uribe Enciso et al., 2017). Critical thinking abilities enable learners to have multiple skills that can be utilized in any circumstance in life that requires extensive reflection, critical analysis, and effective planning (Darling-Hammond et al., 2020). The worldwide knowledge economy is driven by information and technology. One must have the ability to be able to change quickly and effectively (Greenhill, 2010).

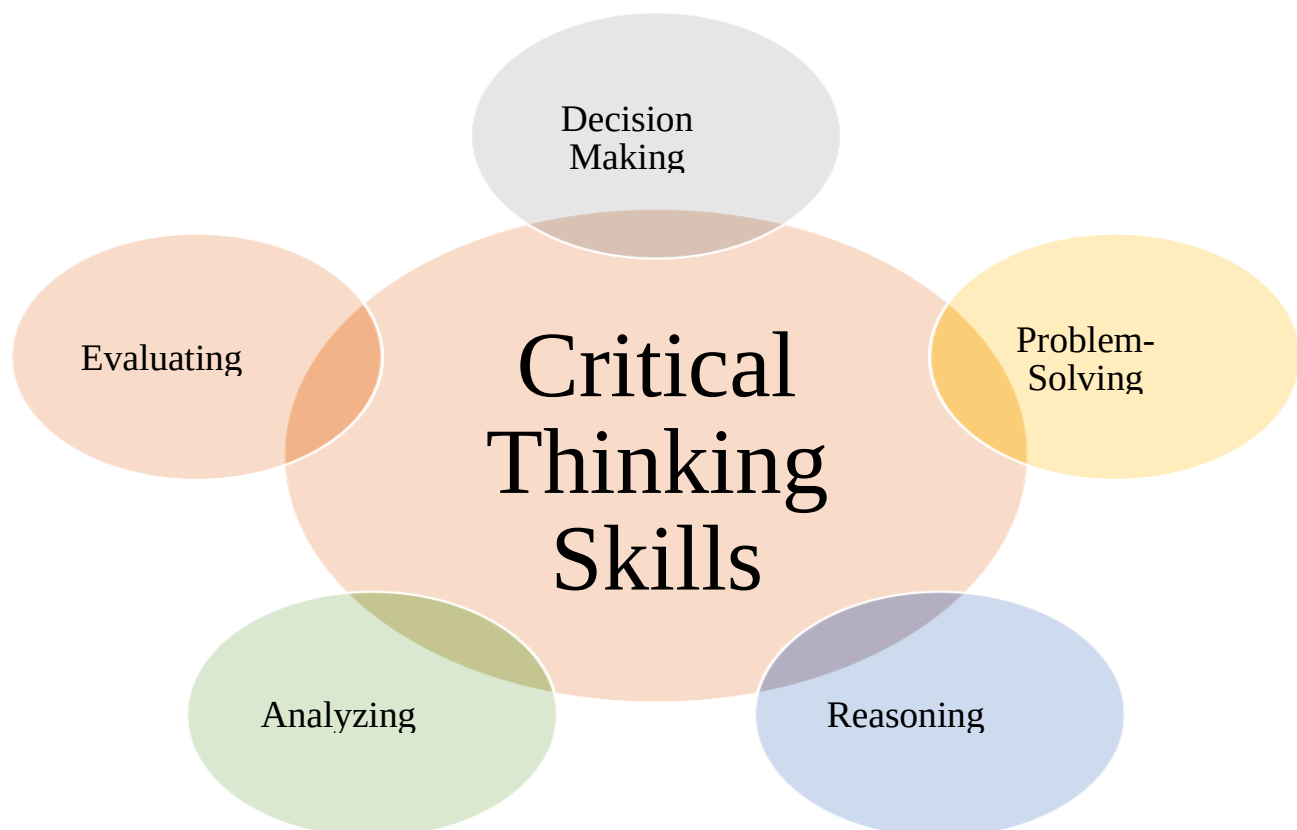


Figure 1: Model of critical thinking skills

Modern economies emphasize adjustable scholarly abilities and the capacity to evaluate the data and utilize different sources of information to solve any issue or problem (Binkley et al., 2012). Excellent critical thinking skills advance such reasoning abilities and are essential in the evolving working environment (Tang et al., 2020). To live a purposeful and meaningful life and design our experiences according to our needs, we should legitimize and ponder our characteristics and decisions. Additionally, critical thinking skills engage individuals in introspection (Alam, 2022) as it fosters self-awareness. Rather than depending on instructors and school time for directions, students with critical thinking skills become increasingly autonomous, self-ruling learners (Boud, 2012). Analyst Jane Qinyuan Zhang states that critical thinking skills engage students in assessing their learning styles, characteristics, and inadequacies and empower them to assume their learning (Elder & Paul, 2020; Greenhill, 2010).

2.5. Link of critical thinking skills with examination boards and curricula

Critical thinking skill is an important skill required to survive in the 21st century. Most countries have included critical thinking skills in their curriculum; even in the National Curriculum of Pakistan, the component of critical thinking is embedded. Moreover, critical thinking skills are emphasized in the teaching instructions of a variety of academic disciplines, curricula, and examinations to develop critical thinkers (Karbalaie, 2012; Živković, 2016). If the examination is intended to assess critical thinking level questions then the content, which is to be taught, in that case, teaching approaches and syllabus will target the development of critical thinking skills among students. On the other hand, if memory and comprehension are assessed in the examination, curricula and teaching approaches will develop these things (Aycicek, 2021). This example shows the relationship of critical thinking skills with the examination and curricula clearly.

3. Methodology

This section includes the research design adopted for this study. It consists of six main sections: research design, sample, data collection tools, validity and reliability of the tools, data collection procedure, and data analysis techniques. Finally, the ethical considerations are discussed.

