Students' Critical Thinking Skills Based on Gender And Knowledge Group

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ABSTRACT

The study aimed to measure the validity of critical thinking instruments and determined the differences in critical thinking skills in terms of gender and knowledge group. The study was used survey method. Critical thinking instruments were developed based on the Facoine (2015)'s indicators of critical thinking. Data were obtained from 285 respondents (N = 285) of first-year students who took Indonesian language courses. Respondents consisted of 78 male and 207 female students. The 25 questions in critical thinking instruments were claimed valid and homogeneous with r count of 0.266. Data were analyzed using non-parametric statistics of Mann-Withney test in SPSS version 21 application for Windows. There was no significant difference in students' critical thinking skills in gender differences and knowledge groups. Result of the study showed that 22 sub-indicators of students' critical thinking was found similarity in gender and 20 sub-indicators also found similarity in knowledge group. The study supported the new paradigm that students regardless of gender differences and science clusters needed critical thinking skills. Based on learning context in various science groups, there was no need to differentiate gender even though there were differences in the number of a certain gender in one class.

Keywords: Critical thinking, gender, humanity students, science students.

INTRODUCTION

Higher education is a place for students to improve their critical thinking skills. Thinking activities can be trained through oral and written on language skills (Marni et al., 2019; Sumarmi et al., 2020). Both language and media make important contributions to

students in improving their critical thinking skills. It is a way to prepare students to be able to compete globally in facing the 21st century challenges (ŽivkoviŁ, 2016). To prepare generations for future challenges, special skills such as critical thinking skills needed to be taught (Rahdar et al., 2018). Critical thinking is an effective pedagogy in creating learning that involves students in class dialogue and enhancing their thinking (Dehghayedi & Bagheri, 2018; Dewi et al., 2019).

In higher education, knowing critical thinking skills at the beginning of the academic year is very helpful for students and lecturers to process the learning well (Demiral & Çepni, 2018; Kaya et al., 2018). For students, the way they are able to interpret, analyze, infer, and evaluate problems around them will teach students to reach the maturity of thinking. It will help students to be successful in the academic area in each given class. The critical thinking ability is able to help students reasoning to solve problems (Jatmiko et al., 2018). At universities, students must pass the classes with good grades and be able to solve all academic and personal problems (Andheska et al., 2020). Therefore, students need to develop their critical thinking skills in facing various academic difficulties (Marni et al., 2019; Serin, 2013a).

Indonesian Language is subject that must be taken by students in each faculty for personality development class. The class is given in the first semester of the academic year. The class aimed to train students to be skillful in scientific writing or academic writing. Before they are skillful at writing, their critical thinking skills must be known in advance (Demiral & Çepni, 2018; Sinaga & Feranie, 2017). The class will be beneficial for students to know their critical thinking abilities. It cannot be denied that language activities are a representation of thinking activities. Language skills such as reading and writing are closely related to critical thinking activities (Ataç, 2015; Dewi et al., 2019). It is also in line with research which states that there is a very close relationship between quality writing and critical thinking skills (Andheska et al., 2020; Hunanda Kuswandari, 2018; Sinaga & Feranie, 2017). Before knowing how students can put their critical thinking skills into oral and written language, they certainly need to know about their critical thinking abilities (Abdurrahman et al., 2019). In preparing the learning process, it is necessary to test the ability of critical thinking (Fuad et al., 2017). It can showed the extent of students' self-readiness and maturity in dealing with problems emotionally and intelligently.

The study of thinking skills examined by gender has been carried out by several researchers, including research on the influence of gender orientation on critical behavior and thinking of nursing students in Taiwan (Liu et al., 2019). The finding showed that masculinity and caring behavior contribute more to the critical thinking skills of nursing students. In Greece, gender studies were also carried out in improving students' computational thinking skills through robotic education (Atmatzidou & Demetriadis, 2016). The finding showed that differences in abilities based on gender are only found in specific skills. Female students need a lot of time and a lot of practice to achieve the same level of skill as male students. Meanwhile, other studies examine the relationship between gender and brain thinking styles with students' creative thinking abilities in Malaysia (Piaw, 2014). The results showed that there was a significant relationship between the three variables. The study on the education area has become a major issue in several countries, such as in China. Researchers at the University of Catolica Cheele reviewed the assessment of argumentation and critical thinking in higher education by looking at educational correlations and gender differences. The result showed that gender differences do not affect the ability to write and think (Preiss et al., 2013). Previously in Malaysia, it had also been studied about the influence of gender on the ability to think critically by concluding that there was no significant difference between critical thinking skills between man and woman so that the instruments tested to measure critical thinking skills did not contain gender bias (Verawati et al., 2010). According to some of these

studies, it appears that the study of gender needs more consideration in the education area. Thus, activities need to be assessed by gender. Therefore, it easier for students to understand and improve their thinking skills. It also means that seeing critical thinking skills based on gender helps teachers to provide learning strategies well.

Furthermore, it is necessary to know students' critical thinking skills based on the knowledge group. For higher education in Indonesia, students are differentiated into two knowledge groups, science-based and humanity-based. Each group has a different characteristic. Therefore, the differences have different consequences. Since the Indonesian Language classes are taught by all faculties, so that the study can help the teachers to find out student's critical thinking based on their knowledge group. Based on the research, (Billington et al., 2007) stated that the systematic ability of science students is higher than humanity students are and ultimately becomes a stereotype in society. Further research is needed to determine differences in abilities, especially the critical thinking skills of science students and humanity students.

Therefore, the study examined in depth: 1) the instrument's validity and reliability of the student's critical thinking on the first year, 2) critical thinking skills level between male and female students viewed from indicators of interpretation, analysis, evaluation and inference, 3) critical thinking skills level of science and humanity students reviewed from indicators of interpretation, analysis, evaluation, and inference. The difference with previous research is on the main variables, that is examining differences in interpretation abilities, analytical abilities, evaluation abilities, and inference abilities (Facione, 2015) towards gender and knowledge group.

