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RESEARCH PAPER

Effect of Using Analytic and Holistic Rubrics on Critical Thinking of University Students

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ABSTRACT

The study was aimed at investigating the effect of using analytic and holistic rubrics on critical thinking scores (CTS) of master level students. Pre-test post-test nonequivalent control group design was used for this study. Three intact groups of students consisted of 27, 20 and 30 students were selected for this study. Both Experimental groups were given 16 weeks intervention with four assignments along with rubrics. Rubrics were developed by the researcher and validated by relevant experts. The CT test of AssessmentDay (2018) was adapted. CTS of control and experimental groups were compared using ANOVA. CTS of post-test and pre-test were compared using paired sample t-test. Significant difference p=.001 was found in CTS of all three groups, the group which was administered analytical rubrics got the highest mean score, which indicates analytic rubrics are more effective to increase CTS. Therefore, analytic rubrics are recommended to be given with research related assignments.

KEYWORDS Analytic Rubrics, Critical Thinking, Holistic Rubrics, Pakistan, University Students

Introduction

In the rapidly evolving landscape of higher education, fostering critical thinking skills has become a central objective for university instructors and policymakers. Critical thinking, often defined as the ability to analyze, evaluate, and synthesize information in a reflective and reasoned manner, is increasingly viewed as an essential competency for students navigating complex academic, professional, and societal challenges (Facione, 2020). Given its significance, educators have sought effective assessment tools to measure and enhance students' critical thinking abilities. Among these tools, rubrics as structured frameworks for evaluating student performance have gained widespread attention for their potential to guide both teaching and learning processes (Andrade, 2005).

Rubrics, particularly analytic and holistic types, offer distinct approaches to assessment, each with its own set of advantages and implications for promoting critical thinking. The present study seeks to explore the effect of using analytic and holistic rubrics on the critical thinking skills of university students. The distinction between analytic and holistic rubrics lies in their respective approaches to evaluating student work. Analytic rubrics break down assignments into specific components or criteria, allowing for more detailed feedback on various aspects of the task, such as organization, content, and argumentation (Brookhart, 2013). This approach allows students to understand their strengths and areas for improvement more precisely, theoretically fostering targeted cognitive development in critical thinking. By contrast, holistic rubrics assess student work as a whole, providing a single, global score that reflects overall performance (Moskal, 2000). Proponents of holistic rubrics argue that this method better mirrors real-world problem-solving, where success is often based on the integration of multiple skills rather than isolated criteria. The question of whether analytic or holistic rubrics are more effective in promoting critical thinking has generated considerable debate. Some researchers argue that analytic rubrics, by offering detailed feedback, encourage deeper reflection and self-

assessment, which are crucial for the development of critical thinking (Jonsson & Svingby, 2007). Others contend that holistic rubrics, by emphasizing the overall quality of reasoning and coherence, may better capture students' ability to think critically in a more authentic manner (Moskal, 2000). Despite these differing perspectives, empirical evidence on the relative effectiveness of these two types of rubrics in fostering critical thinking remains limited, particularly in the context of higher education.

This study aims to fill this gap by examining the impact of both analytic and holistic rubrics on the critical thinking abilities of university students. Using experimental research design, the research assessed the development of critical thinking in students exposed to either type of rubric over the course of a semester in Research Methods. The study explored the quantitative differences in students' critical thinking scores. By comparing the effects of these two assessment tools, this research seeks to provide insights into best practices for educators aiming to enhance critical thinking skills in university settings. In conclusion, while both analytic and holistic rubrics have their merits, their specific impact on critical thinking remains underexplored. This study will contribute to the ongoing discourse by providing empirical evidence on how these two rubric types influence students' critical thinking development. Understanding these effects is crucial for educators seeking to cultivate students' abilities to analyze, evaluate, and synthesize information in a reasoned and reflective manner, thereby preparing them for the complexities of both academic and real-world challenges. After careful consideration of literature, the major construct e. g. critical thinking is operationally defined into five sub-constructs; Arguments, Assumptions, Deduction, Interpretation, Inferences.

Literature Review

Critical thinking is commonly characterized as the aptitude for contemplative and self-directed thought. The act of discerning, scrutinizing, and reconstructing the thinking involves making rational and well-considered decisions. Critical thinking is a self-reflective, intentional decision that involves interpretation, analysis, evaluation, inference, and explanation. (Facione, 1990) This skill is described by Paul & Elder (2006) as the ability to approach one's thoughts in an appropriate manner, taking into account both its advantages and disadvantages. Critical thinking, as described by Dewey (1933), involves active and careful consideration of a belief or form of knowledge based on its justification and further conclusions. According to him, critical thinking is primarily focused on questioning assumptions while also exploring evidence and implications.