3.1. Research Design

A non-experimental, ex post facto research design was adopted to conduct the study. The primary purpose was to identify the difference in critical thinking skills in BISE, AKU-EB, and CIE examination board students. The independent variable was examination boards (the BISE Examination Board of Sukkur, AKU-EB, and CIE), and the dependent variable was critical thinking skills. The goal of ex post facto research design is to demonstrate causal linkages based on retrospective data analysis by examining the impact of pre-existing factors without using direct manipulation (Sharma, 2019).

3.2. Sample of the study

To collect data for the current study, a purposive sampling technique was used to select a school. The school was located in the suburban area of Sukkur, Sindh, Pakistan, in which three different examination boards were being conducted. There were 90 participants (30 students of each examination board) of secondary/o-level students, this was the whole population.

3.3. Data collection tool

A researcher-developed questionnaire was used to collect data about critical thinking skills from students of BISE, AKU-EB, and the CIE examination board. The survey consisted of 20 items on different sub-variables of critical thinking skills: reasoning, decision-making, evaluation, problem-

solving, and analysis. The behavior of students who demonstrate critical thinking skills was asked in the frequency of doing that action. The five Likert scales consisted of options: never, rarely, sometimes, often, and always.

3.3.1. The validity of the survey

The questionnaire was developed after an extensive review of the literature. Furthermore, the validity of the questionnaire was ensured by getting the tool reviewed by an expert. His validation results stated that the instrument was valid. The tool was also piloted on twelve students to simplify the vocabulary and make it easy to understand for students. Moreover, the data was collected from students twice to see if the results were the same both times or not. By following these three steps, the validity of the tool was ensured.

3.3.2. Reliability of the tool

To analyze the reliability of the questionnaire, Cronbach's alpha coefficient was calculated. The Cronbach's alpha value of the overall 20 items of the survey was .814, which was above the acceptable value for the reliability of the tool.

3.4. Data collection procedure

The data was collected by first explaining to students, teachers, and administrators the purpose of the study. Then the questionnaire was distributed among three classes of students who study on different examination boards. The background questionnaire was also distributed among students to gather age, gender, and examination board information. The students were asked to fill out the questionnaire in thirty minutes by reading it carefully.