METHODS

The study used the survey method as a quantitative approach that aimed to determine the difference of critical thinking skills on first-year students in Indonesian Language class based on gender and knowledge group. The questionnaire was distributed to first-year students of Brawijaya University, Indonesia who took Indonesian Language class in several faculties.

a) Sample

The population in the study was the first-year students of Brawijaya University who took the Indonesian Language class. The sample was 285 students, consisted of 78 males (27.4%) and 207 females (72.6%). The data collected from questionnaires that distributed to students throughout social media application, WhatsApp, to the group of the Indonesian Language class from various faculties both on science and humanity classes. The distribution showed in table 1.

Table 1. *Demographic of Research Samples*

Variable		F	%
Age	17-19	200	70.17
	20-22	76	26.67
	23-25	9	3.16
Gender	Male	78	27.4
	Female	207	72.6
Knowledge Group	Humanity Students	154	54.04
	Science Students	131	45.96

b) Instrument and Procedure

The study used a questionnaire to measure students' critical thinking ability. The questionnaire consisted of 25 statements, divided into 4 indicators, which are interpretation, analysis, evaluation, and inference (Facione, 2015). Those indicators expanded into sub-indicators contained of 8 sub-indicators for interpretation, 5 sub-indicators for analysis, 5 sub-indicators for evaluation, and 7 sub-indicators for inference. The questionnaire used a Likert scale with the value range of 1 to 4. The value of each indicator then summed and average into 3 categories: 1.0 – 2.0 (low category), 2.1 – 3.0 (medium category), 3.1 – 4.0 (high category). The questionnaire transferred to the Google Form which is an application that helped data to turn into digital form. The questionnaire had tested its validity and reliability using application SPSS version 21 for windows.

c) Data Analysis

The study tested for the validity and reliability of the instrument with the 54 students besides the main subject of the research. Then the primary data was collected from the main subject of 285 students to test each indicator of the instrument. The subject then grouped based on gender and knowledge group. Furthermore, the primary data obtained were tested for normality using the Kolmogorov-Smirnov and Shapiro-Wilk tests. However, the result showed that the sig value was ($p < .05$), so the data analysis was continued using the non-parametric statistical test using the Mann-Whitney test processed on the SPSS application for Windows version 21.

FINDINGS

a) Instrument Validity and Reliability

A good instrument is an instrument that is able to collect valid information from respondents. The research instrument was tested with 54 students of Brawijaya University to find out the validity and reliability of the questionnaire. The following are the results of validity and reliability tests.

Table 2. *Test Results for Questionnaire Instrument Validity of Critical Thinking Ability*

Indicator	Question	P (2- tails)	r
Interpretation	I can determine the cause of the problem that I'm facing (Q1)	0.000	0.482
	I can mention statement including facts (reality) or opinions (Q15)	0.000	0.563
	I can determine whether an opinion said by someone is true or not (Q17)	0.002	0.410
	I respect the opinions of others despite differing opinions (Q18)	0.018	0.320
	I speak with easy-to-understand sentences (Q21)	0.000	0.525
	I convey information clearly (Q22)	0.000	0.507
	I understand the information that other people give (Q23)	0.001	0.455
	I dare to express my opinion in front of the class (Q24)	0.000	0.597
Analysis	I associate one thing with another to solve a difficulty (Q2)	0.012	0.339
	I can sort out what problems that I am facing (Q6)	0.000	0.572
	I am able to estimate the consequences that will occur if I am in trouble (Q7)	0.001	0.423
	I can distinguish between facts (reality) and opinions (Q10)	0.000	0.607
	I will check the truth, when I doubt someone else's answer (Q20)	0.000	0.550

	I made a backup answer to a question (Q3)	0.000	0.511
	I can choose correctly when I am faced with several choices (Q8)	0.000	0.557
Evaluation	I discuss difficulties with others to get the right answer (Q9)	0.003	0.393
	I summarize a number of issues into one of the most important issues (Q11)	0.001	0.446
	I want to listen to criticisms and suggestions from others (Q25)	0.002	0.416
	I feel that every difficulty must have a solution (Q4)	0.006	0.368
	I can provide evidence when arguing (Q5)	0.000	0.551
	I solve the problem one by one, not simultaneously (Q12)	0.003	0.401
Inference	I can tell some answers that are appropriate for a question (Q13)	0.000	0.486
	I am not ashamed to ask other people if I am having trouble (Q14)	0.000	0.606
	I look for the truth, when there is uncertain news (Q16)	0.000	0.503
	In my opinion, every answer must have a basis (Q19)	0.000	0.515

Based on table 2. Pearson correlation test results from 25 questions indicated the value of r count > r table withr table = 0.266and N = 54. These results proved that the instrument is valid to be used in collecting data on students' critical thinking abilities. After testing the validity of the instrument, the instrument reliability test was conducted to see the consistency of the questions. It can be seen in table 3.

