

## ORIGINAL ARTICLE

## ASSOCIATION OF CRITICAL THINKING AND CURRICULUM FOR COLLEGE STUDENTS; A CHALLENGE FOR DEVELOPING COUNTRIES TO ACHIEVE SDG FOUR

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**Background:** Present challenge for sustainable development goal four is quality of education for all. Critical thinking is the most important skill that an educational institute gives to students and it should be learning outcome at all levels of education. This study aimed to identify critical thinking and its association with curriculum among college students of Rawalpindi, Pakistan. **Methods:** It was cross-sectional study with 400 college students from federal and Cambridge system selected by multistage random sampling. Structured questionnaire was used with two sections, i.e., demographic and Cornell critical thinking version X. Cronbach's alpha was 0.85. Chi square test of association was used for overall and stratified data for inferential analysis. **Results:** Study showed that overall, 64% of students had high critical thinking ( $40.2 \pm 10.4$ ). Chi-square test of independence showed significant relation of critical thinking with curriculum, family economic status, being first child, extra-curricular activities, availability of school playground and career counselling services to the students ( $p$ -value  $< 0.05$ ). Stratified analysis showed gender and availability of play ground to be associated with critical thinking for federal while for Cambridge system, living with single or both parents, working status of father, sports week and school playground were significantly associated. **Conclusion:** Overall results suggested that curriculum does have an effect on the critical thinking of students along with facilities available at school. There is need to synergize theoretical and practical approaches in all curriculums to reduce educational inequities. It is needed for growth of our students and to achieve SDG 4 (to ensure inclusive and equitable quality education) in true spirit.

**Keywords:** Critical thinking; Cornell critical thinking tool; Curriculum; Students; Cambridge system; Federal system; Pakistan

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## INTRODUCTION

In 2015, the 2030 Agenda for Sustainable Development was adopted by the United Nations and it identified 17 goals for sustainable development. Goal 4 is related to quality education with overall aim of “ensuring inclusive and equitable quality education and promote lifelong learning opportunities for all”. There are seven outcome targets for this goal; one is related to the acquisition of skills for decent work this emphasis that besides work related skills we must conceptualize the importance of cognitive and non-cognitive skills such as critical thinking.<sup>1</sup>

Critical thinking is the most important skill that an educational institute gives to students and it should be learning outcome at all levels of education. However, it still needs a lot of effort to integrate critical thinking into curriculum because it demands philosophical shift output to process and subject isolation to harmony. Critical thinking is an objective analysis of facts to form a judgment.<sup>2</sup> it is defined as “the process of actively

and skilfully conceptualizing, applying, analysing, synthesizing and evaluating information to reach an answer or conclusion”.<sup>2</sup> Among many educational experts John Dewey expressed that a curriculum aimed at building thinking skills would benefit the individual learner, the community and the entire democracy.<sup>3</sup> Previous researches showed that critical thinking is a multifaceted factor that not only depends on type of curriculum but also on different educational factors, student's factors and child-rearing factors while higher income and urban locality also proved to be a significant factor for having better critical thinking.<sup>4</sup>

Curriculum has been defined by oxford dictionary as course components in a school or college. The word curriculum has evolved from a Latin word “Curricule” means “a race” or “the course of race”. In education, a curriculum is broadly defined as the totality of student's experiences that occur in the educational process.<sup>5</sup> Curriculum has either facilitative or hindering effects on the student's critical thinking. A study aimed at determining the effect of problem based

learning and lecturing approach on student's critical thinking showed that there was a significant enhancement in the development of critical thinking who undertook problem based learning approach ( $p$ -value =0.0048).<sup>6</sup> A study<sup>7</sup> found that students studying in problem based learning system had high critical thinking skills ( $p$ -value<0.05) similarly study of showed that the type of educational approach has a significant effect on the development of critical thinking.<sup>8</sup>

Typically, traditional curriculum involves a teacher delivering a lecture from a text book, covering few or more aspects of the subject.<sup>8</sup> It is composed of specific knowledge which is selected by the respective provisional or national text book board experts. John Dewey considered traditional curriculum as a business of transmitting skills, facts and standards of moral and social conduct to next generation that adults consider to be necessary for next generation. Non-traditional curriculum or experiential learning is the process of learning through experience and is more specifically defined as "learning through reflection on doing".<sup>9</sup> This curriculum focuses on the idea that one should teach students how to think and considers individual learning process.<sup>10</sup> It helps to develop individuals who could question the facts, who don't rely only on what is being taught or told to them.<sup>9</sup>