The definition of critical thinking by Ennis (1985) emphasizes the importance of rational and analytical thinking in deciding what to believe or do, with an emphasis on using logic and reasoning to evaluate information. It also entails being open-minded and capable of considering other perspectives when making sound decisions. Many frameworks and academics outline different aspects of critical thinking, but there is a consensus on some key components: b) Interpretation: Understanding and explaining the meaning of information, data, and experiences. Understanding and elucidating concepts, statements, ideas, and descriptions (Facione, 1990) is encompassed by analysis. The process involves identifying arguments, verifying the credibility of sources, and comprehending their logical connections. Additionally, Ennis (1993) highlights the importance of evaluating the validity of statements or sources and the persuasiveness of arguments. Judging the accuracy and usefulness of information to arrive at a reasonable conclusion (Paul & Elder, 2006); d) Inference: Drawing from evidence and reasoning. To achieve this, it is necessary to consider evidence, alternative perspectives, and potential outcomes (Facione 1990); e) Clarification: Outlining clearly the findings, reasonings, or processes used to arrive at conclusions. Ennis (1993) outlines two approaches to thinking: self regulation and reflection on one's own thinking process, biases, and assumptions. Self-regulation entails monitoring, adapting and improving one's cognitive abilities (Paul & Elder, 2006)..... All of these components are utilized to facilitate individuals in solving problems logically, analyzing complex situations,

and making informed decisions. A number of philosophers have contributed to the recognition of critical thinking as an essential educational instrument, with their individual perspectives based on knowledge theory, logic, and pedagogy.

The combination of these viewpoints highlights the crucial role of critical thinking in education and demonstrates how diverse it is to promote its development. Socrates is widely recognized as a pioneer of critical thinking, known for his method of dialectical questioning, now called the "Socratic method." He believed that learning involves asking and responding to probing questions, which helps individuals identify inconsistencies in their own thinking and arrive at more profound truths. In Socrates' view, critical thinking can be seen as a process of inquiry rather than merely an instrument for acquiring knowledge, with the aim of engaging in intellectual and ethical engagement. His method of critical thinking emphasizes the importance of being humble and willing to make changes in one' underlying beliefs. While Plato's ideas are not explicitly outlined in his writing, they can be taken from these through the philosophical questions (elenchus), which he addresses in several of his philosophical tracts. Guiding Critical Thinking: The Socratic Method is based on open-ended questioning and dialogue, which encourages students to think deeply, reflect on their beliefs, and defend them in the process. ". Plato characterized critical thinking as the pursuit of higher, universal truths (the Forms), in dialogues such as "The Republic" and "Meno.". He contended that questioning and reasoning could enable individuals to move beyond merely opinion (doxa) and towards more secure and credible knowledge.

Similarly, Plato stressed the importance of self-reflection and introspection for critical thinking. The "Allegory of the Cave" in "The Republic" embodies the idea of progressing from ignorance to knowledge, challenging the viewer to question their beliefs and perceptions of reality. Equally, expertly-crafted rubrics offer measures that facilitate students in evaluating their work, comprehending expectations and reflecting on their performance. Rubrics can serve as a complement to the Socratic Method by offering distinct criteria for critical thinking required in answers, as per Jenkins and Svingby's 2007 study. Educational settings that prioritize critical thinking can relate assessment rubrics to the Socratic Method. Despite their differences, the Socratic Method and rubrics involve structured assessments and self-examination. The Socratic Method emphasizes critical thinking eliciting responses to questionation, but rubrics can be used as a tangible method of measuring and providing feedback on the quality of that critical thought. As a team, they foster an atmosphere that promotes student autonomy, self-reflection and greater comprehension. By contrast, one of the father's greatest advocates in modern educational philosophy was John Dewey who saw critical thinking as a form of inquiry required to solve problems through reflection. According to Dewey, education should not solely focus on memorizing information or absorbing facts; it must also cultivate Page 1 of 3 students' capacity for active, critical thinking. ". He defines critical thinking as the process of transforming uncertainty into knowledge through systematic questioning and evidence-based reasoning.