Tabel 3. *Instrument Reliability Test Results from Critical Thinking Ability*

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.862	.864	25

The reliability test results in table 3 showed that the Cronbach's alpha value of the research was exceeded r table (r count > .266). It proved that the instrument can be used to obtain primary data on students' critical thinking abilities.

b) Primary Data Result

The study was conducted to examine the differences in students' critical thinking skills based on gender and knowledge groups in indicators of interpretation, analysis, evaluation, and inference. The following graph presents the average value of students' critical thinking skills based on the gender and knowledge group in the four indicators.
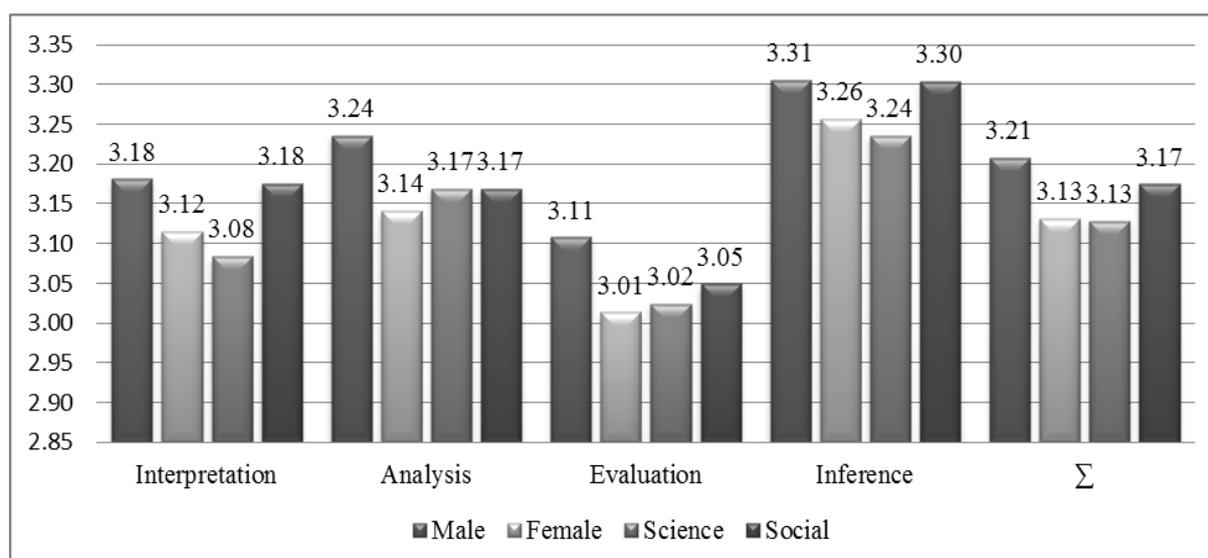
Figure 1. Critical Thinking Value Based on Gender and Knowledge Group

Based on figure 1 it can be explained that the average value of students' critical thinking skills is high because the average student's critical thinking ability was 3.21 for male students and 3.13 for female students. Although it was concluded as high category, it was clearly seen that there were differences in the average values between bothmale and female students. In general, it could be interpreted that male students had higher critical thinking skills than female students. The highest value shows it was obtained by male students with a value of 3.31 on the inference indicator, while female students obtained the lowest value with a value of 3.01 on the evaluation indicator. The result is reinforced by previous research, which stated that males are superior to inference analysis abilities compared to females (Preiss et al., 2013).

Figure 1 also explained the critical thinking skills of students based on knowledge group was at a high level because the average value of science group student was 3.13 and humanity group students was 3.17. In general, students in the humanity group had a higher ability than students in the science group on the inference indicator have. The highest value was obtained by humanity students a value of 3.30 on the inference indicator, while the lowest value was obtained by science students with a value of 3.02 on the evaluation indicator. The results of the study were different from the results of the study presented by Billington et al (2007) which stated that the systematic ability of science students is higher than humanity students have. To strengthen the position of the study compared to other research results, the details can be seen in the following explanation of indicators.

c) Students' Critical Thinking Skills in Indicator of Interpretation

Interpretation is the ability to understand, explain the meaning of data or information (Facione, 2015). The ability is a standard of whether someone is able or not to understand data, information, or problems. In detail, the results of research that explained the differences in critical thinking skills based on indicators of interpretation can be seen in table 4.

Table 4. *Results of the Mann-Whitney Test Indicator Interpretation*

Variable		Q1	Q15	Q17	Q18	Q21	Q22	Q23	Q24
Gender[a]	U	7012.5	7580.0	7573.5	8045.0	8014.0	7788.5	7173.0	7239.5
	W	28540.5	29108.0	29101.5	11126.0	11095.0	10869.5	28701.0	28767.5
	Z	-2.117	-.942	-.900	-.053	-.107	-.541	-1.781	-1.441
	p	.034	.346	.368	.958	.915	.588	.075	.150

Knowledge	U	10005.5	9934.0	9200.0	9471.0	8217.0	7887.0	9318.5	8633.5
Group[b]	W	18651.5	21869.0	21135.0	18117.0	16863.0	16533.0	17964.5	17279.5
	Z	-.146	-.262	-1.430	-1.044	-3.021	-3.736	-1.365	-2.250
	P	.884	.794	.153	.296	.003	.000	.172	.024

