Critical Thinking Skills on Human Digestive System Materials: Contextual Teaching and Learning Based Gender

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Abstract: Critical thinking skills greatly determine the quality of education, especially in biology students. This research aimed to determine the influence of Contextual Teaching and Learning (CTL) learning models based on gender on students' critical thinking skills on human digestive system materials. This research uses quantitative research with experimental quasi research methods. The research design uses pretest-posttestnonequivalent control group design. The instrument used is a problem of essay tests that aim to find out the ability to think critically. Data analysis uses descriptive statistical analysis and inferential statistics. The results of the data analysis showed that there was a significant influence on the use of CTL learning models on critical thinking skills. The average value of pretest and posttest critical thinking skills in the experimental class was 40.71% and the control class was 29.14%. Gender has no significant effect on critical thinking skills in the material of the human digestive system. This is evidenced by the results of hypothesis tests that show that sig values. (2-tailed) > α was 0.677 > 0.05. The interaction of learning and gender models has no significant effect on critical thinking skills on the material of the human digestive system. This is evidenced by the results of hypothesis tests that show that sig values. (2-tailed) > α is 0.394 > 0.05. Thus, the results of this research provide recommendations so that teachers can apply the CTL learning model to students who have different gender characteristics in biological learning.

Keywords: Human digestive system, contextual teaching and learning,critical thinking skills, gender

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1. Introduction

The progress of a nation can be determined by the quality of education. Quality education can be seen from the quality of its students. Qualified students are students who can develop themselves, one of which is developing high-level thinking skills. High-level thinking skills is the critical thinking skills (**Setiawan, et al 2017**).

Mahanal et al (2018), revealed that critical thinking skills are the skill to think to solve problems with critical traits and talents, namely the nature of curiosity, daring to take risks, daring to decide and implement, and the nature of always respecting the rights of others. Furthermore, **Duda (2017: 54)** states that critical thinking skills are very important abilities for life, work, and functioning effectively in almost all other aspects of life.

Critical thinking skills have an important role for students that can be used as a basis for argument analysis and insight into each meaning and interpretation in developing logical reasoning in each student (**Bustami, 2017: 2**). Furthermore, research of **Suswati et al. (2015)** revealed that critical thinking skills can help students face challenges in the 21st century oriented in the teaching and learning process.

The fact that the low critical thinking skills of students in junior high school education are revealed from the results of **Rosyida et al (2016)**, stating that 60% of students are still not developing critical thinking skills, so it still needs to be improved. Furthermore, research conducted by **Muhlisin et al (2016)** revealed that 80.9% of junior high school critical thinking skills fall into the low category. Similarly, Budi &Azizul (2017) research results, that students' critical thinking skills are still low, which only reaches 36.26% for natural science subjects, especially human digestive system materials.

Factors that cause critical thinking skills are still not developed in learning according to **Widiawati (2016)** and **Masitoh, et al (2017)**, that learning in schools mostly emphasizes low-level thinking skills. Emphasizing low-level thinking skills means that in the learning process students are only required to absorb information passively so that learning becomes less meaningful and students are easy to forget from the subject matter that has been delivered before.

Another factor that causes critical thinking skills is still not developed in learning, namely only expected to appear as a mere grinding effect and the lack of teachers in paying special attention to train critical thinking skills in learning (**Wartiningsih et al, 2016**). Furthermore, **Muhlisin, et al (2016)** said that the learning methods or models used in the learning process are less able to develop students' critical thinking skills, teacher-centered learning, and have not actively involved students in the learning process (**Fuad et al, 2017**).

According to **Khairunnisa&Nining (2017)**, stated that students' critical thinking skills about the material of the human digestive system owned by each student are different, even though the problems faced are the same. This skill difference is due to several factors. One of the factors that influences are gender differences. Gender differences are often found at every level of education, especially in state junior high school 2 Sungai Tebelian

and state junior high school 5 Sungai Tebelian. Gender is a term used to describe the difference between men and women socially that is seen when viewed from the values and behavior of students in **Widiawati (2016)**.

According to **Indrawati&Nurfaidah (2016)** and **Hodiyanto (2017)**, stated that in male students more developed left brain so that he can think logically, think abstractly, and think analytically, while in female students more developed right brain, so he tends to move artistically, holistically, imaginatively, intuitive thinking, and some visual abilities. The same thing was also shown based on observations that have been made in state junior high school 2 and state junior high school 5 Sungai Tebelian which showed that female students had higher cognitive learning outcomes than male students.

