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Exploring the Relationship Between Critical Thinking and Creativity in University Students: Gender Differences and the Assessment of Skills

Nelofir Shaber [1], Syed Kazim Shah [2,*], Muhammad Imran [3,4,*] and Norah Almusharraf [3]

[1] Department of English, University of Okara, Okara 56130, Pakistan; nelofirshaber@uo.edu.pk
[2] Department of Applied Linguistics, Government College University Faisalabad, Faisalabad 38000, Pakistan
[3] Educational Research Lab, Prince Sultan University, Riyadh 11586, Saudi Arabia; nmusharraf@psu.edu.sa
[4] English Language and Literature Department, Khazar University, Baku AZ1096, Azerbaijan
* Correspondence: kazim.shah@gcuf.edu.pk (S.K.S.); mimran@psu.edu.sa (M.I.)

Abstract: This study aimed to explore the relationship between the critical thinking and creativity skills of university students. The objectives were to explore the level of critical thinking skills, the degree of creativity in students' written exam papers, the nature of the relationship between these constructs, and gender differences in the manifestation of these skills in writing. A sample of 167 students, including 100 females and 67 males, from a co-educational university participated in the study. Data were collected using self-report measures for critical thinking and creativity from student mid-term exam papers. The assessment tool to assess critical thinking skills, and an adapted version of the TTCT Verbal-A was used to measure the creativity level in the written products. Descriptive statistics, correlation analysis, and comparative analysis were conducted using SPSS (version 29). The findings revealed that both the variables' scores were moderate in the data. They also indicated that students fall within the moderate level of both the skills. A significant positive correlation was found between critical thinking and creativity, suggesting a meaningful relationship between these constructs. Gender differences were also observed, with females scoring higher in both the constructs compared to males. Furthermore, these insights highlight the need for educational strategies that foster both skills, ensuring a balanced development among students. This study is useful for educators, policymakers, and researchers interested in critical thinking and creativity and also underscores the need for future research and curricula to enhance student learning outcomes.

Keywords: creativity; critical thinking; gender; written papers; TTCT

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1. Introduction

Critical thinking (CT) skills and creativity are considered to be essential academic skills. The student's ability to use these skills during their study is a subject of great attention, relevance, and significance in the field of education. The area is of much significance because it addresses the implied tensions between critical and creative practices in creative writing (Welsch, 2015). According to past studies (Gibson et al., 1968; Gadzella & Penland, 1995; Qiang et al., 2020; Park et al., 2021; Akpur, 2020; Rosba et al., 2021) CT and creativity are linked and have a positive correlation. They suggest that proficiency in one skill often enhances the other one. This mutual reinforcement is explored by some studies (Almulla, 2023; Misechko & Lytniova, 2022) in educational settings. However, in 2021, Park et al. (2021) suggested that the interplay may vary across cultural and educational contexts.

While others (Wechsler et al., 2018; Ling & Loh, 2020) suggest that these two practices and approaches are independent. This study intends to contribute to the ongoing discussion and debate by investigating the relationship between CT and students' creativity in writing in exams.

The existing literature on the concepts of CT and creativity in students in any educational context has considerable gaps and limitations that this study aims to address. Firstly, much of the research focuses on these concepts of creativity (Chambers, 1973; Fasko, 2001; Wong & Siu, 2012; Ramankulov et al., 2016; Omdal & Graefe, 2017; Matraeva et al., 2020; Lu & Kaiser, 2021; Rashid et al., 2024) or CT (Tahira & Haider, 2019; Wilson, 2016; Faridi et al., 2020; Karapetian, 2020; Parks, 2020; Stewart, 2021) separately, without probing into the interaction between the two or in the context of writing exams specifically. There are very few studies (Adriansen, 2010; Edwards, 2017; Caratozzolo et al., 2021; Prakoso et al., 2021; Rosba et al., 2021; Vincent-Lancrin et al., 2019) that explore the relationship between the two. The study at hand seeks to bridge the gap by exploring the relationship between CT and students' creativity while writing their exam papers within a given time frame.

Secondly, though there are few studies (Ventista, 2017; Kusumawardhani et al., 2019; Shively et al., 2018; Bloom & Doss, 2019; D'Alessio et al., 2019; Akpur, 2020; Supena et al., 2021) on the investigation of students' CT and creativity in the context of exam writing, these studies have not explored the interplay of students' CT and creative skills in the context of writing in exams using a rubric for assessing criteria specifically at the university level in Pakistan, and there is also lack of studies that explore the role and impact of gender. There is a dire need for more empirical research in this area. To support the available theoretical framework for the concept, the available limited empirical research is not enough to provide concrete evidence to support the phenomena of this relationship.

Previous studies in this area have investigated the impact of creative writing activities on story writing skills, 'enhancing students" creative writing skills and the process of creative thinking development in students through journal writing (Şenel & Bağçeci, 2019; Temizkan, 2011; Ahmad et al., 2024; Ambreen et al., 2023; Masrai et al., 2021; Nasir et al., 2013). However, the existing literature is lacking regarding the interplay between CT and creativity, specifically in the context of writing in exams at the university level in Pakistan. The research aims to fill the gap and try to provide a better understanding of the relationship between CT and students' creativity in writing exams at the university level.

Finally, the existing studies (Shavelson et al., 2019; Siburian et al., 2019; Akpur, 2020) on the concept also lack diversity in terms of academic fields or disciplines and the sample and population of the students that are studied. This study aims to address this limitation by considering different disciplines and different numbers of student groups. So, this study aims to contribute as empirical research to probe into the academic process and examine the relation of students' CT and creativity while writing in exams and the role of gender in it.

The questions this study addressed are as follows:

1. To what extent do BS English Linguistics students exhibit CT skills, as assessed by Dong's (2015) CT evaluation criteria rubric?
2. What is the extent of the creativity exhibited by BS English Linguistics students in their written exam papers, as evaluated by the adapted TTCT scale?
3. What the relationship between CT skills and creativity is demonstrated in the written exam papers of BS English Linguistics students?
4. To what extent do male and female BS English Linguistics students differ in their manifestation of CT and creative skills as exhibited in their written exam papers?

2. Literature Review

2.1. Critical Thinking (CT)

CT can be characterized as a multifaceted concept that is complex enough to be defined in simple terms. As Halpern (1998) describes, its various dimensions are 'logical reasoning, evidence evaluation, argument analysis, problem-solving, decision-making, and creative thinking'. Paul and Elder (2006) have defined CT as 'the ability of individuals to take charge of their thinking and develop appropriate criteria and standards for analyzing their thinking'. Paul and Elder (2006) have also elucidated CT as 'the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action'. They have suggested that the composition of CT is based on three dimensions: elements of thought, intellectual standards, and intellectual traits (see Figure 1). CT is demonstrated through intellectual standards to measure elements of thought.

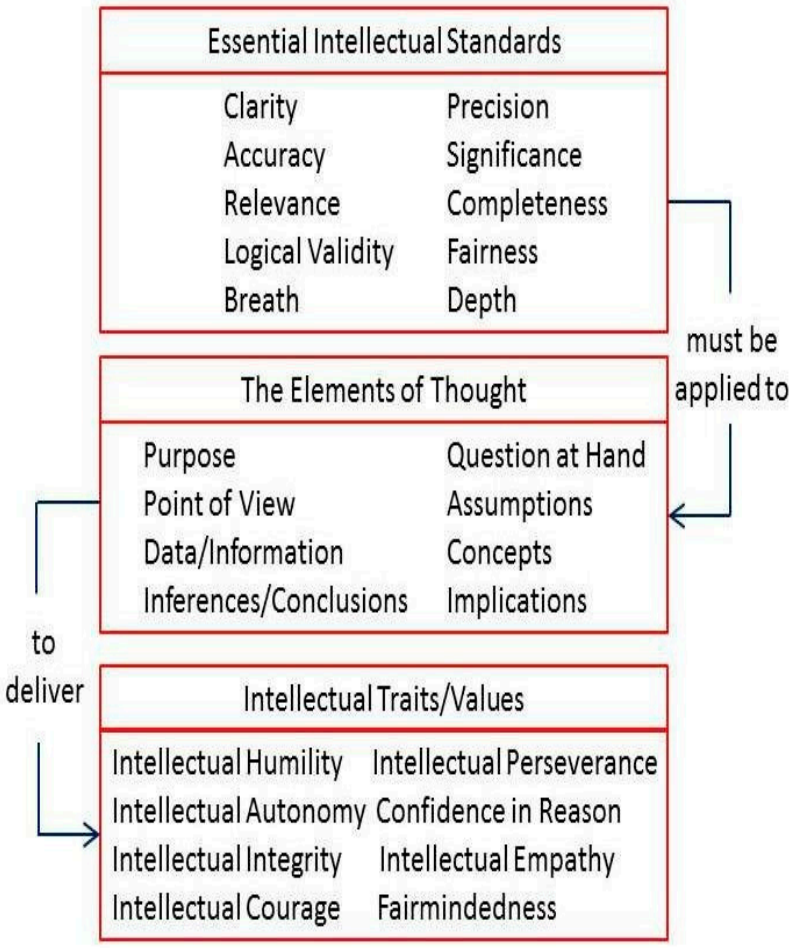

Figure 1. The Paul–Elder CT framework (Paul & Elder, 2002).