a. Grouping Variable: Gender, b. Grouping Variable: Knowledge Group

Based on table 4, the results of the Mann-Whitney test stated that there was no difference in the thinking ability of student interpretations based on their gender in general. It is showed by the value of Asymp-Sig > 0.05. There was only one sub-indicator of the eight sub-indicator interpretations that stated differences in interpretation ability Asymp-Sig value (p < .05) which is determining the cause of the problem (Q1). Different results were shown in the sub-indicators interpreting of clear sentences (Q21) and the sub-indicators of dare to express opinions (Q24) with Asymp-Sig (p < .05). It proved that there were differences in the ability of interpretation between students of the science and humanity group. The Mann-Whitney test also proved that the sub-indicators (Q1, Q15, Q17, Q18, Q22, and Q23) explain that there was no difference in interpretation ability between students of science and humanity. The details can be seen in Figure 2.
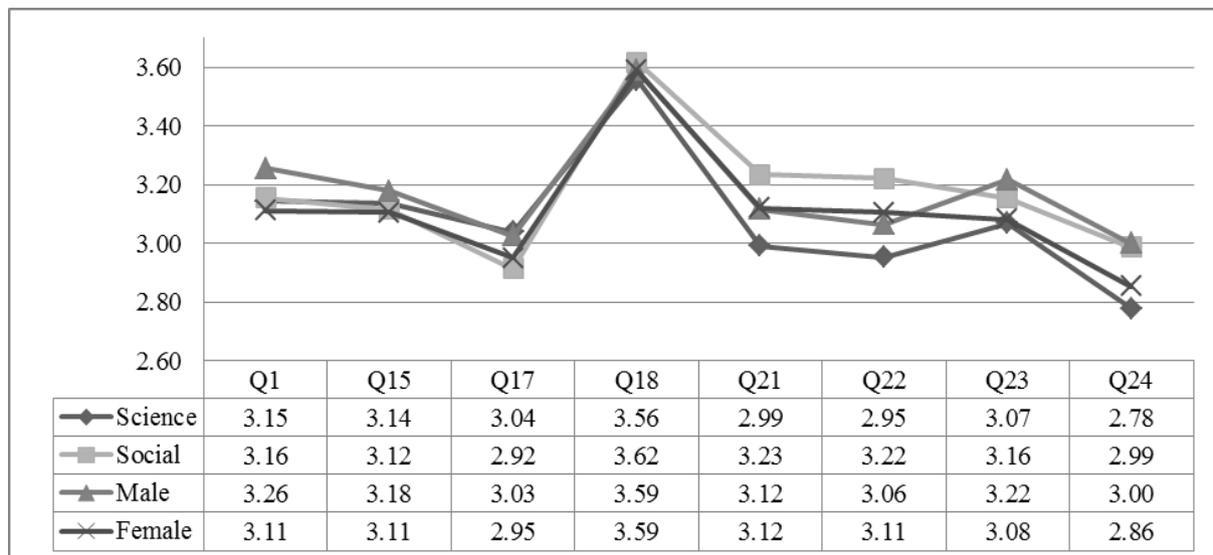
	Q1	Q15	Q17	Q18	Q21	Q22	Q23	Q24
Science	3.15	3.14	3.04	3.56	2.99	2.95	3.07	2.78
Social	3.16	3.12	2.92	3.62	3.23	3.22	3.16	2.99
Male	3.26	3.18	3.03	3.59	3.12	3.06	3.22	3.00
Female	3.11	3.11	2.95	3.59	3.12	3.11	3.08	2.86

Figure 2. Critical Thinking Value Based on Indicators of Interpretation

The results of the research presented in figure 2 explained that male and female students got the same and higher average value that other sub-indicators with a value of 3.59 in the interpretation ability which is respecting differences of opinion (Q18). The figure showed that female students had the lowest value on the sub-indicator of illustrating the problem in the critical thinking abilities of (Q24) with a value of 2.86. Then the humanity students obtained the highest value on sub-indicators of respecting dissent (Q18) with a value of 3.62 and the lowest value in the sub-indicator determines the correctness of opinion (Q17) with a value of 2.92. Meanwhile, the science students obtained the highest value on the sub-indicator of respects dissent (Q18) with a value of 3.56 and the lowest value in the sub-indicator of dare to express an opinion (Q24) with a value of 2.78.

d) Students' Critical Thinking Skills in Indicator of Analysis

Analysis is an ability to be able to identify or describe the relationship between information or data obtained to be an appropriate structure so that thoughts or opinions are
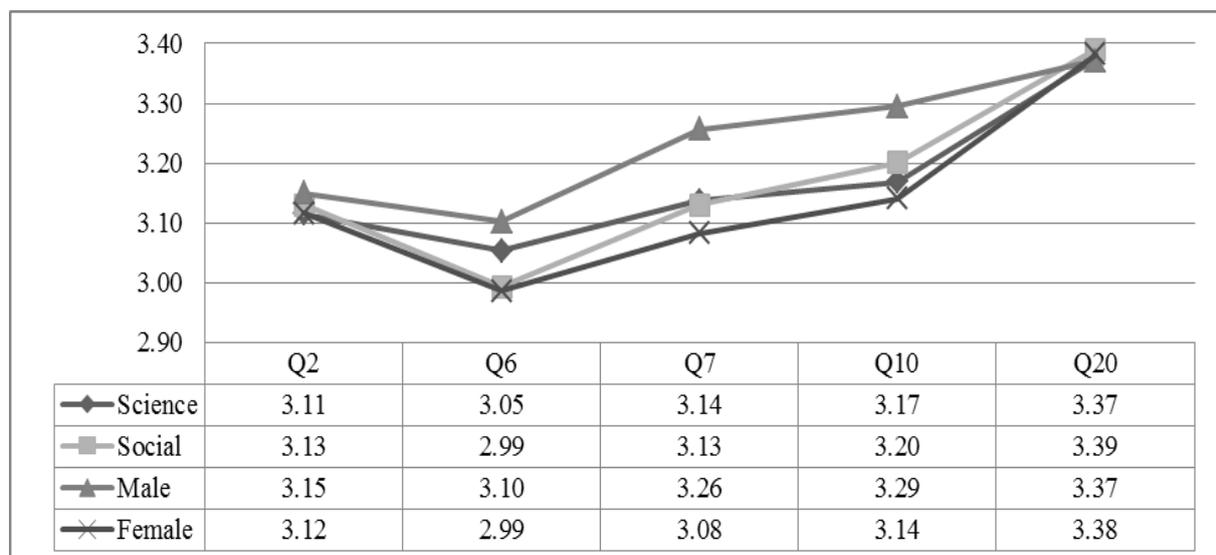
expressed properly (Facione, 2015). The ability is very useful to lead someone to construct a problem-solving agenda. Students' analysis ability in the study can be seen in table 5.