3.5. Data analysis

Before analysis, the data was prepared. In the original data, there were 100 responses; however,

only 90 valid answers were selected for analysis because they did not contain any missing values. The data were analyzed using SPSS 23. Firstly, Cronbach's alpha value and the descriptive statistics of the participants' demographic information were done. Next, one-way ANOVA was done to know the mean difference between all three examination boards concerning their critical thinking skills. The assumptions of doing one-way ANOVA were also checked before proceeding to the analysis.

3.6. Ethical Considerations

The research problem identified to conduct this study is beneficial to the individuals being studied and examination board members and educational researchers. The data from students was collected at their own will. During their free time and before collecting data, teachers and school administrators were already contacted to get their consent. Other than this, during the data collection procedure, students were informed about the purpose of the study, and they were asked to sign a consent letter, too.

4. Findings and Results

4.1. Research question 1

What are the mean scores of critical thinking skills of the secondary/o-level students of BISE, AKU-EB, and CIE board examinations?

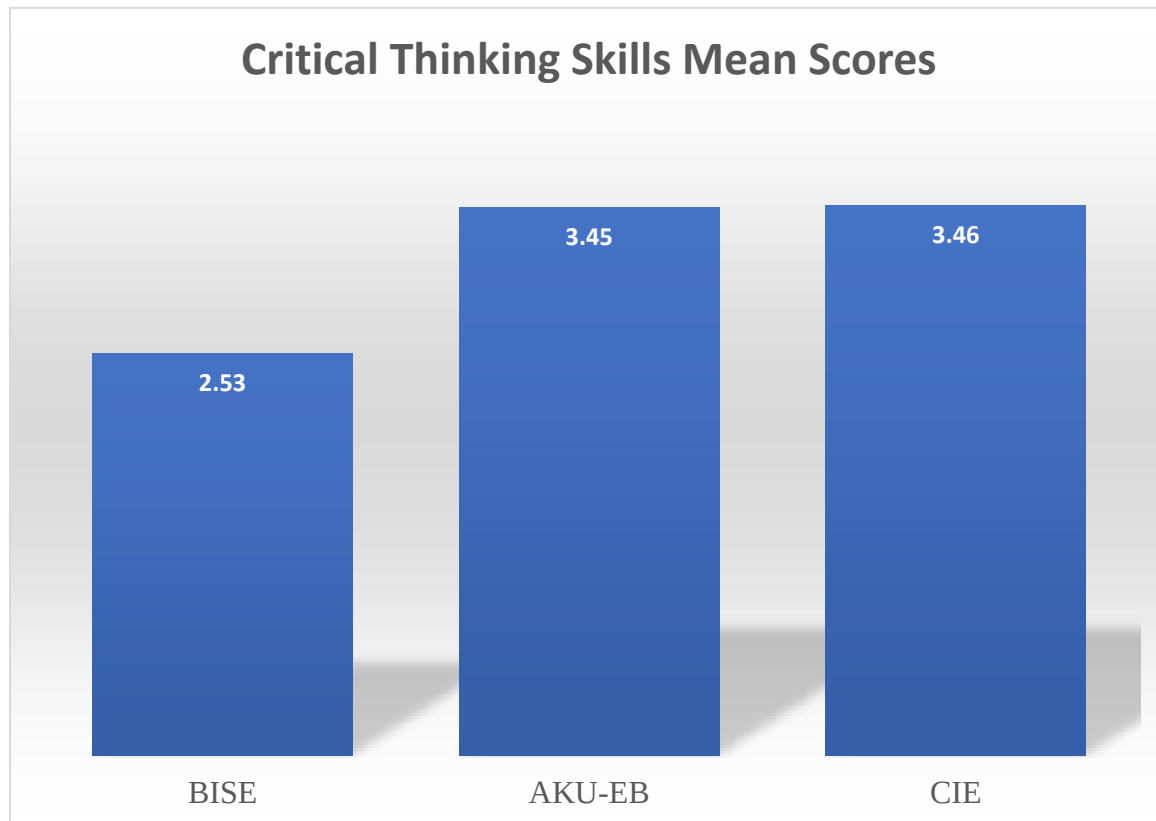


Figure 2: Critical thinking skill mean scores of three examination boards

Figure 2 shows the Critical thinking skill mean scores of students of different examination boards. The mean score of students on the BISE examination board in critical thinking skills was 2.53. Whereas the critical thinking skill mean scores of AKU-EB and CIE students are almost the same, which is 3.45 and 3.46, respectively. This figure indicates that the students of the BISE examination board have low critical thinking skills compared to students of other external examination boards.