This research is guided by Paul and Elder's (2006) CT framework, which provides a foundation for identifying the essential components of CT and evaluating students' CT skills. It proposes intellectual standards through which the CT skills are demonstrated in any context, specifically in writing. In this way, this framework aligns with this study.

2.2. Creativity

Creativity is a complex and multifaceted phenomenon that has been described and conceptualized in various ways. Koestler (1964) says creativity emerges from combining

unrelated ideas into novel concepts. Amabile (1983) defines creativity as producing novel and useful ideas within a specific domain. Sternberg (2003) suggests that creativity is the application of existing knowledge to novel situations, yielding original and valuable outcomes. Gardner (2011) favors that it entails solving problems or creating products that are initially novel but eventually accepted as new standards. Sawyer (2011) names it a process of producing original and worthwhile ideas through generation and implementation. Thus, various definitions by eminent and influential figures in the field of creativity support the claim that creativity is a complex construct, and its multifaceted nature makes it difficult to define it. In light of these definitions, it could be deduced that they highlight the importance of novelty, originality, value, flexibility, practicality, and adaptability in the creative process. Thus, creativity can encompass various domains, such as art, daily tasks, education, fashion, etc.

In contrast, creativity in writing is the application of creative thinking specifically within the realm of writing. It involves generating unique, new, and original ideas, employing stylistic linguistic expressions, and innovative writing techniques. While general creativity can manifest in numerous forms, writing creativity is confined to the writing only.

This study is aligned with Guilford's (1967) dimensions of creativity based on which Torrance (1974) developed his TTCT framework. The framework focuses on four key components: Fluency (large variety of ideas), Flexibility (variety of perspectives/viewpoints), Originality (novelty and uniqueness of ideas), and Elaboration (depth, detail, and richness of ideas). These four dimensions are highly relevant to assessing creativity in written papers, which suits this study's objectives. The researchers used the version adapted by Rababah (2018) which has three components shown in Figure 2:

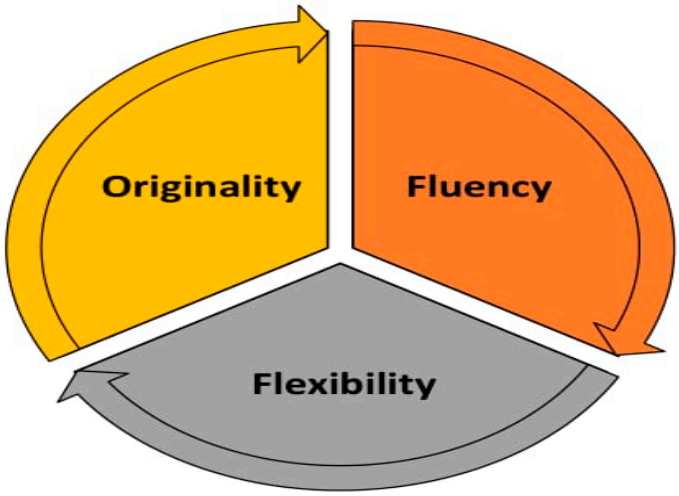

Figure 2. Adapted TTCT by Rababah (2018).

In the context of academic writing, particularly in exams, creativity involves the production of new, unique, original, fluent, and imaginative responses to meet the expected standards of the field. It enables students to approach exams in unconventional ways. They can propose alternative perspectives and solutions. They also exhibit originality in the expression of their ideas. In light of the above discussion on the concept of creativity, the operational definition for this study is 'creativity in writing is defined as the ability of students to produce written responses that exhibit fluency, originality, and flexibility'. In this definition, fluency means a large variety of ideas, flexibility refers to a variety of perspectives/viewpoints, and originality indicates the novelty and uniqueness of ideas. It resonates with the research questions of this study which aim to evaluate the levels of creativity demonstrated by BS English Linguistics students in their written exam papers.

3. Materials and Methods

3.1. Research Design

This study employed a quantitative research approach. The researchers aimed to investigate the level of CT skills and creativity in BS English students' written exam papers. The data were collected at a specific time, capturing a snapshot of the student's performance. As suggested by Ladd et al. (2015), correlational studies are used to see a correlation between two (or more) variables; to achieve the research objective, a correlational analysis was conducted to explore the relationship between CT skills and creativity in writing. This study also utilized a comparative design by comparing the CT skills and creativity between male and female students to examine the potential gender differences in these cognitive abilities.

3.2. Participants

Fraenkel et al. (2011) suggested that a sample of at least 50 participants is suitable for a correlational study. This study's participants included 167 BS English Linguistics first-semester students (100 females and 67 males) aged 17–20 years attending a public university (Government College University Faisalabad) in a city in Pakistan during the session 2023–2027. The participants were from two classes labeled as Group A (n = 85) and Group B (n = 82) in the study. The focus of this study was on first-year students only because it will help with the early identification of trends. First-semester courses are designed to enhance creativity and CT skills. This will make the implementation of targeted interventions easy to support skill development.

A non-probability purposive sampling method was used for this study. As Campbell et al. (2020) claimed, the justification 'for purposive sampling is the better matching of the sample to the aims and objectives of the research.' In the sample, more than half of the students were females (59.88%), and less than half were males (40.12%). Approximately all students were admitted in the first semester of GCUF on open merit after 12 years of education. Approximately all the students were from middle-class families and received their prior education from local city schools. In the case of the students, English was not their first language.

3.3. Data Collection

A positive correlation between argumentative writing and critical thinking skills is explored by various studies directly or indirectly (Pei et al., 2017; Widyastuti, 2018; Beniche et al., 2021; Lustyantie et al., 2022). Therefore, argumentative writing is considered to be an effective way to assess students' CT skills. Yuli and Halimi (2020) and Jaijon and Tawilapakul (2021) explored that familiarity with the topic also positively affects students' CT and creative skills. So, the writing task used for the present study was to write an argumentative dialogue between two friends on a topic of poetry/literature in which one favored it and the other was against it. As the participants were divided into two groups, both groups were given different topics to write argumentative dialogue. The topics were familiar to the students. The students were required to produce their answers in English, which was not their first language. They were given one hour to complete their writing task, which was their mid-term exam paper (see Appendix A for the writing task prompts). The participants completed and submitted their written dialogues in English on the given topic within the timeframe of one hour. Some studies (Kong, 2023; Antes & Mumford, 2009; Tromp & Baer, 2022) suggested that time constraints may enhance performance by increasing focus, while others (Cromwell, 2024; Damadzic et al., 2022) suggested that time pressure may hinder creativity or critical thinking. In this study, the one-hour exam duration was chosen deliberately. It provides realistic conditions to assess creativity and

critical thinking. It also reflects typical academic settings where students are often required to work under time constraints.

3.4. Instruments

Two instruments were used in this study: Dong's (2015) CT Assessment Tool and an adapted version of the TTCT (verbal) scale by Rababah (2018) to measure creativity.