This can be seen from the differences in emotional, behavioral, thinking patterns and intelligence shown by male and female students are different because they are caused by daily activities between male and female students. Thinking patterns and intelligence are very influential in studying the material of the human digestive system (**Apriyono, 2016**). Based on the above exposure, it can be concluded that gender differences can affect students' critical thinking skills.

According to **Bustami et al (2018)**, stated that students' critical thinking skills can be improved through a variety of innovative learning, namely by involving students directly in the learning process or student-centered, collaborating, and self-learning in the learning process. Innovative learning is learning that requires a learning model in the teaching and learning process. The learning model is the Contextual Teaching and Learning (CTL).

CTL learning model according to **Rokhma (2014)**, states that students are not just objects but able to act as subjects, with encouragement from teachers, students are expected to be able to construct lessons in the minds of students themselves, so students not only memorize the facts but students are required to experience them themselves and students are also able to master thinking skills in the learning process.

The research of **Susialita (2016)**, revealed that the CTL learning model allows students to connect students' academic thinking with the context of everyday life to find new goals through experiences in everyday life and classroom learning so that the need to apply such models that can improve students' critical thinking skills and cognitive learning outcomes. Based on this background, researchers are very interested in conducting research on CTL learning models based on gender on students' critical thinking skills in human digestive system materials.

2. Methods

The research approach used in this research was a quantitative. The research method used in this research was an experimental research method. The type of experimental research used in this study was quasi-experimental. The design of the study used a 2x2 factorial trial model. More details about the 2x2 factorial design can be seen in Table 1.

Table 1. Factorial research design 2x2

Gender	Learning Model	
	CTL (M_1)	Conventional (M_2)
Male (K_1)	$K_1 M_1$	$K_1 M_2$
Female (K_2)	$K_2 M_1$	$K_2 M_2$

Note:
K_1	:	Male gender
K_2	:	Female gender
M_1	:	CTL learning model
M_2	:	Conventional learning

The 2x2 factorial design referred to from this study are two learning models, namely the CTL learning model and conventional learning with two different genders, male and female. The study used a pretest-postest nonequivalent control group design that compared the initial test results with the final tests. The pretest-posttest form of the nonequivalent control group design can be seen in Table 2.

Table 2. Pretest-posttest nonequivalent control group design

Pretest	Treatment	Posttest
O_1	S_1Y_1	O_2
O_3	S_1Y_2	O_4
O_5	S_2Y_1	O_6
O_7	S_2Y_2	O_8

Note:
O_1, O_3, O_5, O_7 : Pretest score
O_2, O_4, O_6, O_8 : Posttest score

S₁	: CTL learning model
S₂	: Conventional learning
Y₁	: Male gender
Y₂	: Female gender

The population in this research was all students of class VIII of State Junior High School 2 Sungai Tebelian and students of class VIII of State Junior High School 5 Sungai Tebelian both male and female students numbering 94 students. The sample in this study was a student of class VIII A as an experimental class and VIII B as a control class of State Junior High School 2 Sungai Tebelian. Determination of samples in this research with saturated sampling techniques. Saturated sampling is a sampling technique when all members of the population are used as samples.

The instrument used is a critical thinking essay test. The essay test used amounted to 6 questions. This instrument is used to obtain data on the critical thinking skills of grade VIII students on human digestive system materials in Junior High School. The test has been validated by content, construct, and empirical. Validation of contents and constructs is done by 3 validators. Empirical validation is conducted in field trials. The test results showed valid and reliable results.

Data is analyzed using descriptive statistical analysis and inferential statistics. The data begins by conducting a prerequisite test in the form of a normality test and a homogeneity test. The normality test using the Kolmogorov-Smirnov Sample and the homogeneity test using the formula one-way anova, then continued with the analysis of covariance (anacova) at a significant level of 0.05 and further tests of LSD. All data analysis is assisted by SPSS version 18.

3. Results

The results of the descriptive analysis are done to find out the average on pretest and posttest values. Pretest and posttest were followed by 45 students in the experimental class and 49 students in the control class. The following results of descriptive analysis of students' critical thinking skills can be seen in Table 3.

Table 3. Students' critical thinking skills score

Scores	Experiment Class		Control Class	
	Pretest	Posttest	Pretest	Posttest
Highest Score	50	85	50	70
Lowest Score	20	60	20	50
Average Score	34.09	74.80	33.84	62.98
Category	Very low	Good	Very low	Enough
Increased	40.71		29.14	

Based on Table 3 it is seen that the average pretest grade of experimental students is 34.09 with the highest score is 50, the lowest score is 20, while the average posttest score is 74.80 with the highest score is 85, the lowest score is 60. The control class obtained a pretest average value was 33.84 with a top value is 50, a low is 20. In the posttest obtained an average of 62.98. High value 70, lowest value 50. The average grade of critical thinking skills of students in the experimental class increased was 40.71 while for the control class increased was 29.14.