The current educational approach emphasizes problem-solving and learning by modifying the way the student learns. The use of assessment rubrics can be linked to John Dewey's perspective on critical thinking, particularly in terms of their potential to promote reflective thinking and problem-solving in education. In his essay on critical thinking, Dewey emphasized the importance of reflective inquiry, which involves learners engaging with problems, analyzing situations, and reflecting on their experiences to develop understanding and meaning. The use of analytic and holistic rubrics is a suitable approach to promote and guide reflection, feedback, and student engagement. The perspective of Immanuel Kant on critical thinking was not as profound, but more abstract in its approach. In Kant's view, critical thinking was linked to both the independence of reason and the individual' innate ability to think independently. By utilizing critical thinking, his moral and epistemological theories enable individuals to exercise their right to reason beyond the confines of dogma or tradition.elective reasoning. According to Kant, critical thinking is not

merely an intellectual exercise but also a moral necessity, as it allows individuals to pursue their own intellectual liberation. A common thread between this idea and contemporary educational ideals is their emphasis on freedom, autonomy, and the ability to question established beliefs. Paulo Freire, a contemporary educator and philosopher, introduced politcal and social ideas to critical thinking. In Freire's view, education served as a means of liberation, and critical thinking played essentially the role of empowerment for marginalized groups. According to him, education entails critically considering the world to identify and confront oppressive systems. The notion of "critical consciousness" by Freire goes beyond cognitive abilities and the role of critical thinking in enlightening students to social realities and inspiring transformative action.

This concept is central to his philosophy. I think Freire's perspective is compelling, especially in light of the fact that education should not only provide knowledge but also promote equity and social justice. ". Ultimately, contemporary theorist Richard Paul contended that cognitive abilities and dispositions must be integrated into critical thinking. His perspective was that critical thinking involves more than just intellectual depth, as it seeks to foster traits such as open-mindedness and empathy, along with intellectual humility.... Paul suggests that education should emphasize these traits alongside critical thinking, as they are necessary for making sound judgments. Through his holistic approach, which combines skill development with character formation, the author offers a comprehensive and balanced perspective on critical thinking as primarily educational. To sum up, while philosophers like Socrates, Dewey, Kant, Freire, and Paul have different interpretations of critical thinking, they all agree that it is crucial for effective learning. However, not all of them agree on this point. In my view, their collective experiences demonstrate that critical thinking is not solely a cognitive skill but also has ethical, social, and emotional dimensions, making it an essential aspect of education that helps students become independent, reflective, productive, or both. According to recent research, rubrics that are scored can significantly enhance students' ability to think critically.

The Rubrics offer structured, targeted feedback and enable students to make self-referential assessments that contribute significantly to their comprehension of the curriculum. Studies in STEM education suggest that rubrics designed for critical thinking and information processing can help students identify areas of improvement and provide regular feedback to instructors and students throughout a semester. This is particularly beneficial during high-stakes competitions. Rubrics can be used to grade students' critical thinking. Research suggests that rubrics provide an unbiased means of assessing challenging assignments, making it easier for students to identify their performance and its quality. Students who are familiar with the expectations can improve their capacity to analyze their own work, evaluate themselves, and reflect on their learning. Additionally, these expectations should be respected. In their 2010 study, Reddy and Andrade (2010) observed that the use of rubrics had a positive impact on students' academic performance as well as boosted self-regulation and critical thinking. By making rubrics transparent, students can study the components of quality work to a greater extent, leading to increased comprehension and analysis. The evidence demonstrates that scoring rubrics can improve students' critical thinking by providing clear, structured evaluation criteria.

According to Jonsson and Svingby (2007), rubrics are believed to enhance the reliability and validity of assessments by helping students comprehend quality performance elements, which promotes self-assessment and critical analysis. According to Andrade (2005) and Brookhart (2013), rubrics provide explicit assessment criteria, which can aid in cognitive awareness and metacognition. Additionally, some research has shown that grades may not be entirely objective. By providing students with this clarity, they can learn more effectively by critically analyzing their work and learning more. The focus on important task elements in formative assessment rubrics, as noted by Panadero and Jonsson (2013) for the first time, Page 2 of 3 enables students to improve their analytical abilities. Furthermore, Mabry (1999) asserts that rubrics, as a component of alternative assessments, create

individualized feedback loops where students analyze their results critically. As a whole, these studies demonstrate that rubrics not only help students comprehend student expectations but also foster critical thinking by encouraging self-regulation/reflection, reflection, and thorough engagement with the material. Jonsson and Svingby assert (2007) that rubric reliability and validity are important factors in measuring performance, as students who understand the criteria for evaluation can improve their critical thinking skills and self-evaluation abilities.