3.4.1. CT Assessment Tool

The researchers used Dong's (2017) tool for CT Assessment to evaluate the participants' CT scores. The evaluation criteria of the set comprise nine dimensions and a five-point band scale (see Appendix B). The tool was developed by Dong (2017) for her study of the impact of an infused CT approach on students' CT and their L2 writing achievement. The scale, as claimed by Dong (2017), is believed to be applicable in L1 as well as L2 writing contexts for assessing the level of CT. It combines both CT and the standards of writing. It is validated by various studies (e.g., Dong & Chang, 2023; Johnson et al., 2023; Baber et al., 2022; Wijayati & Lestari, 2021; Yulian, 2021; Dong, 2017).

3.4.2. A Scale to Measure Creativity

The research used an adapted version of the TTCT (verbal) scale by Rababah (2018) to measure the creativity level of the participants. Torrance originally developed the TTCT in the 1960s to assess students' creative thinking skills (Torrance, 1962, 1965). The adapted version was developed by Rababah (2018) and is also applicable, as claimed by Rababah (2018), to any EFL/ESL context. It can also be utilized, as claimed by Cheung (2005), to measure creativity in writing from the preschool level to the graduate level. The adapted version of the TTCT is a verbal-A test to assess the degree of creativity in ESL or EFL students' writing. It covers assessments of only three components: Fluency, Flexibility, and Originality. 'Fluency' is the first element of the scale that focuses on the investigation of the ability to generate several new ideas. Each idea in the writing was counted from 0 to 3. The second element is 'Flexibility', which assesses the ability to generate a wide variety of ideas. The degree and the level of diversity of the sample were scored on a 0–3 scale. 'Originality' is the third element that addresses the level of uniqueness of the ideas in the sample which was also counted from 0 to 3 (see Appendix C).

3.4.3. Validity and Reliability

The author and an ESL teacher, having 13 years of teaching experience at two different public sector universities, served as the raters for the research. They had previous experience as raters using this set of criteria. The raters first evaluated 10 dialogues/written papers randomly chosen for initial scoring that met the criteria of high inter-rater reliability with a correlation coefficient (r) of 0.88, showing a high degree of agreement, and with a p-value of ($p < 0.05$), showing a statistically significant value. The raters mutually discussed the evaluation differences and continued rating the rest of the dialogues/written papers. An average score was calculated to become the final score for each dialogue based on the CT and creativity scores of the two raters for each dialogue. If a rating discrepancy greater than one point occurred between the two raters, a third rater would have been requested and paid to rate the dialogue in dispute. However, such discrepancy or dispute did not occur.

The second tool, the adapted version of the TTCT, as claimed by Rababah et al. (2013), is validated by a team of English specialists from Jordan (EFL context) and Malaysia (ESL context). They evaluated its items and scoring methods. The team included one full professor and two assistant professors who were specialists in the relevant fields. The TTCT and its scale were modified according to the comments and suggestions provided by the team. Thus, the adapted TTCT version was validated and prepared in English and Arabic.

As Rababah et al. (2013) claimed, the TTCT was highly reliable with a (0.886) outcome of Cronbach Alpha (for details see Rababah et al. (2013)).

Thus, the rubrics for assessing creativity and critical thinking in this study were chosen based on their relevance to the objectives, reliability, and success in previous educational research. Compared to other established measures, these rubrics provide a more comprehensive assessment. They are contextually appropriate and are not complex or time-consuming. It also allows for both qualitative and quantitative evaluations, which align with the objectives of our study.

3.5. Data Analysis

The data were analyzed using SPSS (version 29). Descriptive Statistics such as Mean scores, standard deviations, minimum and maximum values, as well as quartile values (Q1, median, Q3) were calculated for both CT and creativity to obtain an idea of the central tendency, variability, and distribution of scores for each variable. Box plots were generated for both CT and creativity to visually represent the distribution of scores, including the median, quartiles, and any outliers, and identify each variable's range and spread of scores. Line charts were also created to visualize the trend and patterns of scores for both variables across the data set to identify any systematic changes or trends across different groups. Lastly, the correlation coefficient value was calculated to determine the strength and direction of the relationship.

4. Results and Discussion

4.1. The Extent of CT and Creativity in Participants' Writing

To answer the first two research questions of this study, the participants' scores based on the CT rubric and creativity scale were analyzed using SPSS (version 29). Table 1 shows the results of the descriptive analysis for both the variables of CT and creativity of Group A (n = 85) in the study. It provides an initial understanding of the participants' levels of creativity and CT skills.

Table 1. Descriptive analysis of CT and creativity of Group A.

Variables	Mean	StDev	Minimum	Q1	Median	Q3	Maximum
CT	56.72	10.76	26.67	53.33	57.78	60.00	82.22
Creativity	57.209	9.158	30.556	52.778	55.556	61.111	86.111

The descriptive analysis of the CT variable shows that the mean score was calculated as 56.72. It indicates that the participants displayed an average level of CT skills. The standard deviation value, which is 10.76, demonstrates a moderate degree of variability in the CT scores. The minimum CT score found was 26.67. It represents the lowest score observed in the data. The first quartile (Q1) value is 53.33. It indicates that 25% of the participants had CT scores below this threshold. The median value of 57.78 represents the middle value of the distribution. It indicates that 50% of the participants had CT scores above this point. The third quartile (Q3) value is 60.00. It indicates that 75% of the participants had CT scores below this point. It reflects a range of CT abilities within the sample. The maximum CT score is 82.22. It represents the highest score observed in the data. It suggests that some participants demonstrated advanced levels of CT skills.

Similarly, the mean score for creativity was found to be 57.209. It indicates the high average level of creativity by the participants. A standard deviation value of 9.158 was observed. It suggests that there is a moderate value of variability in the creativity scores. Some of the participants exhibited higher or lower levels of creativity. The 30.556 value

for creativity was the minimum value. It represents the lowest score observed in the data. The 52.778 value of the first quartile (Q1) indicates that 25% of participants had creativity scores below this threshold. The median value of 55.556 represents the middle value of the distribution. The 62.111 value of the third quartile (Q3) shows that 75% of the participants had creativity scores below this point. This indicates the range of creativity expressed by the participants. The highest observed creativity score is signified by the maximum value of 87.111. It suggests exceptional levels of creativity by some of the participants.

Moreover, Table 2 shows the results of the descriptive analysis of data from Group B (n = 82). The descriptive statistics were computed for both variables. First comes the description of the CT variable. The mean score for CT was 46.72, and the value of the standard deviation was 13.81. The minimum score observed was 0. It indicates that some participants had the lowest level of CT skills. The maximum score was observed as 77.78. It suggests that some participants demonstrated higher levels of CT. The value of 42.22 in the first quartile (Q1) shows that 25% of participants had CT scores below this value. The middle value is represented by the median score, which was 44.44. The value of 55.56 in the third quartile (Q3) shows that 75% of participants had CT scores below this value.

Table 2. Descriptive analysis of CT and creativity of Group B.

Variables	Mean	StDev	Minimum	Q1	Median	Q3	Maximum
CT	46.72	13.81	0	42.22	44.44	55.56	77.78
Creativity	46.35	13.63	11.11	36.11	47.22	55.56	77.78

The descriptive analysis of the creativity variable showed strikingly similar results. The mean score of 44.35 indicates the average level of creativity of Group B participants. The moderate degree of variability of creativity is indicated by the value of standard deviation, which is 11.63. The minimum level is displayed by the minimum score, which is 10.11. The maximum score of 70.78 demonstrated the higher levels of creativity by some participants. The first quartile (Q1) value of 32.11 shows that 25% of scorers reached below this score. The median value observed was 45.22. The third quartile (Q3) value of 50.56 shows that 75% of scorers reached below this score.

The researchers also produced boxplots for the data of each group. The boxplots provide, as shown in Figure 3, visual representations of the distribution of scores for CT and creativity and identify the spread of the scores of these variables through the data. The CT and creativity scores for Group A are displayed in the boxplot in Figure 3. The creativity scores on the boxplot reveal that the median value is 55.556. The interquartile range (IQR) spans from 52.778 to 61.111. The whiskers extend to the minimum and maximum scores of 30.556 and 86.111, respectively. The distribution shows that the majority of scores in Group A are in the middle range, and there are some outliers on both ends of the distribution. The boxplot displays the CT scores of Group A as well. The median value displayed is 57.78. The IQR spans from 53.33 to 60.00. The extension of the whiskers shows the minimum and maximum scores of 26.67 and 82.22, respectively. Most of the CT scorers in Group A fall within the middle range, like those of creativity. Nevertheless, the outliers are comparatively more in number on both ends.