Pakistan is practicing two types of curriculum, i.e., Cambridge and government based boards systems; both of these systems are entirely distinguished from each other.<sup>10</sup> Cambridge system is more focused on analytical methods of thinking

which is close to critical thinking however government based system is purely traditional.<sup>11</sup> Very less literature is available from Pakistan regarding critical thinking among high school/college students. Therefore, this study aimed to check level of critical thinking along with its association with type of curriculum among college students of Rawalpindi city. Our secondary objective was to run stratified analysis on the basis of type of curriculum to assess other associated factors with level of critical thinking.

## MATERIAL AND METHODS

It was quantitative cross-sectional study which was carried out in different colleges of Rawalpindi city. Colleges in this study were divided into two groups based on curriculum being followed. Group A were colleges of federal board system and Group B were colleges offering Cambridge curriculum. Study was completed within the period of six-month, i.e., May, 2018 to November 2018. Sample size comes out to be 384 calculated by using open epi; with 50% previous prevalence (unknown), margin of error of 5% and with non-response rate of 5% total sample size came out to be 400.

Educational institutes offering exclusively either Cambridge or Federal system were included. Students who have completed matriculation or O' level and were willing to participate were included in study. Students with any mental disability and not willing to participate were excluded. Multistage random sampling was done (Figure-1).

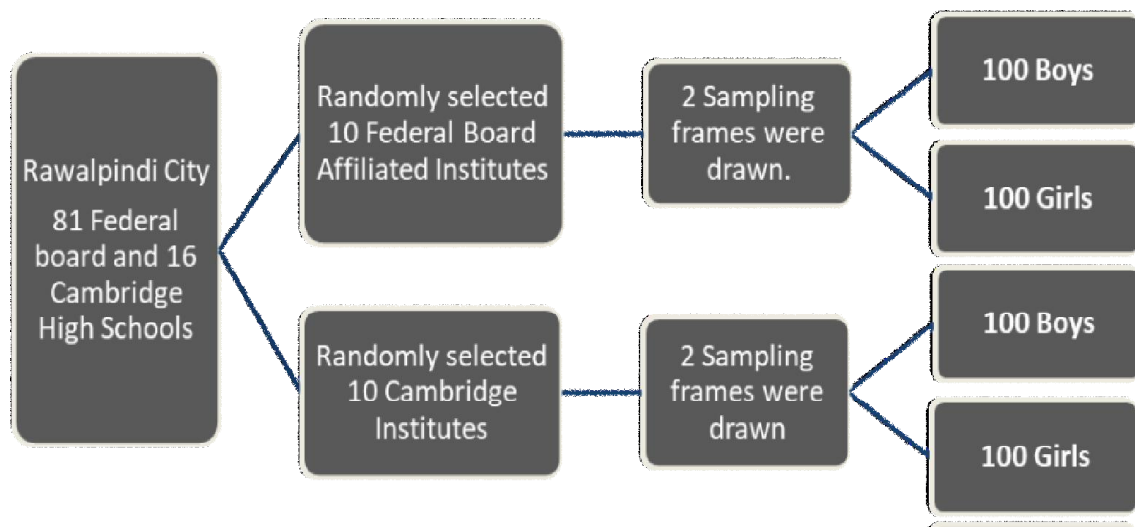


Figure-1: Sampling Strategy

A structured questionnaire was used with two sections, i.e., demographic and Cornell critical thinking. Demographic section was covered with the help of age, gender, religion, ethnicity, economic status, parental working and education status. Economic status was assessed through computing responses (No=0, Yes=1) of four questions, i.e., “Do you have own house?”, “Do you have you have car?”, “Do you have any land?” and family income (less than or equal to one lac and > one lac) and later turned to binary through median. Education status of parents were originally asked with five options that were later transformed into three options, i.e., 1=No education/primary, 2=Matric/F.Sc and 3=Higher than intermediate.