4.2. Research question 2

Is there a difference in the critical thinking skills of BISE, AKU-EB, and CIE examination board secondary/o-level students?

Table 1: Descriptive statistics of critical thinking skills of BISE, AKU-EB, and CIE students

Critical Thinking Skills		N	Mean	SD	Std.	95% Confidence Interval for Mean		Min	Max
Examination boards	Error					Lower Bound	Upper Bound		
BISE Board		30	2.53	0.30	0.05	2.42	2.63	1.85	3.00
AKU-EB		30	3.45	0.45	0.09	3.27	3.64	2.55	4.20
CIE		30	3.46	0.32	0.06	3.33	3.60	2.90	4.40
Total		90	3.11	0.57	0.06	2.98	3.24	1.85	4.40

In table 1, it can be seen that there were 30 students of the BISE Examination board, and their mean scores in critical thinking were 2.53, and the standard deviation was 0.30. Whereas the mean score of 30 students of the AKU-EB was 3.45, and the standard deviation was 0.45. Likewise, the mean critical thinking skills score of 30 students on the CIE board was 3.46, and the standard deviation was 0.32. These results show that AKU-EB and CIE students' critical thinking mean scores were similar; whereas, the critical thinking mean score of BISE examination board students was less than the other two boards. This difference is also illustrated in Figure 2.

Table 2: Test

of Homogeneity of Variances

Test of Homogeneity of Variances Critical Thinking Skills			
Levene Statistic	df1	df2	Sig.
4.23	2	77	0.08

Levene's test is significant $F(2,77) = 4.23$, $p = 0.08$. The assumption of homogeneity is met for this sample. As the p-value is greater than .05, it indicates that the assumption of homogeneity of variance is not violated.

Table 3: Results of the One-way ANOVA test

ANOVA					
Critical Thinking Skills	Sum of Squares	Df	Mean	F	Sig.
Between Groups	16.28	2	8.144	61.91	.000
Within Groups	10.12	77	.132		
Total	26.41	79			

The significance value at the F ratio (61.91) in one-way ANOVA is .00, which is less than 0.05. Because of this, it is concluded that there is a statistically significant difference among the scores of the critical thinking skills of BISE, AKU-EB, and CIE examination boards.

Observing the significant p-value column shows that most of the values are lesser than 0.05 except the values between the AKU-EB examination board and the CIE examination boards, which are 0.99 and greater than 0.05. The significant values in the BISE examination board correspond to a considerable difference in the level of critical thinking skills of BISE examination board students from AKU-EB and CIE board students. However, the critical thinking skills of AKU-EB and CIE

board examination board students are not significantly different from each other. The actual difference in mean scores between the groups was quite significant. The effect size calculated using η^2 square was 0.61, which indicates a moderate effect of examination boards on critical thinking skills.

Table 4: Multiple comparisons of three different examination boards

Multiple Comparisons						
Dependent Variable: Critical Thinking Skills						
Tukey HSD						
(I) EB	(J) EB	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
BISE Board	AKU-EB	0.92*	0.09	0.00	1.15	0.69
	CIE	0.93*	0.09	0.00	1.17	0.70
AKU-EB	BISE Board	0.92*	0.09	0.00	0.69	1.15
	CIE	0.01	0.10	0.99	0.25	0.23
CIE	BISE Board	0.93*	0.09	0.00	0.70	1.17
	AKU-EB	0.01	0.10	0.99	0.23	0.25

*. The mean difference is significant at the 0.05 level.