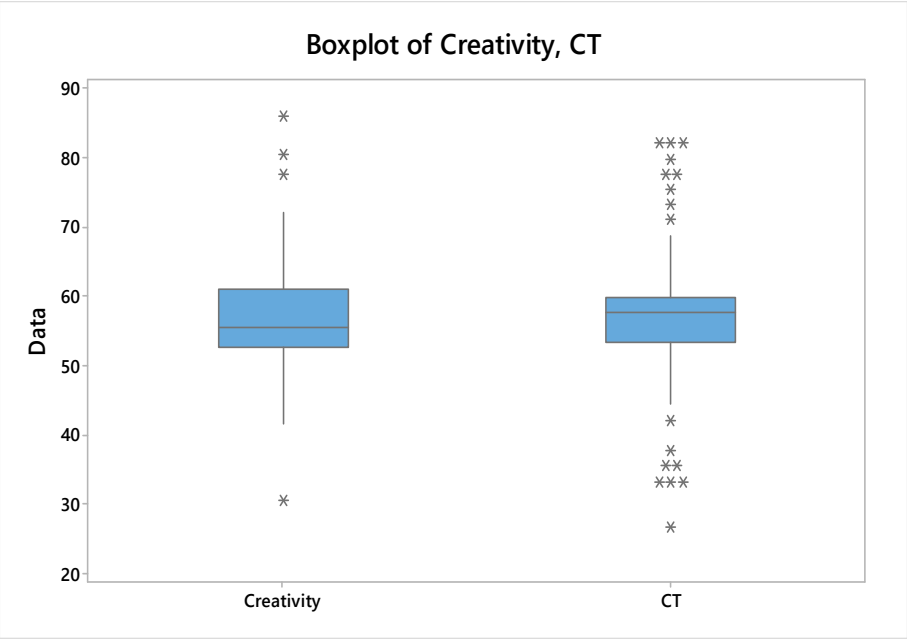

Figure 3. Boxplots of CT and creativity of Group A students. [Outliers are represented by asterisks (*) in the boxplot. A single asterisk (*) indicates one outlier, two asterisks (**) indicate two outliers, while three asterisks (***) represent three outliers. These outliers are located on both sides of the whiskers and may warrant further examination or investigation].

The line chart of Group A in Figure 4 indicates the points of variation in the CT and creativity scores observed in the data. The CT scores show variations that range from 26.67 to 82.22. The creativity scores also fluctuate throughout the data. They range from 30.56 to 86.11. Fluctuations are shown in the line chart through the higher peaks and lower points of both variables. The range of variability is approximately similar for both variables.

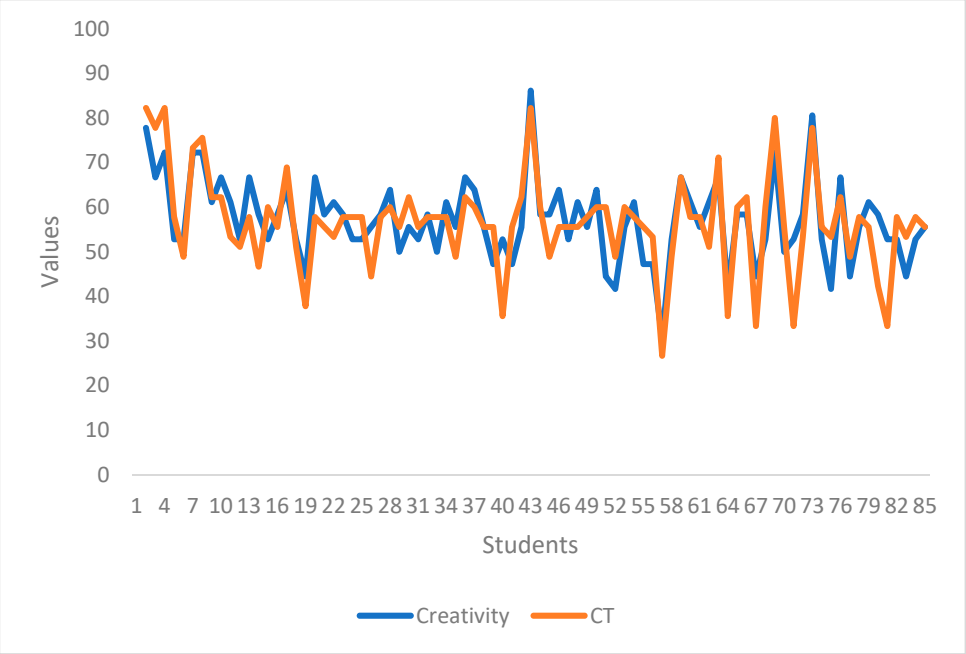

Figure 4. Line chart of CT and creativity of Group A students.

The boxplot of Group B in Figure 5 displays the values of CT and creativity of the Group B scores. The boxplot shows that the median value of creativity is 47.22. Its IQR

spans from 36.11 to 55.56. The extension of the whiskers shows the minimum and maximum scores of 11.11 and 77.78, respectively. This indicates that the score of creativity of Group B is lower as compared to that of Group A. It also suggests that Group B has a narrow spread of values and has fewer outliers. The boxplot of the CT scores of Group B shows that the median value is 44.44. The IQR is from 42.22 to 55.56. The extension of the whiskers reveals the minimum and maximum scores of 0.00 and 70.78, respectively. The boxplot shows that the scores for CT in Group B are also lower as compared to those of Group A. Group B also has a narrower distribution and fewer outliers. These outliers were kept because their impact on the overall conclusions was minimal, and they did not substantially influence the key findings of this study.

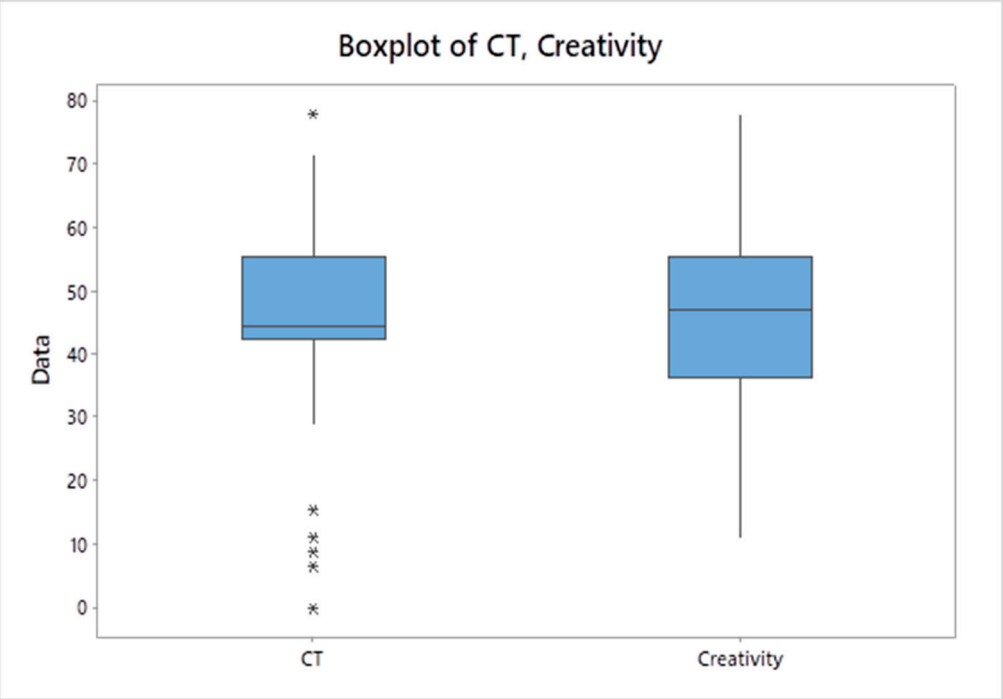

Figure 5. Boxplots of CT and creativity of Group B students. [Outliers are represented by asterisks (*) in the boxplot. A single asterisk (*) indicates one outlier].