The Cornell critical thinking version X was used in the study as it is suitable till 14 years of education. Critical thinking tool was composed of 71 multiple choice questions with the options Yes, No, maybe.<sup>12</sup> Correct answer was coded as “1” and incorrect answer was coded as “0”, for every question there was only one correct answer among yes, no and may be. Cornell tool was divided into four sections; induction, credibility, deduction and assumptions. All 71 answers were added to obtain final critical thinking score of each student and later on by taking reference cut-off value of 37 binary critical thinking variables was developed, i.e., low critical thinking (0–37) and high critical thinking (>37).<sup>13</sup> Scores were also computed for sub-sections.

Pilot study on 10% of total sample was done to calculate reliability coefficient (Cronbach’s alpha) and it was 0.85, according to Ennis<sup>7</sup> reliability coefficient of this scale was between 0.60–0.90. Minor changes were done for the questionnaire with the help of experts. SPSS-22 was used to analyse the data. For continuous variables mean and standard deviation were reported. For categorical variables frequencies and percentages were reported. All the continuous variables from section one such as age and family economic status were also changed into categorical variables. For inferential statistics Chi-square test of independence was conducted to check significant association between independent variables and dependent variable.

All ethical codes of conduct were followed during this study. Approval letter for carrying out this research study was obtained from ethical board of Al-Shifa school of public health (IRB: 1/2018/ASoPH). Permission from the schools was taken prior to study. Informed consent was taken from the parents/guardians of the students who participated in this study.

## RESULTS

Description of 400 randomly selected students are shown in table 1. Mean age of respondents was  $16.9 \pm 1.13$  while seventy-four percent of respondents had age between 15–17 years. Sixty-four percent of respondents were studying in 2<sup>nd</sup> year of their college. Forty percent of respondents didn’t have educational counselling services available in their schools. Twenty percent respondents had working mothers. Fifty-five percent respondents were not the first child in the family and same proportion (55%) had high economic status. Sixty-three percent students were free to choose their future field depending on their interest in the field. Fifty-four percent respondents like to play physical sports. Thirty-nine percent respondents don’t have playground their schools.

Mean critical thinking ( $40.3 \pm 10.6$ ) had range of 7–71 on a scale from 0 to 71 and overall, 64% of randomly selected students had high critical thinking. Students of Cambridge system showed 98% high critical thinking skills where as 70% students of federal board system showed low critical thinking skills. Table-2 shows Cornell critical thinking mean scores by skills along with standard deviation. All components of Cornell critical thinking were normally distributed.

Chi-square test of independence was carried out to find out association between critical thinking and socio-demographic variables as shown in table 3. Chi-square test of independence showed a significant association between type of curriculum and critical thinking  $\chi^2(1, n=400) = 195.4, p\text{-value} = 0.0005$ ; other significant factors were economic status, living with single or both parents, first child, availability of counselling services, extracurricular activities and play ground in school.

Sixty-four percent of respondents from federal education system did not had sports week in their schools. Chi-square showed a significant association between sports week and critical thinking with  $\chi^2(1, n=200) = 3.8, p\text{-value} = 0.05$ . Chi square also found a significant association between gender and critical thinking with  $\chi^2(1, n=200) = 4.62, p\text{-value} = 0.03$  (Table-4).

Ninety-seven percent of respondents from Cambridge education system had sports week in their colleges. Chi-square showed a significant association between sports week and critical thinking with  $\chi^2(1, n=200) = 8.47, p\text{-value} = 0.004$ . Ninety-three percent of students had playground in their colleges, chi-square showed a significant association between college playground and critical thinking with  $\chi^2(1, n=200) = 5.83, p\text{-value} = 0.01$ . Other significant factors for critical thinking among students from Cambridge system are shown in table-5.