Additionally, As per Brookhart (2013), rubrics aid in the process of learning by guiding students, increasing their critical thinking skills through metacognition. Paper of Andrade (2005) highlights the positive impact of rubrics on students' learning by making the assessment criteria explicit, leading to greater critical thinking. The use of rubrics in formative assessment is analyzed by Panadero and Jonsson (2013), who note that rubRICS aid students in recalling important components of an assignment, improve their critical thinking and the development of analytical skills. Additionally, The use of rubrics and other alternatives to assessments, as noted by Mabry (1999), can foster learning environments that encourage students to critically evaluate their work through structured feedback and self-evaluation.

The use of Analytic and Holistic Rubrics is a common practice among assessment tools for student performance, with distinct characteristics and purposes associated with each. Several criteria are used to evaluate the assessment, which is then broken down into an analytic rubric for each. Each criteria has detailed descriptive terms ranging from excellent to good or poor performance.. The rubric of this kind offers a more thorough and precise appraisal of student work. They provide in-depth evaluations of specific performance elements, enabling students to identify strengths and weaknesses. Strengthening inference consistency, as teachers evaluate each criterion separately, diminishing the risk of holistic bias (Jonsson and Svingby 2007, 2007). Incentives pupils to concentrate on different aspects of the task, enabling them to learn effectively and evaluate themselves accordingly (Arter & McTighe, 2001). The development and utilization of these criteria is more time-consuming due to the need to scrutinize multiple factors. They may limit student responses if the criteria are too rigid. However, a comprehensive rubric measures student performance in its entirety. By focusing on an overall perspective of the student's work, it assigns a single score instead of breaking down the task into individual components. The rubric includes a set of descriptive terms for each level of performance.

They are faster and more efficient for grading, especially when dealing with large numbers of students or quick assignments (Brookhart, 2013).) A holistic rubric is used to capture the general nature of work, providing greater flexibility in response. The absence of specific feedback on individual aspects of the performance makes it difficult for students to identify areas that need improvement (Arter & McTighe, 2001). Differences in scoring may arise from overall impressions, as different assessors may evaluate components differently (Jonsson & Svingby, 2007). In essence, Analytic Rubrics are beneficial when the task consists of several significant components, and detailed feedback is required. Formative assessments, where students require guidance on certain aspects of their work, are where they shine. Holistic Rubrics are better suited for summative assessments or when an overall assessment is necessary, such as evaluating the final product or performance.

This study aimed at finding out the effect of analytic and holistic rubrics on the overall CTS of students and on the sub-constructs of CT.

$H_{0\,1.}$ There is no significant effect of analytic rubrics on critical thinking skills of university students

$H_{0\,1.1.}$ There is no significant effect of analytic rubrics on arguments skills of university students.

$H_{0\ 1.2.}$ There is no significant effect of analytic rubrics on assumptions skills of university students.

$H_{0\ 1.3.}$ There is no significant effect of analytic rubrics on deduction skills of university students.

$H_{0\ 1.4.}$ There is no significant effect of analytic rubrics on interpretations skills of university students.

$H_{0\ 1.5.}$ There is no significant effect of analytic rubrics on inferences skills of university students.

$H_{0\ 2.}$ There is no significant effect of holistic rubrics on critical thinking skills of university students?

$H_{0\ 2.1.}$ There is no significant effect of holistic rubrics on arguments skills of university students?

$H_{0\ 2.2.}$ There is no significant effect of holistic rubrics on assumptions skill of university student?

$H_{0\ 2.3.}$ There is no significant effect of holistic rubrics on deduction skill of university students.

$H_{0\ 2.4.}$ There is no significant effect of holistic rubrics on interpretations skill of university students.

$H_{0\ 2.5.}$ There is no significant effect of holistic rubrics on inferences skills of university students.

Conceptual Framework of the Study

The conceptual framework was developed on the basis of Paul and Elder (1999) model of intellectual standards. Rubrics are independent variable and critical thinking is dependent variable. Critical thinking is defined in five operational components.