The line chart, as shown in Figure 6, of Group B also illustrates the fluctuations in the scores for CT and creativity. The following chart shows the variability of the CT scores, ranging from 0 to 77.78. The noticeable peaks and valleys in the scores indicate maximum and minimum scores. Similarly, the variation in the creativity scores ranges from 11.11 to 77.78. The fluctuations in the scores of both CT and creativity are displayed by the line chart.

The comparison of the values showed striking similarities between the scores for CT and creativity. The scores for all the values are very close, indicating similarities in the participants' CT and creativity levels. Though Group A demonstrates higher scores for both CT and creativity, both groups generally displayed moderate and average levels of CT and creativity in the data.

This study's findings about the level of creativity are consistent with Rababah et al.'s (2013) study, which used the same tool to assess participants' level of creativity. Rababah et al. (2013) follow the following criteria (see Figure 7) to assess the level of creativity of EFL learners. The current study's results also align with these criteria. Most of the participants fall under the category of an average or moderate level of creativity. Figure 7 illustrates that most participants demonstrate an average or moderate level of creativity, aligning with prior research findings

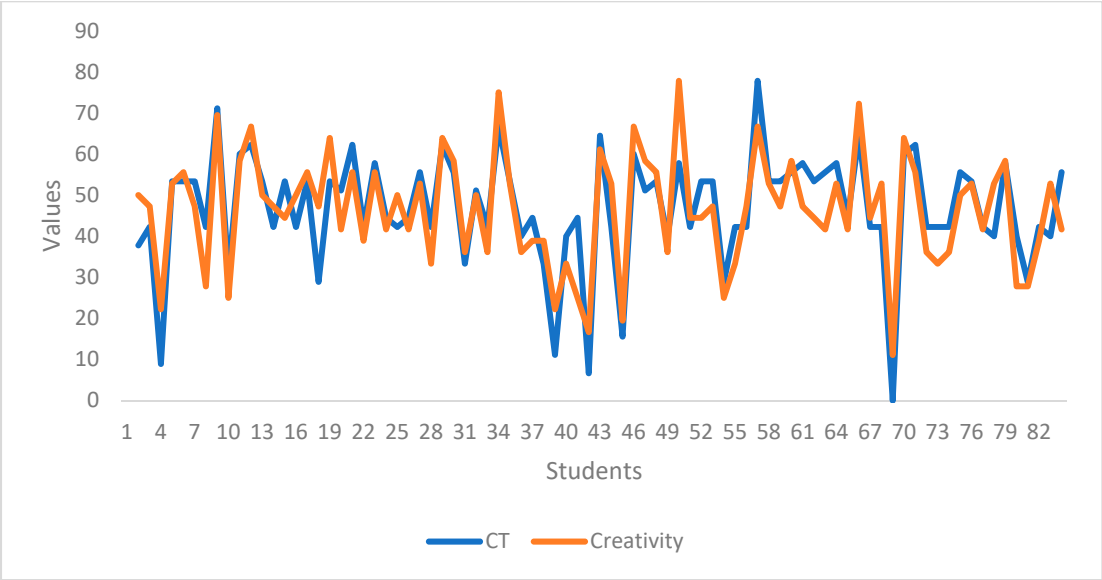

Figure 6. Line chart of CT and creativity of Group B students.

SCALE	SCORE
High Level	Above 57
Average/ Moderate Level	29-56
Low Level	Below 27

Figure 7. Level of creativity.

The current research findings about the participants' CT levels are also aligned with previous studies (Dong, 2015, 2017) that used the same tool to assess CT, except Dong (2015). The studies observed that the L2 learners' level of CT is average or moderate, but they suggest through their studies that the level could be polished after employing different teaching strategies.

4.2. The Nature of the Relationship Between CT and Creativity in Students' Writing

The researchers applied the Pearson coefficient test to explore the nature of the relationship between CT and creativity in the data to answer the third research question. Tables 3 and 4 exhibit the correlational values between the CT and creativity variables for Group A and Group B, respectively. The correlation coefficients between CT and creativity in Group A and Group B are 0.749464 and 0.833245, respectively. The values indicate a strong positive correlation between these two variables. The results suggest that creativity scores tend to increase when CT scores increase. The value of one for the correlation coefficient for both variables shows a perfect positive correlation. These correlational values highlight the positive role of CT skills in enhancing creativity among the participants. The results of this research are aligned and consistent with the prior research that explored a positive correlation between both abilities (Gibson et al., 1968; Gadzella & Penland, 1995; Halpern, 2003; Yang & Chou, 2008; Paul & Elder, 2007a, 2007b; Ülger, 2016; Siburian et al., 2019; Hidayati et al., 2019; Shubina & Kulakli, 2019; Akpur, 2020; Qiang et al., 2020; Park et al., 2021; Álvarez-Huerta et al., 2022).

Table 3. Correlation analysis between CT and creativity of Group B participants.

Variables	CT	Creativity
CT	1	
Creativity	0.749464	1

Table 4. Correlation between CT and creativity of Group A participants.

Values	CT	Creativity
CT	1	
Creativity	0.833245	1

4.3. Gender Differences in the Manifestation of CT and Creativity in Students' Writing

The fourth question of this study deals with the similarities and differences in the level of CT and creativity based on the gender of the participants. To answer the fourth question of this research, the two groups are further divided into female and male subgroups (Group AF: n = 61; Group AM: n = 24) (Group BF: n = 39; Group BM: n = 43). The relationship between gender and creativity was explored through a descriptive analysis. The results demonstrate much distinction in the patterns of creativity in males and females. According to Table 5, in Group A, the mean score of creativity for males was 51.18. The standard deviation value for males was 7.25. The males' minimum score value was 30.50. The value of the first quartile (Q1) was 47.22. It indicates that 25% of males had a creativity score below this point. The median for the male score was 52.70, which shows the middle value. The third quartile (Q3) value was 55.50. It indicates that 75% of males had a lower creativity score than this value. The maximum creativity score by males in Group A was 63.88. Their mean score was 59.58. Females showed a higher standard deviation value than males, which is 8.96. The female scorers' minimum value was 41.60. Their first quartile (Q1) was 52.70, which indicates that 25% of females had creativity scores below this level. The females' median score was 58.30. Their third quartile (Q3) value was 66.60. It shows that 75% of females scored below this point. Their maximum creativity score was 86.10. The comparison of these results of Group A favors the superiority of females over males in the manifestation of creativity.

Table 5. Creativity analysis of male vs. female Group A participants.

Variables	Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Male	51.18	7.25	30.50	47.22	52.70	55.50	63.88
Female	59.58	8.96	41.60	52.70	58.30	66.60	86.10

Moreover, a vertical bar chart in Figure 8 visually represents the comparison of creativity scores by gender. The left bar shows the mean score of males' creativity, and the right bar represents the mean score of female participants' creativity level. The mean score of creativity by the males, which was 51.18, indicates the average level of creativity. The chart shows a wider range of creativity scores by the female participants. The mean score of creativity by females is 59.58. Though both display the average level of creativity through their scores, the values indicate that females exhibit a comparatively higher level of creativity than males.