Based on these findings, the null hypothesis, there is no statistically significant difference in the critical thinking skills of the secondary/o-level students of BISE, AKU-EB, and CIE board examination is rejected, and the alternate hypothesis is accepted that there is a statistically significant difference in the critical thinking skills of the secondary/o-level students of BISE, AKU-EB, and CIE board examination.

5. Discussion

The main finding of the current study was a significant difference in students' critical thinking skills of BISE, AKU-EB, and CIE boards. Research suggests a lack of fairness and unfavorable

learning experiences in the BISE (Munshi & Bhatti, 2007) because similar examination questions with an over-reliance on textbooks, guides, and guess papers spoil the effect of asking higher education level questions. At the same time, AKU-EB and CIE are considered better and preferred examination systems by parents (Jeddy, 2016) and other stakeholders. The current study's findings align with the investigations of (Burdett & Everett, 2015; Munshi & Bhatti, 2007), who also suggest improving local examination boards' quality and prefer private boards.

The findings also indicate that unprejudiced and fine-quality examination boards such as AKU-EB and CIE positively impact students' critical thinking skills; therefore, the teaching of a complete curriculum and promotion of critical thinking skills can be encouraged by it. Assessment has the power to change classroom practice, compel teachers to teach the whole curriculum, and adopt modern pedagogies which inculcate critical thinking skills among students. If assessment or examination fails to elicit higher cognitive skills, critical thinking skills will also be not stimulated.

However, only adopting private examination boards is insufficient as other factors such as the curriculum, textbooks, management, pedagogy, and paper pattern also impact. Sometimes, private examination boards also fail to align students learning outcomes with questions asked in the examination. Most importantly, private boards such as CIE and AKU-EB cannot be afforded by everyone because of their high cost. Apart from that, training invigilators must ensure transparency in examinations, and paper setters and evaluators should be guided about how to assess papers fairly.

The examination system should be aligned with the goals of the curriculum. However this goes the other way around, and examinations have a backwash effect on the curriculum, contrary to the purpose of education. Yet, this approach can be adopted to improve the quality of education and

encourage students' critical thinking skills. The few guidelines given by the Ministry of Federal Education and Professional Training in the National Curriculum Framework Pakistan can be adopted to achieve this purpose. First and foremost, a standardized assessment system can be established to assess students on the same benchmark and ensure examination uniformity. Besides, the examination should be based on SLOs of the national curriculum. Also, close coordination must be secured among curriculum, textbook, teacher education, and examination. Finally, the curricula in the overall country are not harmonized; therefore, cohesion is required to provide the same quality of education to everyone.

6. Conclusions

The primary purpose of this study was to analyze the critical thinking skills of different examination boards on the development of critical thinking skills of the secondary/o-level students of the BISE, AKU-EB, and CIE board examinations. The descriptive statistics showed that AKU-EB and CIE students' critical thinking mean scores were similar; whereas, the critical thinking mean score of BISE examination board students was less than the other two boards. The one-way ANOVA test results revealed a significant difference in BISE examination board students from AKU-EB and CIE board students. However, the AKU-EB and CIE board examination students are not significantly different from each other. The actual difference in mean scores between the groups was quite significant. This is assumed that this difference in students' mean scores of different examination boards exists due to the different examination formats, referred books, and curricula. However, further research is required to explore the reasons for this difference.

6.1. Suggestions and recommendations

Based on the findings, it is recommended that there be a uniform examination board in the whole country that assesses various skills, including critical thinking skills in external examinations. It is found in the study that AKU-EB and CIE examination board students are equipped more with necessary thinking skills than students of the BISE board. To reduce this gap, a public-private partnership will work well to mitigate this problem and provide the same educational opportunities to every national student. It is recommended that local examination boards include critical thinking-based questions in the exams to use such pedagogies and teach students to think critically. This study also suggested the need to have a uniform curriculum because one of the possible reasons for differences in critical thinking skills is the different curriculum and syllabus.

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