**Table-1: Demographic features of students**

| Variables                                    |                          | n (%)     |
|----------------------------------------------|--------------------------|-----------|
| Gender                                       | Male                     | 200 (50)  |
|                                              | Female                   | 200 (50)  |
| Age                                          | 15-17 years              | 295 (74)  |
|                                              | 18-20 years              | 105 (26)  |
| Class                                        | 1 <sup>st</sup> Year     | 143 (36)  |
|                                              | 2 <sup>nd</sup> Year     | 257 (64)  |
| Curriculum                                   | Federal Board            | 200 (50)  |
|                                              | Cambridge                | 200 (50)  |
| Religion                                     | Muslim                   | 390 (95)  |
|                                              | Other                    | 10 (5)    |
|                                              | Urdu                     | 193 (48)  |
| Language at home                             | Other                    | 207 (52)  |
| *Economic status                             | Low                      | 180 (45)  |
|                                              | High                     | 220 (55)  |
| Living with                                  | Single parent            | 16 (4)    |
|                                              | Both parents             | 384 (96)  |
| Family type                                  | Nuclear                  | 232 (58)  |
|                                              | Joint                    | 123 (31)  |
|                                              | Extended                 | 45 (11)   |
| First Child                                  | Yes                      | 181 (45)  |
|                                              | No                       | 219 (55)  |
| Take Tuition                                 | Yes                      | 79 (20)   |
|                                              | No                       | 321 (80)  |
| Father working status                        | Yes                      | 387 (97)  |
|                                              | No                       | 13 (3)    |
| Mother working status                        | Yes                      | 80 (20)   |
|                                              | No                       | 320 (80)  |
| Father education                             | No/Primary education     | 23 (8)    |
|                                              | Matric/Fsc/O, A-levels   | 104 (38)  |
|                                              | Higher than intermediate | 150 (54)  |
| Mother education                             | No/Primary education     | 60 (22)   |
|                                              | Matric/Fsc/O,A-levels    | 85 (31)   |
|                                              | Higher than intermediate | 132 (48)  |
| Counselling services available in school     | Yes                      | 238 (60)  |
|                                              | No                       | 162 (40)  |
| Future field choice                          | Interest in field        | 254 (63)  |
|                                              | Dream of parents         | 146 (37)  |
| Participation in Extra-Curricular Activities | Yes                      | 270 (67)  |
|                                              | No                       | 130 (33)  |
| Favourite Play                               | Computer games           | 182 (46)  |
|                                              | Physical sports          | 218 (54)  |
| Sports Week conducted in school              | Yes                      | 264 (66)  |
|                                              | No                       | 136 (34)  |
| Do you have play ground in school?           | Yes                      | 246 (61)  |
|                                              | No                       | 154 (39%) |

\*Normally distributed (median=3 as cut off)

**Table-2: Comparison of critical thinking between federal and Cambridge students**

| Sections    | (S.D)       |                          | Mean                 | *p-value |
|-------------|-------------|--------------------------|----------------------|----------|
|             | Overall     | Federal board institutes | Cambridge institutes |          |
| Induction   | 14.9 (4.4)  | 12.6 (4.6)               | 17.1 (2.7)           | 0.0001   |
| Credibility | 14 (4.5)    | 11 (3.9)                 | 17 (2.8)             | 0.0001   |
| Deduction   | 7.8 (2.6)   | 6.2 (2.1)                | 9.5 (1.7)            | 0.034    |
| Assumptions | 3.4 (1.5)   | 2.7 (1.4)                | 4.1 (1.1)            | 0.004    |
| Total CT    | 40.2 (10.6) | 32.6 (8.7)               | 47.9 (5.7)           | 0.0032   |