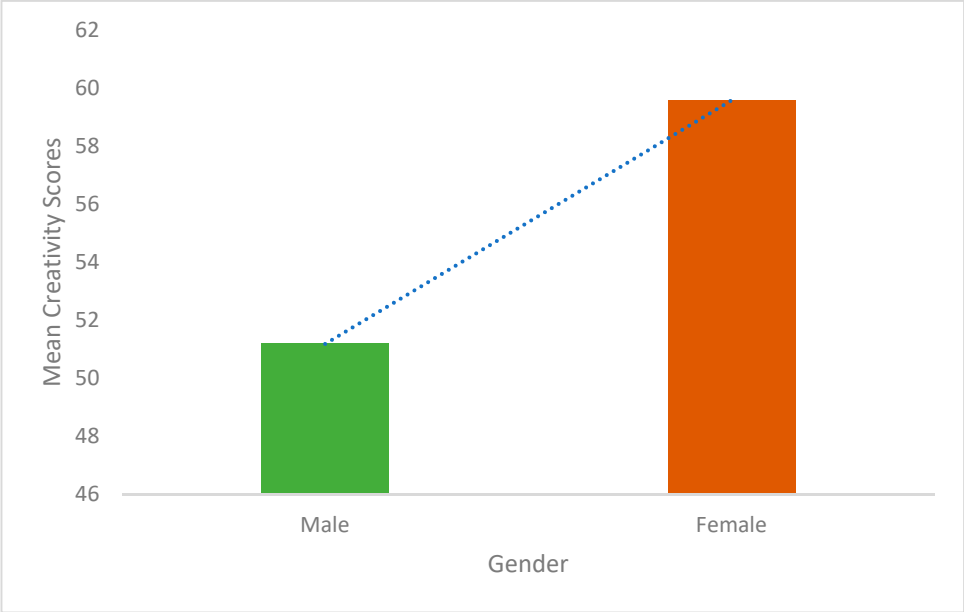

Figure 8. Comparison of creativity scores of male vs. female participants of Group A. [The dotted line in the bar chart represents the difference in height between the bars. It visually highlights the variation or gap between the respective values, providing a clearer comparison].

The descriptive analysis to investigate the association of gender with creativity in Group B also revealed similar results as displayed by Group B, as described in Table 6. The mean score for creativity by the males of Group B was 44.14. Their value of standard deviation was 14.14. The range of their creativity scores varied from a minimum value of 11.10 to a maximum value of 66.60. It can also be observed that 25% of males scored below 34.00 (Q1), and 75% of males scored below 57.7 (Q3). The median score was 47.20. On the other hand, the females of Group B, like the females of Group A, exhibited higher levels of creativity than males. Their mean score value was 49.25. The females' creativity scores ranged from a minimum point of 25.00 to a maximum of 77.70. It was also observed that 25% of females scored below 38.80 (Q1), and 75% of females scored below 58.30. The median creativity score by females was 47.20. The results agree with the findings of Group A, that though the level of creativity for both genders is moderate/average, the female participants are more creative than the male participants in their writing.

Table 6. Creativity analysis of male vs. female Group B participants.

Variables	Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Male	44.14	14.14	11.10	34.00	47.20	52.70	66.60
Female	49.25	12.62	25.00	38.80	47.20	58.30	77.70

Almost similar results are found in the descriptive analysis of creativity for Group B. A vertical bar chart in Figure 9 compares the creativity scores by males and females of group B. The left bar shows the mean score of males' creativity, and the right bar represents the mean score of female participants' creativity level. The mean score of creativity by the males, which was 44.114, indicates the average level of creativity. The chart shows a wider range of creativity scores by the female participants. The mean score of creativity by females is 49.25. Though both display the average level of creativity through their scores, the values indicate that females exhibit a comparatively higher level of creativity than males. The males and females of Group A comparatively show higher levels of creativity than the males and females of Group B.

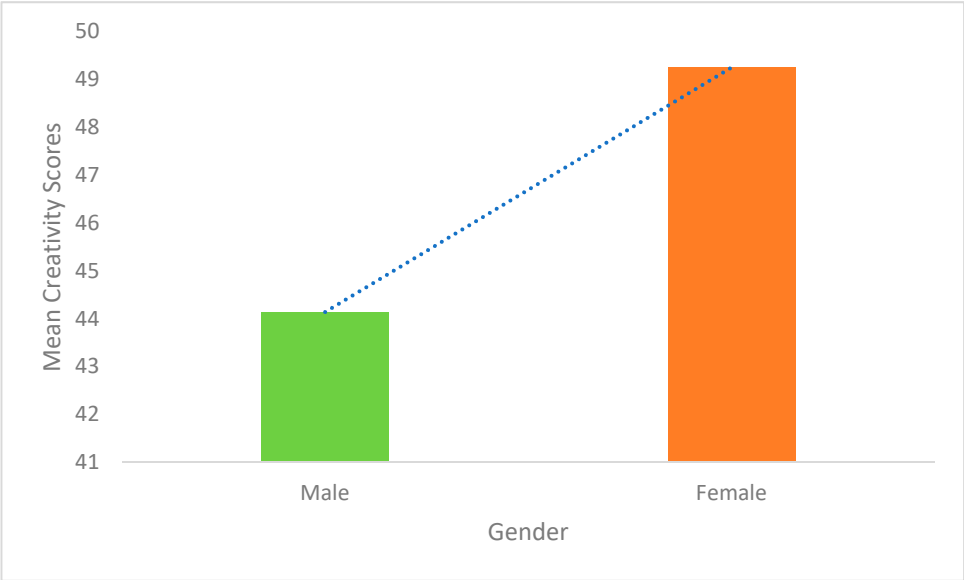

Figure 9. Comparison of creativity scores of male vs. female participants of Group B. [The dotted line in the bar chart represents the difference in height between the bars. It visually highlights the variation or gap between the respective values, providing a clearer comparison].

To answer the second part of the fourth research question, a descriptive analysis was conducted to explore the relationship between gender and CT skills. The values given in Table 7 show the results of the analysis of Group A. Males were observed to have a CT score of 48.23. The standard deviation value was 13.14. The range of the CT scores of males was a minimum of 5.55 to a maximum of 62.22. The median score by the males was observed to be 51.11. The first quartile (Q1) scored 44.44, and the third quartile (Q3) scored 57.70. However, the data from females showed a higher mean score for CT, which was 59.11. However, the standard observed was a little lower, which was 10.49. The females' lowest score in CT was 33.30, which shows a wide difference from the males' lowest score, which was 5.55. A total of 25% of female participants scored below 55.50, as indicated by the first quartile (Q1), and 75% of female participants achieved the target below 62.20, as shown by the third quartile (Q3). The median score for females was 57.70. The highest CT score by females was 82.20.

Table 7. CT analysis of male vs. female Group A participants.

Variables	Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Male	48.23	13.40	5.55	44.44	51.11	57.70	62.22
Female	59.11	10.49	33.30	55.50	57.70	62.20	82.20

In Group A, notable gender differences can be observed by comparing the descriptive analysis of CT scores. The females manifested higher CT scores as compared to those of the males. The evidence is provided by the higher mean and median scores. The standard deviation value for female participants' CT scores was lower, indicating that female participants were more consistent in their CT performance.

The bar graph in Figure 10 presents a graphical and visual demonstration of the mean scores of the CT skills by both male and female participants. The x-axis represents the gender categories, while the y-axis represents the mean scores of CT skills. The bar graph displays the noticeable difference in the achievement of male and female students. The bar representing the mean CT score for female participants is placed higher than that of males. The left bar representing the male students' mean CT score shows a lower achievement.

The contrast in the higher position of the female graph and the lower position of the male graph shows the difference in the CT performance by different genders.

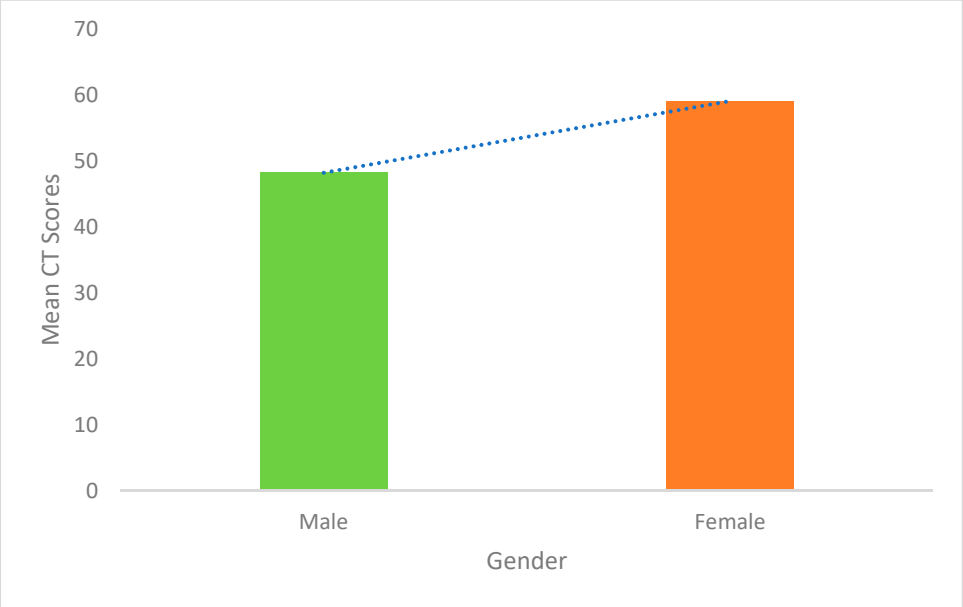

Figure 10. Comparison of CT scores of male vs. female participants of Group A. [The dotted line in the bar chart represents the difference in height between the bars. It visually highlights the variation or gap between the respective values, providing a clearer comparison].