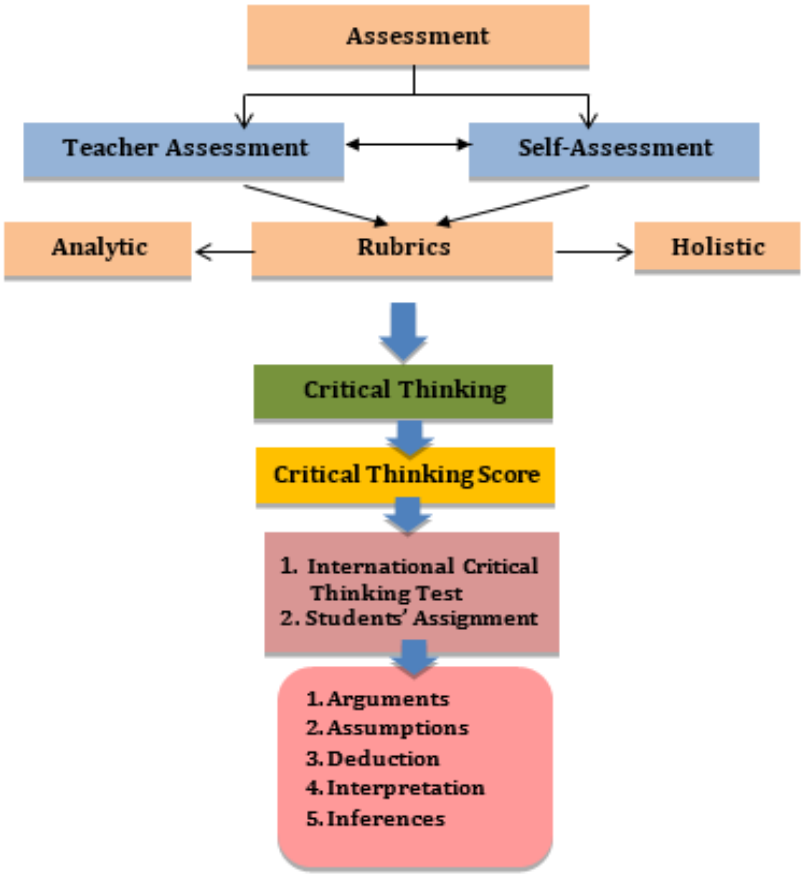

Figure 1 Conceptual Framework

Material and Methods

This research is based on positivist research paradigm being and experimental research relying on quantitative data to reject or accept the hypotheses. This research was quantitative and carried experimental design within the quantitative approach. Pre-test post-test nonequivalent control group design of experimental research was used for this purpose. Three groups of students (approximately 30 in each group) were selected for this purpose. All three groups were given 3-4 assignments during the semester along with scoring rubrics. Control group was not given rubrics along with assignments and both experimental groups were given well developed rubrics along with assignments. Experimental group 1 was given analytic rubrics and experimental group 2 was given holistic rubrics along with assignments.