\*Independent samples t-test

**Table-3: Factors associated with critical thinking**

| Variables                                      |                        | Critical thinking |           | Chi-Square (d.f) | p-value |
|------------------------------------------------|------------------------|-------------------|-----------|------------------|---------|
|                                                |                        | Low               | High      |                  |         |
| Gender                                         | Male                   | 79 (40%)          | 121 (60%) | 2.13 (1)         | 0.14    |
|                                                | Female                 | 64 (32%)          | 136 (68%) |                  |         |
| Age                                            | 15-17 years            | 113 (38%)         | 182 (62%) | 3.1 (1)          | 0.07    |
|                                                | 18-20 years            | 30 (29%)          | 75 (71%)  |                  |         |
| Class                                          | 1 <sup>st</sup> Year   | 51 (36%)          | 92 (64%)  | 0.001 (1)        | 1.00    |
|                                                | 2 <sup>nd</sup> Year   | 92 (36%)          | 165 (64%) |                  |         |
| Curriculum                                     | Federal Board          | 139 (70%)         | 61 (30%)  | 195.4 (1)        | 0.0005* |
|                                                | Cambridge              | 4 (2%)            | 196 (98%) |                  |         |
| Ethnicity                                      | Urdu                   | 76 (39%)          | 117 (61%) | 1.84 (1)         | 0.17    |
|                                                | Other                  | 67 (32%)          | 140 (68%) |                  |         |
| Economic Status                                | Low                    | 101 (71%)         | 135 (52%) | 11.7 (1)         | 0.001*  |
|                                                | High                   | 42 (29%)          | 122 (48%) |                  |         |
| Living with                                    | Single parent          | 10 (62%)          | 6 (38%)   | 4.0 (1)          | 0.04*   |
|                                                | Both parents           | 133 (35%)         | 251 (65%) |                  |         |
| Family type                                    | Nuclear                | 80 (34%)          | 152 (66%) | 0.96 (2)         | 0.61    |
|                                                | Joint                  | 44 (36%)          | 79 (64%)  |                  |         |
|                                                | Extended               | 19 (42%)          | 26 (58%)  |                  |         |
| First Child                                    | Yes                    | 48 (26%)          | 133 (74%) | 11.5 (1)         | 0.001*  |
|                                                | No                     | 95 (43%)          | 124 (57%) |                  |         |
| Take Tuition                                   | Yes                    | 35 (44%)          | 44 (56%)  | 2.68(1)          | 0.101   |
|                                                | No                     | 108 (34%)         | 213 (66%) |                  |         |
| Father working Status                          | Yes                    | 137 (35%)         | 250 (65%) | 0.25 (1)         | 0.61    |
|                                                | No                     | 6 (46%)           | 7 (54%)   |                  |         |
| Mother working Status                          | Yes                    | 27 (34%)          | 53 (66%)  | 0.08 (1)         | 0.77    |
|                                                | No                     | 116 (36%)         | 204 (64%) |                  |         |
| Father education Status                        | No/Primary education   | 8 (35%)           | 15 (65%)  | .21 (2)          | 0.89    |
|                                                | Matric/Fsc/O, A-levels | 36 (35%)          | 68 (65%)  |                  |         |
|                                                | Higher education level | 48 (32%)          | 102 (68%) |                  |         |
| Mother education Status                        | No/Primary education   | 25 (42%)          | 35 (58%)  | 3.1 (2)          | 0.20    |
|                                                | Matric/Fsc/O, A-levels | 29 (34%)          | 56 (66%)  |                  |         |
|                                                | Higher education level | 38 (29%)          | 94 (71%)  |                  |         |
| Availability of Counselling services in school | Yes                    | 59 (25%)          | 179 (75%) | 29.5 (1)         | 0.0005* |
|                                                | No                     | 84 (52%)          | 78 (42%)  |                  |         |
| Future field choice                            | Interest in field      | 89 (35%)          | 165 (65%) | 0.08 (1)         | 0.77    |
|                                                | Dream of parents       | 54 (37%)          | 92 (63%)  |                  |         |
| Participation in Extra-Curricular Activities   | Yes                    | 80 (30%)          | 190 (70%) | 12.74 (1)        | 0.0005* |
|                                                | No                     | 63 (48%)          | 67 (52%)  |                  |         |
| Favourite Play                                 | Computer games         | 66 (36%)          | 116 (64%) | 0.008 (1)        | 0.92    |
|                                                | Physical sports        | 77 (35%)          | 141 (65%) |                  |         |
| Sports Week Conducted in school                | Yes                    | 57 (22%)          | 207 (78%) | 65.9 (1)         | 0.0005* |
|                                                | No                     | 86 (63%)          | 50 (37%)  |                  |         |
| School Play Ground                             | Yes                    | 48 (20%)          | 198 (80%) | 71.5 (1)         | 0.0005* |
|                                                | No                     | 95 (62%)          | 59 (38%)  |                  |         |

Analysis with stratified data on basis of curriculum:

**Table-3 Critical thinking for Federal students**

| Variables |                                                | Critical thinking      |           | Chi-Square (d.f) | p-value  |        |
|-----------|------------------------------------------------|------------------------|-----------|------------------|----------|--------|
|           |                                                | Low                    | High      |                  |          |        |
| 1         | Gender                                         | Male                   | 77 (77%)  | 23 (23%)         | 4.62 (1) | 0.03*  |
|           |                                                | Female                 | 62 (62%)  | 38 (38%)         |          |        |
| 2         | Age                                            | 15–17 years            | 109 (69%) | 50 (31%)         | 1.14 (1) | 0.70   |
|           |                                                | 18–20 years            | 30 (73%)  | 11 (27%)         |          |        |
| 3         | Class                                          | 1 <sup>st</sup> Year   | 48 (73%)  | 18 (27%)         | 0.28 (1) | 0.59   |
|           |                                                | 2 <sup>nd</sup> Year   | 91 (68%)  | 43 (32%)         |          |        |
| 5         | Ethnicity                                      | Urdu                   | 73 (72%)  | 29 (28%)         | 0.24 (1) | 0.62   |
|           |                                                | Other                  | 66 (67%)  | 32 (33%)         |          |        |
| 6         | Economic Status                                | Low                    | 80 (70%)  | 35 (30%)         | 0.00 (1) | 1.00   |
|           |                                                | High                   | 59 (69%)  | 26 (31%)         |          |        |
| 7         | Living with                                    | Single parent          | 9 (90%)   | 1 (10%)          | 1.19 (1) | 0.27   |
|           |                                                | Both parents           | 130 (68%) | 60 (32%)         |          |        |
| 8         | Family type                                    | Nuclear                | 78 (69%)  | 35 (31%)         | 5.35 (2) | 0.69   |
|           |                                                | Joint                  | 42 (79%)  | 11 (21%)         |          |        |
|           |                                                | Extended               | 19 (56%)  | 15 (44%)         |          |        |
| 9         | First Child                                    | Yes                    | 46 (69%)  | 21 (31%)         | 0.34 (1) | 0.98   |
|           |                                                | No                     | 93 (70%)  | 40 (30%)         |          |        |
| 10        | Take Tuition                                   | Yes                    | 33 (77%)  | 09 (21%)         | 1.55 (1) | 0.21   |
|           |                                                | No                     | 106 (67%) | 52 (33%)         |          |        |
| 11        | Father working Status                          | Yes                    | 134 (69%) | 61 (31%)         | 1.01 (1) | 0.31   |
|           |                                                | No                     | 5 (100%)  | 0                |          |        |
| 12        | Mother working Status                          | Yes                    | 25 (62%)  | 15 (38%)         | 0.78 (1) | 0.37   |
|           |                                                | No                     | 114 (71%) | 46 (29%)         |          |        |
| 13        | Father education Status                        | No/Primary education   | 07 (50%)  | 07 (50%)         | 1.41 (2) | 0.49   |
|           |                                                | Matric/Fsc/O,A-levels  | 35 (67%)  | 17 (33%)         |          |        |
|           |                                                | Higher education level | 6 (65%)   | 25 (35%)         |          |        |
| 14        | Mother education Status                        | No/Primary education   | 24 (69%)  | 11 (31%)         | 0.41 (2) | 0.81   |
|           |                                                | Matric/Fsc/O,A-levels  | 28 (64%)  | 16 (36%)         |          |        |
|           |                                                | Higher education level | 36 (62%)  | 22 (38%)         |          |        |
| 15        | Availability of Counselling services in school | Yes                    | 57 (72%)  | 22 (28%)         | 0.25 (1) | 0.61   |
|           |                                                | No                     | 82 (68%)  | 39 (32%)         |          |        |
| 16        | Future field choice                            | Interest in field      | 86 (67%)  | 42 (33%)         | 0.62 (1) | 0.43   |
|           |                                                | Dream of parents       | 53 (74%)  | 19 (26%)         |          |        |
| 17        | Participation in Extra-Curricular Activities   | Yes                    | 77 (71%)  | 32 (29%)         | 0.05 (1) | 0.81   |
|           |                                                | No                     | 62 (68%)  | 29 (32%)         |          |        |
| 18        | Favourite Play                                 | Computer games         | 63 (77%)  | 19 (23%)         | 2.96 (1) | 0.08   |
|           |                                                | Physical sports        | 76 (64%)  | 42 (36%)         |          |        |
| 19        | Sports Week Conducted in school                | Yes                    | 54 (78%)  | 15 (22%)         | 3.81 (1) | 0.049* |
|           |                                                | No                     | 85 (65%)  | 46 (35%)         |          |        |
| 20        | School Play Ground                             | Yes                    | 46 (77%)  | 14 (23%)         | 1.62 (1) | 0.20   |
|           |                                                | No                     | 93 (66%)  | 47 (34%)         |          |        |