The results of the normality test on critical thinking skills can be seen in Table 4. The normality test on a student's critical thinking skills is obtained from pretest and posttest results. The results of the normality test showed that both the pretest and posttest results had a probability value (Sig) greater than alpha 0.05. With the results of the pretest normality test, sig 0.395>0.05 and the posttest result is Sig 0.216>0.05. The results concluded that the research data were both pretest and posttest normal distribution.

Table 4. Normality test results

Type of Test	Sig.	α	Description	Conclusion
Pretest experimental classes and control classes	0.395	0.05	0.395>0.05	Normality
Posttest experimental classes and control classes	0.216	0.05	0.216>0.05	Normallity

The results of the homogeneity test on a student's critical thinking skills can be seen in Table 5. Based on Table 5 obtained sig. (2-tailed) to pretest experimental class students and control class students by 0.935>0.05 then the pretest data is homogeneous and on the sigposttest data. (2-tailed) 0.760>0.05 means homogeneous posttest data. So, the results of the analysis with SPSS Version 18, it proves that the data for each test are all declared homogeneous.

Table 5. Homogeneity test results

Type of Test	Sig.	α	Description	Conclusion
Pretest experimental classes and control classes	0.935	0.05	0.935>0.05	Homogeneity
Posttest experimental classes and control classes	0.760	0.05	0.760>0.05	Homogeneity

The results showed that the CTLlearning model had a significant effect on students' critical thinking skills. Data has a probability (Sig) value. smaller than alpha 0.05, Sig. 0.000, so it can be concluded that the CTL learning model has a significant effect on students' critical thinking skills. A summary of the hypothesis test can be seen in Table 6.

Table 6. Anacova results influence CTL learning model

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2620.064[a]	4	655.016	18.728	.000
Intercept	27064.454	1	27064.454	773.828	.000
Critical thinking _Pretest	87.192	1	87.192	2.493	.118
Model	2498.793	1	2498.793	71.446	.000
Error	3112.755	89	34.975		
Total	458665.000	94			
Corrected Total	5732.819	93			

Based on the calculation of the gain index shows that there is a difference in agroup critical thinking skills between the CTL learning model and conventional learning. Seen in the gain value in the conventional class is lower is 0.44 compared to the higher gain value in the CTL class which is 0.62. Summary results related to average values based on the calculation of the gain index can be seen in Table 7.

Table 7. Summary of gain index calculations

Model	Average Score		Difference	Gain	Category
	Pre critical thinking	Post critical thinking			
Conventional	33.84	62.98	29.14	0.44	Enough
CTL	34.09	74.80	40.71	0.62	High

The results showed that gender had no significant effect on students' critical thinking skills. Gender has a probability value (Sig). greater than alpha 0.05, Sig. 0.677. So it can be concluded that gender has no significant effect on students' critical thinking skills. A summary of children's results on the influence of gender on students' critical thinking skills can be seen in Table 8.

Table 8. Anacova results influence gender on students' critical thinking skills

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2620.064[a]	4	655.016	18.728	.000
Intercept	27064.454	1	27064.454	773.828	.000
Critical thinking _Pretest	87.192	1	87.192	2.493	.118
Gender	6.124	1	6.124	.175	.677
Error	3112.755	89	34.975		
Total	458665.000	94			
Corrected Total	5732.819	93			

The results of the gain index calculation showed that the ability to think critically of female students was 0.53 higher than male students, which was 0.52. So it can be concluded that the critical thinking ability of female students is better than the critical thinking ability of male students although there is no significant difference. A summary of the gender gain index calculation can be seen in Table 9.

Table 9. Summary of gender gain index calculation

Gender	Average Score		Difference	Gain	Category
	Pre critical	Post critical			

	thinking	thinking			
Female	34.04	69.06	35.02	0.53	Enough
Male	33.85	68.07	34.22	0.52	Enough

The results of anacova in table 10 showed that there was no significant influence on the interaction of learning models with the gender on students' critical thinking abilities. This is evidenced by the interaction of models and genders that have sig values. 0.394 is greater than alpha 0.05. So it can be concluded that the increase in the average value of students' critical thinking skills is no different in each class of interaction of learning models with gender.