The descriptive analysis of the scores from the data of Group B showed the values of CT skills of male and female participants that are displayed in Table 8. The findings show that the mean CT score of the males was 43.25. Its standard deviation value was 15.58, which shows a moderate value of variability by male students in their CT skills. The minimum score observed by males was 0.00, and the maximum score observed was 62.20. A total of 25% of males scored below the value of 40, as indicated by the first quartile (Q1), and 75% of males scored below the value of 53.3, as indicated by the third quartile (Q3). The median CT score for males was 43.3. On the other hand, the mean score for the females was 50.56, with a standard deviation of 10.39. This standard deviation value is comparatively lower than that of males, which indicates that females displayed a narrow range of CT scores. The minimum CT score observed by females was 33.30, which is also much higher than that of males. A total of 25% of female participants scored below the value of 42.20, and 75% of females scored below the value of 57.70. The median CT score by females was 53.3. The maximum score female participants achieved was 77.70. This value showed the highest level of CT achieved by the participants of this group, which was achieved by a female participant. Similarly to the results of Group A.

Table 8. CT analysis of male vs. female Group B participants.

Variables	Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Male	43.25	15.58	0.00	40.00	43.30	53.30	62.20
Female	50.56	10.39	33.30	52.20	53.30	57.70	77.70

The findings mentioned in Table 8 show that there is a significant difference in CT scores based on the gender of the participants. The female participants achieved considerably higher scores than the males, as indicated by their higher mean and median

scores. Moreover, the lower standard deviation in the female data shows their consistent performance and narrow spread of scores.

The bar graph in Figure 11 represents the mean scores of CT for males and females from Group B. The graph makes it clear that the bar indicating the females' mean score of CT is positioned much higher than that of the bar displaying the mean CT score of the males in Group B, which is positioned lower. The graphical representation also supports the findings of Group A, that, on average, the female participants possess a higher level of CT in their writing. After the comparison of the findings of both groups, it becomes clear that females consistently demonstrated higher mean scores for their CT skills than the males. This consistency indicates that there are considerable gender-based differences in the manifestation of CT skills in both groups.

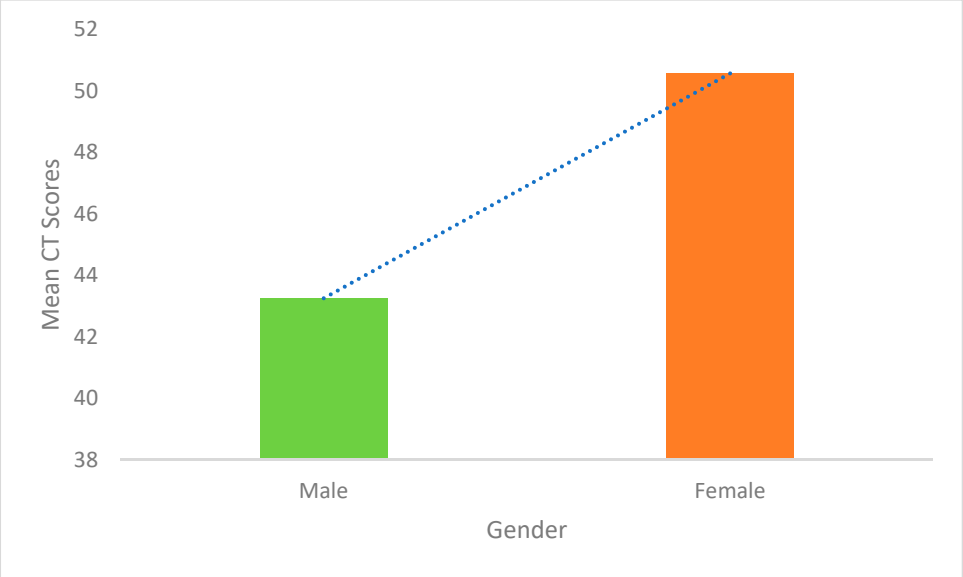

Figure 11. Comparison of CT scores of male vs. female participants of Group B. [The dotted line in the bar chart represents the difference in height between the bars. It visually highlights the variation or gap between the respective values, providing a clearer comparison].

A striking finding revealed by the graph in Figure 11 shows that the males in Group B displayed a noticeable difference in their CT scores as compared to the males in Group A. This discrepancy indicates that the males in Group B have lower mean CT skill scores than the males in Group A. It suggests a lower level of CT abilities in the males of Group B. The descriptive statistics of the males' data revealed a higher value of standard deviation for males in Group B. It suggests a wider range of scores and variability of CT skills among males, with some participants scoring lower than their Group A counterparts. Thus, the comparison between the two groups reveals a nuanced difference in the CT performance of males, while it shows the consistency in the CT performance of the females.

There are several studies that explored the role of gender differences in the manifestation of creativity and CT skills (Sari et al., 2021; Ramdani et al., 2021; Arifah et al., 2021). The findings of the prior research showed mixed results. The findings of the CT superiority of females in the current study align with the studies (e.g., Perdana, 2019; Shubina & Kulakli, 2019; Saryanto et al., 2021) that claimed females to be superior in CT skills and are partially consistent with the findings of Ramdani et al. (2021) that supported females' superiority over males in some dimension of a single construct. Some other studies favored the superiority of men over women, but many researchers found no significant gender difference in possessing these abilities, like CT. Azizi et al. (2022) found no significant

difference and suggested that both fluctuate in the possession of these skills for mastering different components.

The findings of the current study align with the findings of some previous researchers (Arifani & Suryanti, 2019) and are partially consistent with the findings of Ülger (2016) and Betancourt et al. (2022) that discovered the superiority of females in some aspects of creativity. This study's results are also consistent with a few findings of prior research that have explored the relationship between gender and creativity (e.g., Baer & Kaufman, 2008; Runco et al., 2010; Stoltzfus et al., 2011; Abraham, 2016) and observed mixed results. The current study's findings do not align with some studies that support the superiority of males over females in possessing creativity (e.g., Perdana, 2019; Shubina & Kulakli, 2019; He & Wong, 2021). The results of this study are also supported by Abraham (2016) and Nakano et al. (2021), who presented their review of the literature on gender and creativity. Though they reported mixed results regarding the relationship between gender and creativity, Nakano et al. (2021) reported that 45.11% of studies showed no difference in creativity based on gender, 54.88% of studies showed the existence of a difference in gender, among which 45.2% of studies favored the superiority of women over men while 23.28% of studies showed the superiority of men over women.

5. Conclusions

This research provided a comprehensive analysis of two major constructs—CT skills and creativity—to assess what gender (male students or female students) manifests higher levels of CT skills and creativity in their writing at the BS level. The analysis through SPSS provides several significant findings. Firstly, the assessment of CT skills showed that the participants exhibited a moderate level of CT skills. This is evidenced by the mean score of CT, which is 56.72 for Group A and 46.72 for Group B. In the same way, the mean score of the creativity of Group A, which was 57.209, and of Group B, which was 46.35, indicated a moderate level of creativity among the participants of both groups. The results showed that Group A falls into the category of a comparatively higher moderate level than Group B.