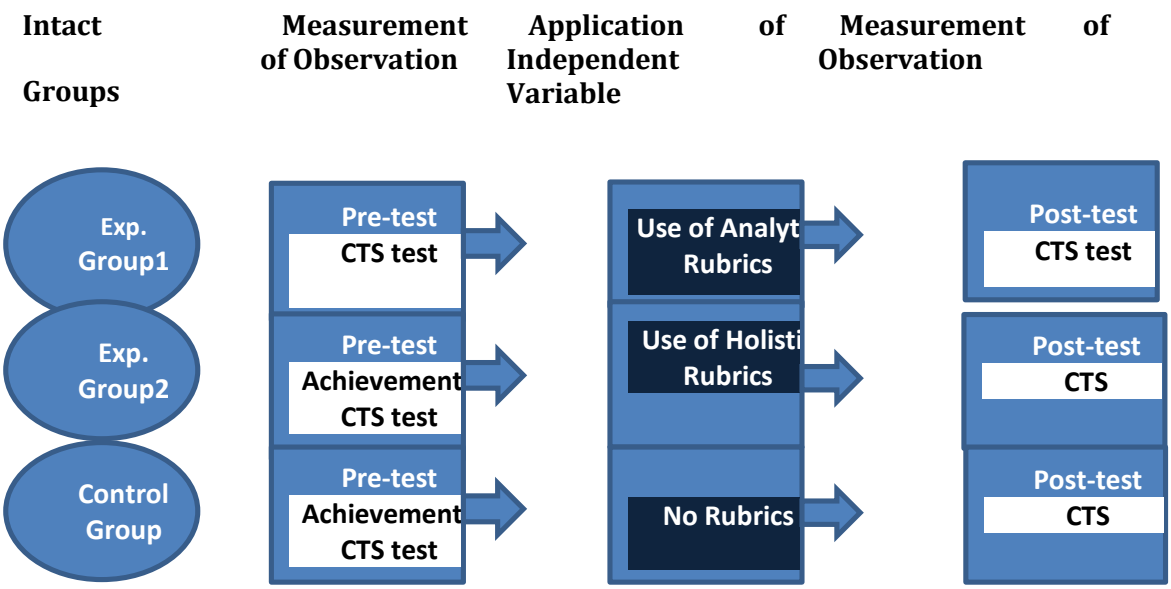

Figure 2 Pre-Test Post-Test Nonequivalent Control Group Design of Experimental Research

All the master level students of Institute of Education and Research (IER), University of the Punjab are population of this study. Total number of master level students in IER is 1078 in eight different programs (Institute of Education and Research, 2021).

Sample of the study was comprised of three intact groups of master level students. There were total 77 students in these three groups. The three groups were: 1) Control; 2) Experimental 1; and 3) Experimental 2. The control group consisted of 27 students and was not given any treatment. Experimental group 1 was consisted of 20 students and exposed to analytic rubric and Experimental group 2 was consisted of 30 students and was given holistic rubrics as treatment.

After extensive literature review, for dependent variables i.e. critical thinking, a critical thinking test was adapted. This instrument is based on the format of Watson and Glazer Critical Thinking Appraisal model accessed from "Assessment Day". This test was adapted. It originally contained 89 items but for this research 45 most relevant items were selected. This instrument consisted of five sub-construct argument, assumption, deduction, interpretation and inference.

Data were mainly at two points using critical thinking tool; at the beginning of the semester before the intervention was given and at the end of semester when intervention was completed. Draft of each assignment given to all groups was also collected, analyzed

and compared. Critical thinking score of control and Experimental 1 and Experimental 2 group was compared using Analysis of Variance (ANOVA) in order to find out the effect of given intervention on the critical thinking skills of the university students.

Results and Discussion

Paired sample t-test, independent sample t-test and ANOVA were applied to accept or reject hypotheses. Prior to the inferential analysis homogeneity of variance of different groups was measured. Levene's test of homogeneity of variance was applied on pretest of all three groups to check either the groups are homogeneous and fulfill the assumptions to apply analysis of variance (ANOVA). Test results show that the groups are homogenous as the significance value is above .05 based on mean, median, with median and adjusted degree of freedom (df) and based on trimmed mean.

Table 1
Factor Wise Descriptive Statistics on CTS Scale Pre-test

Factor	Group	N	Mean	SD	Min.	Max.
Argument	Control	30	4.000	2.133	1.00	9.00
	Exp1	20	5.047	1.657	2.00	8.00
	Exp2	27	3.000	1.469	.00	7.00
	Total	77	3.948	1.952	.00	9.00
Assumption	Control	30	4.433	1.250	2.00	7.00
	Exp1	20	4.761	1.841	2.00	8.00
	Exp2	27	4.153	1.376	2.00	8.00
	Total	77	4.428	1.472	2.00	8.00
Deduction	Control	30	4.433	1.813	2.00	7.00
	Exp1	20	4.571	1.748	2.00	7.00
	Exp2	27	3.846	1.869	1.00	9.00
	Total	77	4.272	1.818	1.00	9.00
Interpretation	Control	30	3.900	2.233	1.00	8.00
	Exp1	20	4.047	2.155	2.00	9.00
	Exp2	27	3.692	2.149	.00	7.00
	Total	77	3.870	2.160	.00	9.00
Inferences	Control	30	3.3333	2.039	.00	9.00
	Exp1	20	4.142	2.151	1.00	8.00
	Exp2	27	3.000	2.190	.00	8.00
	Total	77	3.441	2.142	.00	9.00
Total	Control	30	20.100	4.301	11.00	35.00
	Exp1	20	21.571	2.908	16.00	27.00
	Exp2	27	17.692	4.888	9.00	35.00
	Total	77	19.961	4.560	9.00	35.00

Theoretical range of CTS instrument was 0 to 45 and of each subsection 0 to 9, as response was dichotomous; either it was 0 or 1. The average CTS score of 20 shows that students' level of critical thinking is quite low as it only makes below 50 percent. Students attained highest score e.g. 4.27 in sub section "Deduction" and lowest in deduction e.g. 3.44.