Table 5. *Results of the Mann-Whitney Indicator Analysis*

Variabel		Q2	Q6	Q7	Q10	Q20
Gender[a]	U	7833.0	7376.0	6907.5	7006.5	7909.0
	W	29361.0	28904.0	28435.5	28534.5	10990.0
	Z	-.445	-1.268	-2.138	-1.951	-.298
	P	.656	.205	.033	.051	.766
Knowledge Group[b]	U	10007.0	9701.0	10059.0	9785.0	9895.0
	W	18653.0	21636.0	18705.0	18431.0	18541.0
	Z	-.132	-.630	-.046	-.495	-.312
	P	.895	.529	.963	.620	.755

a. Grouping Variable: Gender,   b. Grouping Variable: Knowledge Group

Based on the Mann-Whitney test in table 5, there was generally no difference in analysis ability between male and female students. It can be seen that the four sub-indicators obtained Asymp-Sig (2-tailed) value ($p > .05$) on analogizing the problem (Q2), assessing the problem (Q6), distinguishing facts and opinions (Q10), and identifying the truth (Q20). However, there were differences in the thinking ability of student analysis with Asymp-Sig (2-tailed) value ($p < .05$) on sub-indicators of results estimation (Q7). Table 5 also showed that there was no difference in analytical skills with the value of Asym-Sig ($p> .05$) to both science and humanity students from 5 sub-indicators. In detail, the average value of analytical thinking skills can be seen in graph 3.

	Q2	Q6	Q7	Q10	Q20
Science	3.11	3.05	3.14	3.17	3.37
Social	3.13	2.99	3.13	3.20	3.39
Male	3.15	3.10	3.26	3.29	3.37
Female	3.12	2.99	3.08	3.14	3.38

Figure 3. Critical Thinking Value Based on Indicator of Analysis

Figure 3 explained that in general the average value of analytical thinking ability on male students was higher than female students in 5 sub-indicators. The highest value of thinking ability on the male students was found in the sub-indicator of identifying the truth (Q20) with a value of 3.37 while the lowest was found in the sub-indicator of differentiating the problem (Q6) with a value of 3.10. The highest value of thinking ability on the female students was found in the sub-indicator of identifying the truth (Q20) with a value of 3.38 while the lowest was found in the sub-indicator of differentiating the problem (Q6) with a value of 2.99 Figure 3 also showed that humanity students obtained the highest value on the sub-indicator of identified the truth (Q20) with a value of 3.39 and the lowest was on the sub-indicator of analysis thinking (Q6) with a value of 2.99. Then the science students obtained

the highest value on the sub-indicator of identifying the truth (Q20) with a value of 3.37 while the lowest was on the sub-indicator of differentiating the problem (Q6) with a value of 3.05.

e) Students' Critical Thinking Skills in Indicator of Evaluation
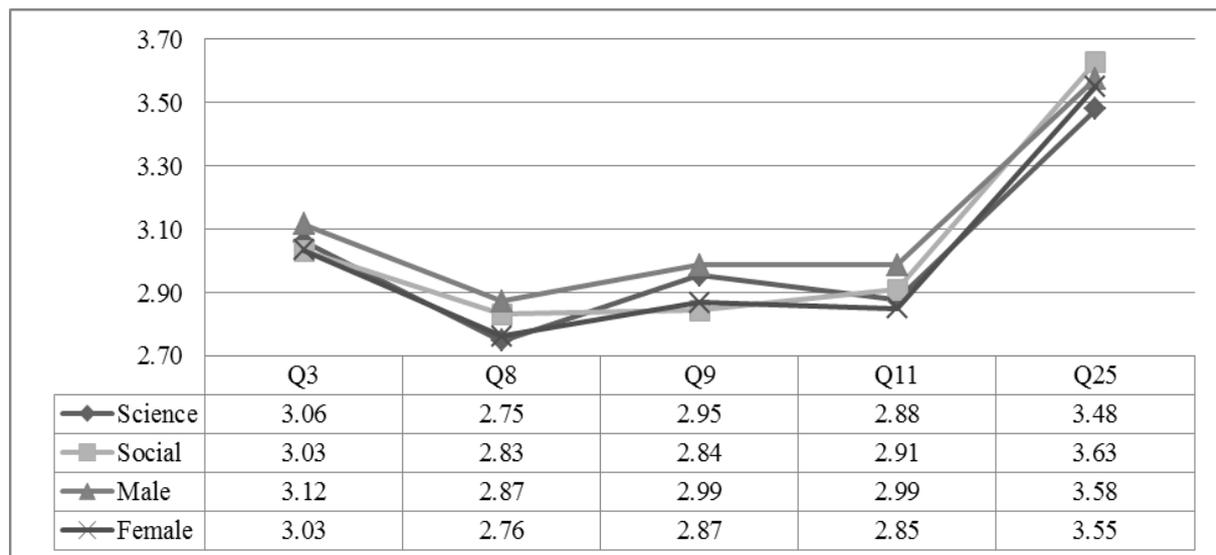
Evaluation ability means estimating the credibility of statements or representations, which are reports or descriptions of perceptions, experiences, and estimating the logical strength of inferential relationships, descriptions, or other forms of representation (Facione, P.A., 2011). The example of evaluation is comparing the strengths and weaknesses of alternative interpretations.

Table 6. *Mann-Whitney Test Evaluation Indicator Results*

Variable		Q3	Q8	Q9	Q11	Q25
Gender[a]	U	7645.0	7234.5	7384.5	7265.0	7964.5
	W	29173.0	28762.5	28912.5	28793.0	29492.5
	Z	-.761	-1.514	-1.200	-1.409	-.204
	p	.447	.130	.230	.159	.839
Knowledge Group[b]	U	9919.5	9498.0	9340.5	9838.0	8690.0
	W	21854.5	18144.0	21275.5	18484.0	17336.0
	Z	-.266	-.954	-1.167	-.389	-2.349
	P	.790	.340	.243	.697	.019

a. Grouping Variable: Gender,   b. Grouping Variable: Knowledge Group

Table 6 showed that there were no differences in the evaluation of thinking skills between male and female students. Based on the results of the Mann-Whitney test, the Asymp-Sig (2-tailed) value of the five sub-indicators was (p > .05). The Mann-Whitney test also proved that only the sub-indicator of identifying errors (Q25) can distinguish between science and humanity students, while the sub-indicator of identifying solutions (Q3), evaluate choices (Q8), analyze errors (Q9), and draw conclusions (Q11) cannot distinguish between science and humanity students. Although there was no significant difference between the ability to think analysis between the two genders, the difference in average values can be seen in figure 4.