Table 10. Anacova results in the interaction of learning and gender towards critical thinking

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2620.064[a]	4	655.016	18.728	.000
Intercept	27064.454	1	27064.454	773.828	.000
Critical thinking _Pretest	87.192	1	87.192	2.493	.118
Model * Gender	25.703	1	25.703	.735	.394
Error	3112.755	89	34.975		
Total	458665.000	94			
Corrected Total	5732.819	93			

However, Table 11 of the gain index calculations showed that the class interaction of CTL learning models with gender had an average value of critical thinking skills better was 0.63 for male gender and 0.61 for female gender compared to the average value of critical thinking ability of conventional class interaction with male gender which is 0.40 and female gender is 0.47. So it can be concluded that the interaction of CTLlearning model class with gender is better than the class interaction of conventional learning model with gender, as shown in Table 11.

Table 11. Summary of interaction gain index calculations

Model	Gender	Average Score		Difference	Gain	Category
		Pre critical thinking	Post critical thinking			
Conventional	Female	33.83	64.69	30.86	0.47	Enough
	Male	33.85	60.50	26.65	0.40	Low
CTL	Female	34.28	74.12	39.84	0.61	High
	Male	33.85	75.65	41.80	0.63	High

- The results of the analysis concluded that the application of CTL learning models is better able to improve students' critical thinking skills than conventional learning. In addition, the CTL learning model is also able to equalize students' critical thinking skills without being gender-based.

4. Discussion

The descriptive analysis results obtained the average value of students' critical thinking skills from the results of pretest and posttest in students of class VIIIA and VIIIB state junior high school 2 and state junior high school 5 Sungai Tebelian. The average results grade analysis showed that there was an increase in students' critical thinking in both experimental and control classes. The average pretest score of students' critical thinking skills in the experimental and control classes fell into the category of very low, namely the experimental class was 34.09 and the control class was 33.84 while the average posttest score of students' critical thinking skills for the experimental class entered the category was 74.80 and the control class entered the category was 62.98. The average grade of critical thinking skills of students in the experimental class increased was 40.71 while for the control class increased was 29.14. The results of the study concluded that learning using the CTL learning model can improve students' critical thinking skills.

The results of this study in line with research by **Bahri, (2017)**, **Bustami et al, (2018)**, and **Rumaini (2018)**, revealed that the CTL learning model has more influence on students' critical thinking skills than conventional learning. Furthermore, research conducted by **Wakijo& Siti, (2016)** and **Setiawan&Lonardus, (2019)** also stated that the CTL learning model affects students' critical thinking skills compared to conventional learning. The influence of the CTL learning model is better than conventional learning because the CTL learning model has many advantages over conventional learning.

The results of the inferential analysis of the influence of CTL learning models on students' critical thinking skills show that sig values. (2-tailed) is 0.000 while the value of α = 0.05. This means sig. (2-tailed) < α which is 0.000<0.05 so there is a significant difference in the use of CTL learning models on students' critical thinking skills.

Students' critical thinking skills are improved because the CTLlearning model has an advantage in its learning syntax especially on constructivism activities, finding, asking, learning society, modeling, reflection, and authentic assessment so that learning is student-centered, thus if learning is student-centered then students will be more active and can improve students' critical thinking skills.

Bahri (2017), revealed that contextual teaching and learning (CTL) inquiry type learning is learning that emphasizes the process of full student engagement to be able to find the material learned and connect it to real-life situations to encourage learners to be able to apply it in their lives. Furthermore, **Wakijo& Siti (2016)** states that the CTL learning model makes the experience more relevant and for students in building their knowledge in their lives.

Furthermore, research according to **Nuryanti et al (2018)** reveals that teachers must be able to create learning that trains students' critical thinking skills. Choosing the right learning model will activate all the potential that students have that can ultimately improve their critical thinking skills. Various learning models that can be applied include guided inquiry learning models.

The stages in the application of CTL learning models can make students more active and dare to perform so that the learning process will be more meaningful and each student can master the subject matter well because of the fun learning process. This proves that the application of CTL learning models can improve students' critical thinking skills significantly.

Related results of descriptive analysis for gender showed that the average pretest and posttest grades of critical thinking skills of students in experimental classes of female students and male students fall into the high category, namely female students, the average pretest score was 34.28 and postestwas 74.12 while the critical thinking ability of male students was 33.85 and posttest average score was 75.65.