Secondly, the nature of the relationship among the constructs was evidenced to be positive as well as statistically significant. This suggests that the participants who possess higher levels of CT skills also have higher levels of creativity. Thirdly, the analysis enlightened the manifestation of gender differences in both constructs. Both subgroups of female participants achieved higher average scores in both CT skills and creativity as compared to the male subgroups. The results also revealed more consistency in females' demonstrations of these skills and the variability among men's demonstrations of these abilities.

Thus, the present research provides quantitative support to the theoretical and conceptual framework of the fields by indicating that in their writing the level of ESL students' CT skills and creativity is evidenced as being moderate and also by exploring the correlation of these two constructs and their relationship with gender.

The finding of this study that female students are more creative and slightly more critical than male students in Pakistan has many practical implications. The educators can design curriculum and writing instruction based on these findings. As female students are more creative, the activities promoting creativity should be prioritized for them in the curriculum. Critical thinking components should also be added to polish their analytical skills. While for male students, argumentation and problem-solving should be focused on in their writing tasks to make them think critically and creatively. Educators should also incorporate gender-neutral group work. This will help both genders to learn from each other's strengths. Educators should also ensure that both skills are given due value in assessments.

Though the present study provided a valuable insight for the research in CT skills and creativity, it had some limitations too that should be acknowledged. Firstly, as the researchers utilized a purposive sampling method, the findings of the study had limited generalizability and may show some bias. The sample is collected from a single department of a Pakistani University. It is recommended that future researchers should work with larger and more diverse samples to validate the results. Secondly, the data for the study were collected at a specific point in time, which cannot assess the change in abilities over time. Longitudinal studies can be conducted to better understand the chances and growth of both the skills over time. Thirdly, though the researchers widely use the tools used by other researchers to measure CT and creativity, the incorporation of multiple tools to assess these complex and multifaceted constructs may produce better results. Fourthly, this study conducted descriptive statistical analysis to explore gender differences in the data, but other statistical tests, such as inferential tests, could be applied to better comprehend the significance and magnitude of the gender differences in both skills. Lastly, the study did not explore contextual, social, cultural, or any external factors that may affect the manifestation of CT and creativity skills. Future researchers may consider these factors to present a more holistic view of these abilities.

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Appendix A

Prompts for Writing Task

GROUP A: Imagine a conversation between two friends, one who is passionate about literature and poetry, and the other who does not see the value in studying it. How do they each defend their respective positions and what insights can be gained from their discussion about the role and importance of literature and poetry.

GROUP B: Imagine a conversation between Plato and Aristotle discussing the importance of literature and the role it plays in society. What arguments would each philosopher make and how would they differ in their views on the value of literature?

Appendix B

CRITICAL THINKING BAND DESCRIPTORS		5	4	3	2	1
		Very good	Good	Average	Poor	Very poor
1	**Clarity**	Completely understandable; Free from any confusion or ambiguity	Fairly understandable even though some words are not completely clear	Understandable, but some words or sentences are not clear enough or slightly confusing	Presenting a number of unclear referents or sentences that are not easily understandable or rather confusing	Hardly understandable; Full of confusion or ambiguity
2	**Accuracy**	Completely free from errors, mistakes or distortions; True; Correct	Fairly correct; No misleading information	Most of the information is fairly correct; Some information needs further verification, but is not quite misleading	Some of the information is not correct, or with unidentified sources; Some information is quite misleading	Presenting many errors or mistakes; Very misleading
3	**Precision**	Completely exact to the sufficient level of detail; Presenting sufficient examples and explanations; Very specific	Exact to the necessary level of detail; Presenting necessary examples and explanations; Fairly specific	Exact to the fundamental level of detail; Presenting some examples and explanations but not enough; Not very specific	Not exact to the necessary level of detail; Lacking some necessary examples or explanations; Not specific	Not exact to the fundamental level of detail; Very general; Lacking many necessary examples or explanations; Not specific at all
4	**Relevance**	Implying a completely close relationship with the task; Covering all the key points; Presenting no irrelevant information	Implying a fairly close relationship with the task; Covering almost all the key points; Presenting no irrelevant information	Implying some relationship with the task; Not covering all the key points; Presenting some information that is not closely related to the task	Not implying a close relationship with the task; Missing some key points; Presenting some information that is not related to the task	Not implying any relationship with the task; Missing all the key points
5	**Depth**	Implying thoroughness in thinking; Presenting full understanding of the complexities	Implying depth in thinking; Presenting an understanding of the complexities	Not implying enough depth in thinking; Presenting a basic understanding of the complexities	Not implying depth in thinking; Not presenting an understanding of the complexities	Not implying any depth in thinking; Not presenting any basic understanding of the complexities
6	**Breadth**	Encompassing multiple viewpoints; Fully considering differing ideas	Encompassing multiple viewpoints; Appropriately considering differing ideas	Encompassing multiple viewpoints to some extent; Not broad-minded enough; Not fully considering differing ideas	Narrow-minded in perspective; Not considering much about differing ideas	Very narrow-minded in perspective; Not considering differing ideas
7	**Logic**	Completely making sense; No contradictions; No logical errors; Providing strongly convincing evidence to fully support all the key viewpoints	Fairly making sense; No contradictions; No logical errors; Providing fairly convincing evidence to support almost all the key viewpoints	Making sense; No obvious contradictions; Having occasional errors in logic; Not providing enough convincing evidence to support all the key viewpoints	Having some obvious contradictions or logical errors; Lacking convincing evidence for several key viewpoints	Having many obvious contradictions or logical errors; Lacking convincing evidence for all the key viewpoints
8	**Significance**	Having great importance; Showing great substantiality in meaning; Highlighting all the important features	Having appropriate importance; Showing appropriate substantiality in meaning; Highlighting most of the important features	Having importance; Missing some important features; Or presenting certain features that are not important enough	Presenting some features that are not important enough; Not substantial enough in meaning; Not highlighting the important features	Not having any importance; Not showing any substantiality in meaning
9	**Fairness**	Presenting ethical appropriateness in the aspects of viewpoints, evidence, argument and conclusion; The writing is based on verifiable facts; Not showing any bias in terms of religion, ethics, gender, age, profession, etc.	Presenting ethical appropriateness in the aspects of viewpoints, evidence, argument and conclusion; The writing is based on verifiable facts; Not showing any obvious bias in terms of religion, ethics, gender, age, profession, etc.	Presenting necessary ethical appropriateness in the aspects of viewpoints, evidence, argument and conclusion; Most of the writing is based on verifiable facts; Not showing any obvious bias in terms of religion, ethics, gender, age, profession, etc.	Not presenting necessary ethical appropriateness in some of the aspects of viewpoints, evidence, argument and conclusion; Part of the writing is not based on verifiable facts; Showing some obvious bias in terms of religion, ethics, gender, age, profession, etc.	Not presenting ethical appropriateness in many of the aspects of viewpoints, evidence, argument and conclusion; Most of the writing is not based on verifiable facts; Showing obvious bias in terms of religion, ethics, gender, age, profession, etc.

Appendix C

TTCT Scale of Creativity in Writing

1. Fluency

- Refers to the ability to generate new ideas
- Count the number of idea units in each paragraph
- Each idea unit will be counted from 0 to 3

0- no answer at all (0 Pt)
1- Unrelated or repeated idea (1-4 Pts.)
2 - Each incomplete idea unit (5-8 Pts.)
3 - Each complete idea unit (9-12 Pts.)

2. Flexibility

- Refers to the ability to generate a wide variety of ideas
- The sample will be scored according to the degree of diversity in the content (paragraph)
- Each idea unit will be counted from 0 to 3

0- no answer at all (0 Pt)
1- No transformation or development of time/ place/person (1-4 Pts.)
2- Each incomplete transformation or development of time/place/person (5-8 Pts.)
3- Each complete transformation or development of time/place/person(9-12 Pts.)

3. Originality

- Refers to the ability to produce unusual, unique or highly personal ideas or solutions.
- Each special quality or originality will be counted from 0 to 3

0- no answer at all (0 Pt)
1- No illustration of originality (1-4 Pts.)
2- Illustration of originality that appears rarely (5-8 Pts.)
3- Illustration of originality that appears more frequently (9-12 Pts.)

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