	Q3	Q8	Q9	Q11	Q25
Science	3.06	2.75	2.95	2.88	3.48
Social	3.03	2.83	2.84	2.91	3.63
Male	3.12	2.87	2.99	2.99	3.58
Female	3.03	2.76	2.87	2.85	3.55

Figure 4. Critical Thinking Value Based on Indicators of Evaluation

Figure 4 showed the average value of male students was slightly higher than female students in all sub-indicators such as identifying solutions (Q3), evaluating choices (Q8),

analyzing errors (Q9), drawing conclusions (Q11), and identifying errors (Q25). The highest value of thinking ability on the male students was found in the sub-indicator of identifying errors (Q25) with a value of 3.58 while the lowest was found in the sub-indicator of evaluating choice (Q8). The highest average value on female students was in the sub-indicator of identifying error thinking (Q25) with a value of 3.55 while the lowest average value was in the sub-indicator of evaluating the choice (Q8) with a score of 2.76. The value of science students was higher than humanity students in the sub-indicator of identifying solutions (Q3) and sub-indicator of analyzing problems (Q9). The value of humanity students was higher than science students in the sub-indicator of evaluating choice (Q8), drawing conclusions (Q11), and identifying errors (Q25). The highest value obtained by humanity students in the sub-indicator of identifies the problem (Q25) with a value of 3.63 and the lowest value on the sub-indicator of evaluates the choice (Q8) with a value of 2.83. The highest value obtained by science students was in the sub-indicator of identifying the problem (Q25) with a value of 3.48 and the lowest value was in the sub-indicator of evaluating the choice (Q8) with a value of 2.75.

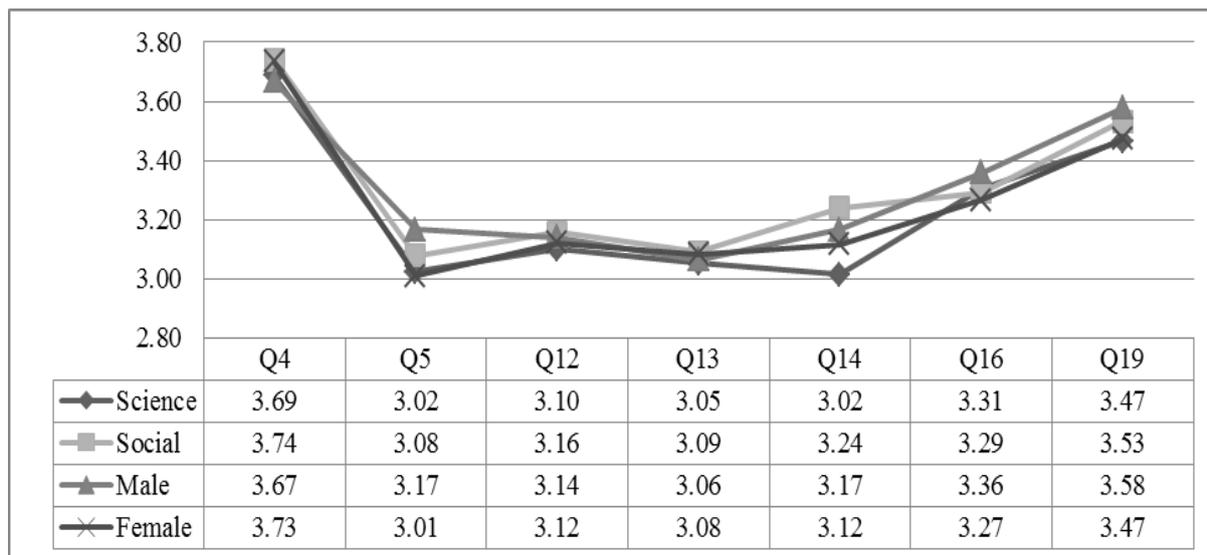### f)　Students' Critical Thinking Skills in Indicator of Inference

Inference means identifying and obtaining the necessary elements to make a reasonable conclusion, making guesses and hypotheses, considering relevant information, and deducing consequences from the data (Facione, 2015). Student inference ability can be seen in Table 7 below.

Table 7. *Mann-Whitney Test Results Inference Indicators*

Variable		Q4	Q5	Q12	Q13	Q14	Q16	Q19
Gender[a]	U	7652.5	7004.5	8002.0	7926.5	7850.0	7524.0	7341.5
	W	10733.5	28532.5	29530.0	11007.5	29378.0	29052.0	28869.5
	Z	-.880	-2.055	-.129	-.278	-.390	-.981	-1.346
	P	.379	.040	.897	.781	.696	.327	.178
Knowledge Group[b]	U	9349.5	9643.0	9594.5	9779.0	8481.5	9921.0	9470.0
	W	17995.5	18289.0	18240.5	18425.0	17127.5	21856.0	18116.0
	Z	-1.380	-.764	-.802	-.524	-2.510	-.266	-1.016
	P	.168	.445	.423	.600	.012	.791	.310

a. Grouping Variable: Gender,　b. Grouping Variable: Knowledge Group

From table 7, it showed that the six sub-indicators had the Asymp-Sig (2-tailed) value (p > .05). It concluded that there was no significant difference on inference thinking ability in the sub-indicator of solving the problem (Q4), making decisions (Q12), making hypotheses (Q13), testing hypotheses (Q14), investigating the truth (Q16), and giving the right reasons (Q19) among male and female students. However, there was one sub-indicator of inference thinking ability which was providing evidence (Q5) that had an Asymp-Sig (2-tailed) value (p < 0.05), which means there were differences in inference thinking skills of providing evidence between male and female students. The Mann-Whitney test also proved that there was a difference in the ability to test the hypothesis (Q14) between science and humanity students because of the Asymp-Sig (p <.05). Meanwhile, other inference abilities (Q4, Q5, Q12, Q13, Q16, Q19) did not prove that there was a difference between science students and humanity because of the value of Asymp-Sig (p> .05). The average value of each sub-indicator can be seen in figure 5.