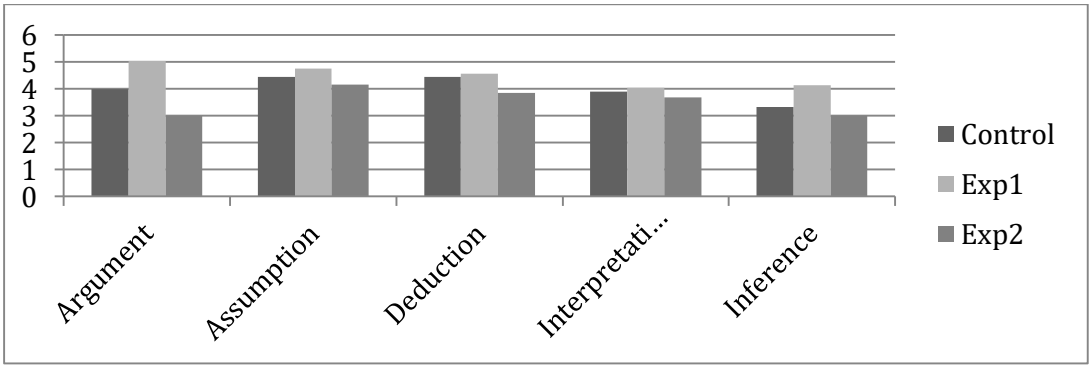

Figure 3 Graph to Compare Scores of Control and Experimental Groups on Sub-Constructs of Critical Thinking Pre-Test

Figure 3 also visually illustrates the students' scores on five different sub-constructs of critical thinking test. Graph shows that scores of experimental1 group are slightly higher than rest of the groups on all the sub-constructs of critical thinking; however ANOVA results show that except argument section the difference is not significant. Another figure is drawn to compare the combined total of all three groups on sub-constructs of critical thinking scores of students in order to check in which sub-construct students attained higher scores (Figure 4).

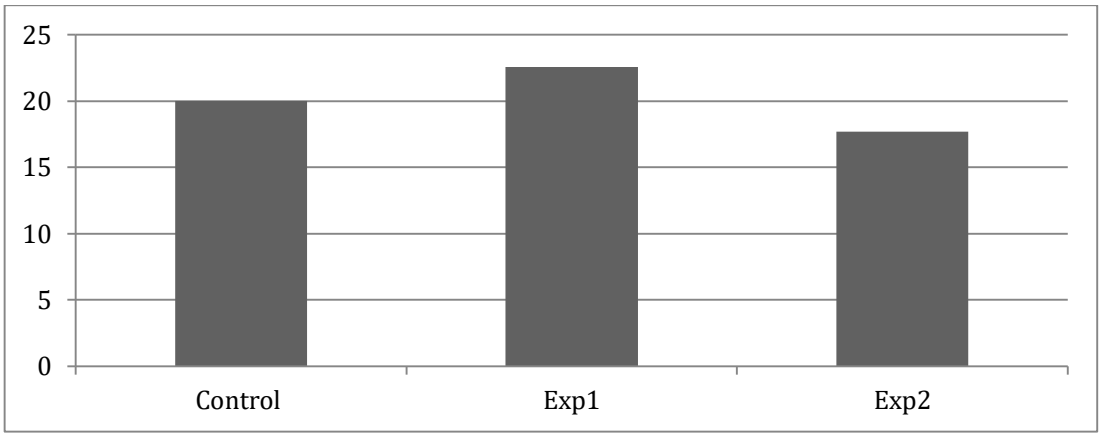

Figure 4 Comparison of Overall Critical Thinking Scores of Control and Experimental Groups in Pre-Test

Another comparison from the same data is drawn to compare the total score (combined score of five sub-constructs) of all three groups on the critical thinking scores of students. The visuals present that Exp1 group scored highest while the Exp2 group scored lowest; however the difference is slight. This score indicates that baseline score of all three groups on critical thinking is almost same.