The average pretest and posttest scores of critical thinking skills in the control class of female students fall into the category of enough with a pretestwas 33.83 and posttestwas 64.69 while male students fall into the category of enough, namely pretestwas 33.85 and post-test was 60.50. The gain index calculation showed the average value of critical thinking skills of female students increased was 0.53 and male students increased was 0.52 with sufficient categories, so it can be concluded that the increase in critical thinking skills of both male and female students did not differ significantly.

Similarly, the results of inferential analysis of gender influence on critical thinking skills show that sig values. (2-tailed) is 0.677 while the value is α = 0.05. This means sig. (2-tailed) > α was 0.677 > 0.05 so that gender had no significant effect on students' critical thinking skills. The results of this study are in line with **Sulistiyawati&Cici (2017)** and **Mahanal et al (2018)**, which found there was no difference in critical thinking skills with differences in the treatment of learning groups mixed and separated because the same thinking skills in both treatment groups can be caused by the same learning experience and during the learning process, all students both male and female are conditioned to cooperate developing their thinking skills so that they can develop their thinking skills. They have the same opportunity to develop their critical thinking skills.

This happens because the CTL learning model is able to instill problem-solving habits, critical thinking, creativity, and independence. Explore the potential of students based on the experience they have to be connected with the knowledge to be learned. By the constructivist theory that in constructing knowledge students do not depart from the "blank mind", students must know what is to be known called preliminary knowledge (**Susiloningsih, 2016**).

Based on the results of descriptive analysis of the interaction of CTL and gender learning models showed that the average value of critical thinking skills of conventional female students pretest 33.83 and post-test 64.69 fall into the category of sufficient and the value of male students is pretest 33.85 and posttest 60.50 falls into the category is sufficient. While the average value of critical thinking skills of pretest female student experimental classes was 34.28 and posttest by 74.12 while the critical thinking skills of male students averaged posttest grades of 33.85 and posttest average scores of 75.65 entered the high category.

The results of the gain index calculation showed that the interaction of CTL learning model class with gender had an average value of critical thinking skills better at 0.63 for male gender and 0.61 for female gender compared to the average value of critical thinking skills of conventional class interaction with male gender which is 0.40 and female gender 0.47. The results of the gain index calculation related to critical thinking skills showed that the combination of the CTL learning model with gender was not real, but different in the combination group of conventional learning with gender. Seen at the percentage level of the male student gain index value of 0.40 with less category and the value of female students is 0.47 with enough categories. The results concluded that classes with CTL learning models were better able to improve critical thinking skills in students based on gender than conventional learning model classes with gender. This is in line with research by **Purwaningsih et al (2017)**, which found that the interaction between NHT Remap and gender had no significant effect on critical thinking skills. So it can be concluded that there is no influence on the interaction of models with gender.

- The results of the inferential analysis influence the interaction of CTL and gender learning models on students' critical thinking skills show that sig values. (2-tailed) is 0.394 while the value of α = 0.05. This means sig. (2-tailed) > α is 0.394 > 0.05 so there is no significant effect on the interaction of CTL learning models and gender on students' critical thinking skills. This proves that the application of CTL (Contextual Teaching and Learning) learning models that require students of different genders to cooperate in groups can equalize students' critical thinking skills. This is in line with **Bahri (2017)**, which states that the involvement of learners to find their materials independently and learn together and become active is expected to expand the insights of learners by exchanging information with each other so that the level of thinking of learners will increase, especially critical thinking.

6.Conclusion

Based on the analysis and discussion in this study in general it can be concluded that there is a significant influence on the use of CTL learning models on critical thinking skills. There was an increase in the average value of pretest and posttest critical thinking skills in experimental classes that applied the CTL learning model was 40.71% and there was an increase in the average value of pretest and posttest critical thinking skills in control classes that applied lecture and discussion methods was 29.14%. The CTL learning model has a significant impact on students' critical thinking skills on the material of the human digestive system. This is evidenced by the results of hypothesis tests that show that sig values. (2-tailed)< the value of α (0.000 < 0.05). Gender has no significant influence on critical thinking skills on the material of the human digestive system. This is evidenced by the results of hypothesis tests that show that sig values. (2-tailed) > α was 0.677 > 0.05. The interaction of learning and gender models has no significant effect on critical thinking skills on the material of the human digestive system. This is evidenced by the results of hypothesis tests that show that sig values. (2-tailed) > α is 0.394 > 0.05. Thus, the results of this study provide recommendations so that teachers can apply the CTL learning model to students who have different gender characteristics in biological learning.

7. Acknowledgment

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