Figure 5. of Critical Thinking Value Based on Indicators of Inference

Based on figure 5, the average value of the inference thinking abilities of the male students was higher than female students in the sub-indicators Q5, Q12, Q14, Q16, and Q19. In addition, the average value of the inference thinking ability of female students was higher than the average value of male students in the sub-indicator of solving problems (Q4) and making hypotheses (Q13). The highest average value of female students with a value of 3.73 was in the sub-indicator of to overcome the problem (Q4) while the lowest ability of female students was in the sub-indicator of providing evidence (Q5) with a value of 3.01. The highest thinking ability of male students was found in the sub-indicator of overcoming problems (Q4) with a value of 3.67 while the lowest value was found in the sub-indicator of assessing problems (Q6) with a value of 3.06. From the graph, it also showed that the inference ability of humanity students was higher than science students in the sub-indicators Q4, Q5, Q12, Q13, Q24, and Q19, while the sub-indicators of truth inquiry ability (Q16) of science students were slightly higher than humanity students. The highest value was obtained by humanity students in the sub-indicator of problem-solving (Q4) with a value of 3.74 while the lowest value in the sub-indicator of provides evidence (Q5) with a value of 3.08. The highest score of science students was obtained in the sub-indicator of solving problems (Q4) with a value of 3.69 and the lowest value in the sub-indicator of tested the hypothesis (Q14) with a value of 3.02.

DISCUSSION

a) Interpretation Ability Based on Gender and Knowledge Group

Gender equality is still a problem among researchers, especially in developing countries. Several studies have shown that male students' critical thinking skills are higher than female students' critical thinking skills (Atmatzidou & Demetriadis, 2016; Azar, 2010; Liu et al., 2019; Piaw, 2014; Preiss et al., 2013; Verawati et al., 2010). However, previous studies did not examine the sub-indicators of critical thinking skills. The study was unique in examining the ability to think critically in more detail. The study examined how the ability of gender-based interpretations with eight sub-indicators. The findings of the study revealed that males were superior in one sub-indicator which is determining the cause of the problem in detail compared to female even though there were no significant differences on the other seven indicators. The interesting part of the finding was that the sub-indicators of value

differences of opinion that have the same average value of 3.59 for both male and female students and was the highest score of eight sub-indicators.

Further, the study examined the differences between science students and humanity students. The interpretation ability based on the knowledge group showed that there was no difference in interpretation ability between science students and humanity students. From the 8 indicators, 2 indicators showed differences, which in the sub-indicator of interpreting with clear things (Q21) and the sub-indicator of dare to express opinions (Q24). Meanwhile, the other 6 sub-indicators did not show a difference. However, based on the value, the interpretation ability of humanity students was higher than that of science students in the sub-indicators of respecting dissent (Q18) which was 3.62. Science students had the lowest value, which is 2.78 in the sub-indicator of dare to express their opinion (Q24). Humanity students tend to have an empathetic cognitive style compared to science students who have a systematic cognitive style (Focquaert et al., 2007). The results of the study revealed that humanity students are superior in respecting dissent. It mean that the empathy thinking style is more highlighted by humanity students. However, the study could refute Focquaert's research that science students have a lower ability to illustrate problems, so that systemic cognitive ability was still in doubt.

The ability of interpretation is the initial ability that must be possessed to achieve critical thinking. Interpretation is a series of understandings, explanations, and descriptions of information or problems faced (Facione, 2015). To overcome the problem, students need to understand and describe the problem clearly. To improve the interpretation ability, it is necessary to have an understanding of conceptual training for students (Serin, 2013b). It becomes a necessity for the instructor so that there needs to be a clear understanding of concepts, clear information, and clear problems in giving or transferring knowledge (Batlolona et al., 2019).

b) Analysis Ability Based on Gender and Knowledge Group

It is undeniable that males tend to be better at describing ideas than females (Piaw, 2014). In line with the results of the study, males are superior in estimating the causes of problems than females. Although in general the male and female analysis ability are not significantly different (Q2, Q6, Q10, Q20), the males' ability to estimate the cause of the problem is still superior to females' (Q7). Even so, males must consider their gender role orientation in behaving (Liu et al., 2019). It is known that critical thinking is a mental process in making the right decisions so that in expressing thoughts students must consider what, how, and to whom the decision was given.

Analysis is the ability to identify the relationship of information used to express thoughts or opinions (Facione, 2015). Males are more likely to identify information in detail and systematically. Their focus is always in one direction so that whatever they want can be found more precisely than females. It is related to the capacity and function of their left-brain, which is more likely to be rational. The left-brain supports many critical thinking abilities, while the right brain supports many creative thinking skills (Rosnawati, 2009). The ability to estimate the cause of the problem on the male students was higher because their brain functions better in some parts than female students.