**Table-4: Critical thinking for Cambridge students**

| Variables |                                                |                        | Critical thinking |           | Chi-Square (d.f) | p-value |
|-----------|------------------------------------------------|------------------------|-------------------|-----------|------------------|---------|
|           |                                                |                        | Low               | High      |                  |         |
| 1         | Gender                                         | Male                   | 02 (02%)          | 98 (98%)  | 0.00(1)          | 1.00    |
|           |                                                | Female                 | 02 (02%)          | 98 (98%)  |                  |         |
| 2         | Age                                            | 15-17 years            | 04 (03%)          | 132 (97%) | 0.71(1)          | 0.39    |
|           |                                                | 18-20 years            | 0                 | 64 (100%) |                  |         |
| 3         | Class                                          | 1 <sup>st</sup> Year   | 03 (04%)          | 74 (96%)  | 0.99(1)          | 0.31    |
|           |                                                | 2 <sup>nd</sup> Year   | 1 (01%)           | 122 (99%) |                  |         |
| 5         | Ethnicity                                      | Urdu                   | 03 (03%)          | 88 (97%)  | 0.47(1)          | 0.49    |
|           |                                                | Other                  | 01 (01%)          | 108 (99%) |                  |         |
| 6         | Economic Status                                | Low                    | 02 (03%)          | 63 (97%)  | 0.36(1)          | 0.54    |
|           |                                                | High                   | 02 (01%)          | 133 (99%) |                  |         |
| 7         | Living with                                    | Single parent          | 01 (17%)          | 05 (83%)  | 6.78(1)          | 0.009*  |
|           |                                                | Both parents           | 03 (02%)          | 191 (98%) |                  |         |
| 8         | Family type                                    | Nuclear                | 02 (02%)          | 117 (98%) | 0.54(2)          | 0.76    |
|           |                                                | Joint                  | 02 (03%)          | 68 (97%)  |                  |         |
|           |                                                | Extended               | 0                 | 11 (100%) |                  |         |
| 9         | First Child                                    | Yes                    | 02 (02%)          | 112 (98%) | 0.00(1)          | 1.00    |
|           |                                                | No                     | 02 (02%)          | 84 (98%)  |                  |         |
| 10        | Take Tuition                                   | Yes                    | 02 (05%)          | 35 (95%)  | 0.97(1)          | 0.32    |
|           |                                                | No                     | 02 (01%)          | 161 (99%) |                  |         |
| 11        | Father working Status                          | Yes                    | 03 (02%)          | 189 (98%) | 4.68(1)          | 0.03*   |
|           |                                                | No                     | 01 (13%)          | 07 (87%)  |                  |         |
| 12        | Mother working Status                          | Yes                    | 02 (05%)          | 38 (95%)  | 0.78(1)          | 0.37    |
|           |                                                | No                     | 02 (01%)          | 158 (99%) |                  |         |
| 13        | Father education Status                        | No/Primary education   | 01 (11%)          | 08 (89%)  | 2.40(2)          | 0.30    |
|           |                                                | Matric/Fsc/O.A-levels  | 01 (02%)          | 51 (98%)  |                  |         |
|           |                                                | Higher education level | 02 (03%)          | 77 (97%)  |                  |         |
| 14        | Mother education Status                        | No/Primary education   | 01 (04%)          | 24 (96%)  | 0.15(2)          | 0.92    |
|           |                                                | Matric/Fsc/O.A-levels  | 01 (02%)          | 40 (98%)  |                  |         |
|           |                                                | Higher education level | 02 (03%)          | 72 (97%)  |                  |         |
| 15        | Availability of Counselling services in school | Yes                    | 02 (01%)          | 157 (99%) | 0.72(1)          | 0.39    |
|           |                                                | No                     | 02 (05%)          | 39 (95%)  |                  |         |
| 16        | Future field choice                            | Interest in field      | 03 (02%)          | 123 (98%) | 0.25(1)          | 0.61    |
|           |                                                | Dream of parents       | 01 (01%)          | 73 (99%)  |                  |         |
| 17        | Participation in Extra-Curricular Activities   | Yes                    | 03 (02%)          | 158 (98%) | 0.07(1)          | 0.77    |
|           |                                                | No                     | 01 (03%)          | 38 (97%)  |                  |         |
| 18        | Favourite Play                                 | Computer games         | 03 (03%)          | 97 (97%)  | 0.25(1)          | 0.61    |
|           |                                                | Physical sports        | 01 (01%)          | 99 (99%)  |                  |         |
| 19        | Sports Week Conducted in school                | Yes                    | 03 (02%)          | 192 (98%) | 8.47(1)          | 0.004*  |
|           |                                                | No                     | 01 (20%)          | 4 (80%)   |                  |         |
| 20        | School Play Ground                             | Yes                    | 02 (01%)          | 184 (99%) | 5.83(1)          | 0.01*   |
|           |                                                | No                     | 02 (14%)          | 12 (86%)  |                  |         |