Table 2
Analysis of Variance (ANOVA) Results on Sub Scales and Total Score of Critical Thinking Skills (CTS) Post-Test

Sab-Scales		Sum of Squares	df	Mean Square	Sig.
Argument	Between Groups	45.200	2	22.600	.002
	Within Groups	237.605	74	3.211	
	Total	282.805	76		
Assumption	Between Groups	44.496	2	22.248	.000
	Within Groups	170.959	74	2.310	
	Total	215.455	76		
Deduction	Between Groups	36.614	2	18.307	.005
	Within Groups	234.841	74	3.174	
	Total	271.455	76		
Interpretation	Between Groups	27.367	2	13.684	.037
	Within Groups	293.152	74	3.962	
	Total	320.519	76		
Inferences	Between Groups	48.720	2	24.360	.007
	Within Groups	336.709	74	4.550	
	Total	385.429	76		
Total	Between Groups	959.321	2	479.660	.000
	Within Groups	1942.809	74	26.254	
	Total	2902.130	76		

One Way Analysis of Variance (ANOVA) was applied to compare the critical thinking skills scores of all three groups. This analysis is done to address the objective number one and two of this research e.g. to find out the effect of analytic and holistic rubrics on critical thinking skills of university students.

ANOVA was applied on the different subscales of critical thinking skills separately and on the overall total score of critical thinking skills (CTS) as well. The overall significance value of .001 showed that there was significant difference in the CTS scores of all three groups. Unlike pre-test results significant difference was observed in all subscales of CTS except Interpretation.

Table 3
Post-Hoc Analysis for Critical Thinking Skills CTS on Post-Test

Sub-Constructs	(I) group	(J) group	Mean Difference (I-J)	Sig.
Argument	Control	Exp. 1	-1.28871*	.038
		Exp. 2	.69975	.312
	Exp.1	Control	1.28871*	.038
		Exp. 2	1.98846*	.001
	Exp. 2	Control	-.69975	.312
		Exp. 1	-1.98846*	.001
Assumption	Control	Exp. 1	-1.43710*	.004
		Exp. 2	.49752	.439
	Exp. 1	Control	1.43710*	.004
		Exp. 2	1.93462*	.000
	Exp. 2	Control	-.49752	.439
		Exp. 1	-1.93462*	.000
Deduction	Control	Exp. 1	-1.19032	.058
		Exp. 2	.59429	.425
	Exp. 1	Control	1.19032	.058
		Exp. 2	1.78462*	.003
	Exp. 2	Control	-.59429	.425
		Exp. 1	-1.78462*	.003
Interpretation	Control	Exp. 1	-1.43226*	.038
		Exp. 2	-.18610	.934
	Exp1	Control	1.43226*	.038
		Exp. 2	1.24615	.096
	Exp2	Control	.18610	.934
		Exp. 1	-1.24615	.096
Inferences	Control	Exp. 1	-1.81290*	.011
		Exp. 2	.00248	1.000
	Exp1	Control	1.81290*	.011
		Exp. 2	1.81538*	.015
	Exp2	Control	-.00248	1.000
		Exp. 1	-1.81538*	.015
Total CTS Score	Control	Exp. 1	-7.16129*	.000
		Exp. 2	1.60794	.469
	Exp. 1	Control	7.16129*	.000
		Exp. 2	8.76923*	.000
	Exp. 2	Control	-1.60794	.469
		Exp1	-8.76923*	.000

Conclusion

On the basis of results presented in previous tables it is concluded that the analytic rubrics are more effective as compared to the holistic rubrics for increasing CTS of master level students. It is probably because they break down the complex task/information into pieces and provide detailed framework for the understanding of the task. It provides students specific criteria to evaluate the specific piece of work which in turn shapes the more cautious and accurate thought process. As compared to analytic rubrics holistic rubrics provide a broader overview of the evaluation of task which in turn leaves the thought process more open and flexible. This flexibility somehow hinders the accuracy of evaluation which can be related to the accurate analysis of given statements. In a nutshell it can be concluded that the analytic rubrics are more effective as compared to holistic rubrics in order to increase CTS of students.

Recommendations

On the basis of findings of this study, following recommendations are given:

- The use of rubrics may be promoted from the earlier grades as the most of students were unfamiliar with the concept of rubrics and sought explanation of rubrics instead of given tasks.
- The use of rubrics along with the assignment is one strategy to improve critical thinking of students, other strategies found in proposed in literature to enhance critical thinking shall also be promoted as the critical thinking score of all the groups was below 50% which is quite low.
- Analytic rubrics may be used for research related complex tasks instead of holistic rubrics as the group which was given analytic rubrics performed better both on CTS and achievement test.

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