In general, the average critical thinking ability of humanity students was higher than science students viewed from the knowledge group. Although there is no statistical difference between the two indicators in the analysis, the sub-indicator of identifying the truth surpassed the highest value by humanity students. It is because humanity students were able to understand information clearly (Q23). However, humanity students also have the lowest ability in the sub-indicator of analysis thinking (Q6) which is also in accordance with the

results of the study (Focquaert et al., 2007). Analytical thinking requires a systemic cognitive pattern and it tends to be owned by science students. The same research results explain that the systemic abilities of science students outperform the systematic abilities of humanity students (Billington et al., 2007).

c) Evaluation Ability Based on Gender and Knowledge Group

Evaluation abilities between males and females do not imply significant differences. It is in line with the results of previous studies that gender did not influence the ability to think critically because the average ability of males and females only differed in terms of specific cognitive abilities (Verawati et al., 2010). Other studies also proved that male and female metacognitive abilities are generally at the same average or do not show significant differences (Azar, 2010; Siswati & Corebima, 2017). Therefore, there are indicators of evaluation ability in metacognition ability.

In general, the evaluation abilities of humanity students were higher than science students in sub-indicators of identifying errors. Scientifically, humanity students had more ideas to express opinions so that they were superior when criticize problems or identify errors. They have more arguing area so that skills in expressing opinions more often occur in academic and non-academic activities. Also, the courage of humanity students in expressing the opinion (Q24) is 2.99 higher than science students showed in figure 2.

Science students obtained the lowest value in the sub-indicator of evaluating ability (Q8). It was because science students are more likely to deal with real things' so that they have difficulty in evaluating choices in practice. The low ability to evaluate was assumed as the result of the lowest score that students got in the sub-indicator of linking one thing to another to solve a difficulty (Q2).

Evaluation is the ability to test the truth of the information used in expressing thoughts or opinions (Facione, 2015). Evaluation means estimating the credibility of statements or representations which are reports or descriptions of perceptions, experiences, situations, judgments, beliefs or opinions of a person, and estimating the logical strength of inferential relationships or referred to among statements, descriptions, questions, or other forms of representation (Filsaime, 2008).

d) Inference Ability Based on Gender and Knowledge Group

In general, based on the average value of inference ability, males' inference abilities are better than females. A significant difference is in the sub-indicator of providing evidence (Q5). Males are more rational than females even though females are more likely to be superior in verbal skills. The result is supported by research that concludes that male was better than female in terms of reasoning and inference analysis (Preiss et al., 2013). However, in the sub-indicator of problem-solving, female students achieved a perfect score, of 3.73, which meant that females were superior to males. Align with previous studies that the critical thinking ability of female students was higher than male students (Fuad et al., 2017). It is reinforced by previous research, which concluded that females have higher learning achievement than males (Demir et al., 2016). In addition, female students are also superior to male students in processing factual information. Associated with females' brain abilities that tend to be balanced make females more critical in dealing with problems than males. However, it was different from the results of the Fuad et al study (2017) which reported that males were superior in solving problems. The results of the study can refute research that stated females were superior in overcoming problems even though there is no significant difference.

Based on the knowledge group, the inference ability of humanity students is higher than science students in the sub-indicator of problem-solving (Q4). The ability was supported by several factors, including humanity students' superiority in the ability to identify the truth (Q20) and identify errors (Q25) so that these abilities could help them to solve problems. Problems arise when the truth and error are not clearly identified. In the study, humanity students outperformed those abilities.

Surprising results were found science students on the sub-indicators of testing the hypothesis (Q14) showed that they obtained the lowest average of all inference abilities. There was an interesting finding that science students outperformed humanity students when investigating the truth (Q16). However, the sub-indicator of testing the hypothesis was low on humanity students. After testing, the science students have weaknesses in relating one thing to another to solve a problem (Q2). It was shown from the values obtained by science students (see graph 3).

The inference was defined as the ability to identify and obtain the elements needed to make a reasonable conclusion (Facione, 2015). Inference means identifying and acquiring the elements needed to make reasonable conclusions, making guesses and hypotheses, considering relevant information and deducing the consequences of data, situations, questions or forms of representation others (Filsaime, 2008).

CONCLUSION

The findings of the study concluded that there are no significant differences in critical thinking skills between males and females. In the interpretation skills, the seven sub-indicators indicated that there were no significant differences. However, one indicator had a significant difference, which was the sub-indicator of determining the problem's cause. In analytical skills, four indicators had no significant differences, though one indicator showed a significant difference, which was the sub-indicator of estimating the problem's cause. In the evaluation ability, the five sub-indicators showed no significant differences between the abilities of male and female students. Furthermore, in the inference ability, there was an indicator of the seven indicators showing a significant difference, which was the sub-indicator of providing evidence. However, when viewed from the total value of the four indicators, the ability of male students was higher than female students. The study also breakdown the stereotype in developing countries that male students generally have lower critical thinking skills than female students.

Viewed from the knowledge group, there was no significant difference between the critical thinking skills of science students and humanity students in general. In the ability of interpretation, 5 sub-indicators showed the same ability and the other 3 sub-indicators showed differences. The ability to analyze thinking showed that there was no difference between science students and the humanity of the 5 sub-indicators. On evaluation ability, there was an indicator that showed differences and the other 4 sub-indicators showed the same ability. Meanwhile, in inference ability showed the similarity between science and humanity students in 6 sub-indicators and the other 1 sub-indicator showed differently. However, the average value of critical thinking ability showed that humanity students are superior to science students.

IMPLICATIONS and RECOMMENDATIONS

The research can be a reference for university lecturers to determine students' critical thinking skills. The research will make the lecture more focused because it can help to see the

ability of male and female students and the ability of students based on the knowledge group. The result of the study recommended to prepare the curriculum before the semester begin, so that it will be more targeted, in both materials, medias, and lecture strategies.. The sub-indicators used in the study can be selected according to the characteristics of the department and learning outcomes. In addition, several faculties that have a gap in the number of males and females also can use the research. Thus, it will provide equal opportunities for students to develop academic and non-academic abilities. Lastly, for universities, the students who still have low and moderate critical thinking skills must be given a training to improve their critical thinking skills.

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