**DISCUSSION**

Our study overall showed a medium level (total score) for critical thinking among students however students from Cambridge had higher total critical thinking score and also higher scores for all sub-sections; this was consistent with previous research.<sup>14</sup> For both education systems there were different associated factors but availability of playground and sports week were found to be significant at all levels. Previous researches<sup>14,15</sup> also found that students who took part in extra-curricular activities especially tend to be better at critical thinking. Another study<sup>16</sup> highlighted that school environment as an important confounder for developing critical thinking skills ( $p$ -value < 0.05). Analysis of this study showed that there was not any significant association between gender and critical thinking without stratification ( $p$ -value >0.05) which is similar to the findings of another study.<sup>17</sup> Nevertheless we also have literature that showed not any significant association between gender and critical thinking ( $p$ -

value >0.05)<sup>18</sup>, and<sup>14</sup>, our stratified analysis showed females with higher critical thinking as compared to males in federal system because even if education system doesn't force to study girls tend to be more responsible. These irregular findings emphasized presence of some mediator or moderator controlling the association.

Students from low economic status had low critical thinking and a significant association was found between economic status of family and critical thinking skills among students as ( $p$ -value <0.05) and this has been shown by previous study as well.<sup>19</sup> The possible reason for this association is the availability better education opportunities for students with high economic status. Researchers showed that sibling order does have a significant association with the development of critical thinking ( $p$ -value <0.05) because they are brought up to be more responsible in almost all cultures. Our findings are also consistent with this aspect. Results of this study revealed no

significant association between parent's occupation and parent's education with level of critical thinking ( $p$ -value  $>0.05$ ). Results from another study also showed similar findings.<sup>19</sup> However, student living with single or both parents had significant association with critical thinking ( $p$ -value $<0.05$ ) and this was supported by<sup>20</sup> that elaborated difference in rearing styles of father and mother with level of critical thinking of their child.

The study had few limitations that needed to be consider like the Cornell tool is quite long and complex to fill which made many respondents uneasy; this might have resulted in careless responses. The tool was already very lengthy so researcher didn't use IQ examination which can be an important factor for critical thinking. Subject wise stratification of respondents was not made which can be an important factor for critical thinking along with curriculum. However, study had multiple strengths like this study brought a newer aspect as no such studies were conducted on high school students for the assessment of critical thinking in Pakistan to the best of researcher's knowledge. The study used equal number of students for both education systems (Federal & Cambridge) and also equal representation was given to boys and girls. The analysis was covered by stratification on the basis of curriculum which added to its strength.

## CONCLUSION

Results of this study showed difference in critical thinking skills of students studying in different curricula. Apart from curriculum, various other contributing factors such as playgrounds in schools, extra-curricular activities, counselling services in the school should were also significantly associated with critical thinking of students. Hence these should be monitored by the educational regulatory authorities and is a need to discourage small schools running in residential areas. Moreover, curriculum should be designed in a homogenous way for all students that can enhance critical thinking among them through synergizing theoretical and practical approaches hence we need to address these inequities of our education system in order to achieve SDG four in true spirit.

## AUTHORS' CONTRIBUTION

AE: Literature search, conceptualization, data collection, write-up. HS: Designing data collection tool, data analysis, interpretation and proof reading.

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