Implementation of Flipped Classroom Learning to Improve Critical Thinking and Self Managements Skills of Vocational Students

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Abstract: The involvement of vocational students to be minimized makes their critical thinking skills being underdeveloped, especially in the new normal period where studying in school is limited. This study aims to determine the improvement and differences of critical thinking skills, the differences in self-management and the correlation of them after implementation of flipped classroom learning. This study used a quantitative approach, applied research, and pre-experimental method with one group pretest-posttest design. The subjects of this study were 35 students of class X majoring in Fishing Vessel Nautics at SMK Negeri 6 Lhokseumawe which 30 students and SMK Negeri 1 Muara Batu which 5 students on November-December 2021. The parameters measured were critical thinking skills, self-management, correlation of them. The instruments used are multiple-choice questions with reasons for critical thinking skills and questionnaires for self-management. Data collected through pretest and posttest. Data on critical thinking skills and self-management were analyzed by n-gain test, the paired sample t-test, correlation between self-management and critical thinking skills with the Pearson correlation test, and expert validation. The results showed critical thinking skills was increased which 0.61 with the medium category, there were differences in students critical thinking skills and self-management after the implementation of flipped classroom learning on reproduction and basic genetics in fish which the value of ρ is $0.000 \leq 0.05$, and there was a correlation between self-management and critical thinking skills of vocational students which 0.793 with high positive correlation category.

Keywords: Flipped classroom; Critical thinking skills; Self-management; Vocational students

Introduction

Currently most schools especially in Aceh have held face-to-face learning, although all activities must comply with COVID-19 security health procedures and limited duration of study. The current condition is known as VUCA or volatility, uncertain, complex, and ambiguity where the environmental circumstances are many changes are unstable so it takes a variety of abilities, skills, and strong characters to be able to adapt in the 21st century (Sinha and Sinha, 2020). Abilities and skills that must be mastered by someone include critical thinking, self-management, problem solving, literacy, communicating, collaborating, innovating, and creating. Learning today not only emphasizes the mastery of the material but also on high-level thinking skills in order to go hand in hand with problem-solving skills. Self-management is also necessary at the same time to encourage independence and the development of other life skills worth it. Critical thinking skills are skills in analyzing ideas based on facts and evidence so that a conclusion is obtained (Shriner, 2006). Self-management is defined as a technique of behavior change as desired. Some students assume that learning activities can only

be done in school so that some learners do not have the desire to use free time for individual learning activities at home, so as to support the success of learners, the importance of self-management must be emphasized (Nurwijaya, 2018).

Teachers must adapt to these interaction restrictions and move on to teaching and learning ways with various scenarios that support learners' learning (Flores and Swennen, 2020). Integration of skills and self-skills, mastery of technology, and adjustment of interactive teaching materials is certainly needed including in vocational high school Fisheries Biology (SMK) lessons with the Department of Fishing Boat Aeronautics. Based on the results of observations in the field it was found that the obstacles faced by the department were still limited textbooks for vocational fishery biology so that learners only get material sources from teachers or the internet. The material accessed by learners from various internet sources certainly makes it an additional task for teachers to evaluate the truth of the information they get. The results of interviews with teachers also showed that the percentage of final assessment results of the semester in 2020, nautic learners of fishing vessels of Lhokseumawe and Aceh Utara in solving fishery biology problems about reproductive and basic genetics in fish correctly, which is 29% including low, one of which is because fishery biology learning tends to use teacher centers with lecture methods so that it also makes learners less interested to study the material. In addition, the results of previous research on the critical thinking skills of SMK Aceh learners showed that the involvement of learners tends to be realized resulting in students' critical thinking skills are less well developed (Marwan, et al., 2016).

Flipped classroom learning can be used as an alternative to the optimization of the learning process and the devaluing of critical thinking and self-management skills due to the limited duration of school study. Flipped classroom learning is the idea of learning that is first done independently outside the classroom before finally being done face-to-face in the classroom (Betihavas, et al., 2016; Gilboy, et al., 2015; Nouri, 2016). The results of previous research show that it is this learning that enables learners to learn independently and responsibly, as well as encouraging learners to be actively involved during learning thus making learning while in the classroom more effective (Betihavas, et al., 2016; Gilboy, et al., 2015; Nouri, 2016). Educators are highly required to be able to adapt to technological advances and innovative pedagogy of learning in the face of the digital era and the industrial revolution 4.0 (Farida et al., 2019). Today educators can facilitate learners with various technological innovations such as computers, electronic whiteboards, electronic modules, etc. (Larson and Miller, 2011). If the results of previous studies flipped classroom learning generally uses video

as a teaching medium, then this research will use interactive electronic modules during learning. Electronic modules can be an innovative and interactive learning resource for learners that can be used anywhere and anytime (Zhang, et al., 2017). Based on the problems that have been raised before, one of the efforts that can be done is through research on flipped classroom learning implementation to improve critical thinking skills and self-management of vocational Students in reproductive materials and basic genetics of fish.

The study aims to determine the differences and improvements in critical thinking skills, differences in self-management management, and the correlation between self-management and critical thinking skills after the implementation of flipped classroom learning on reproductive materials and basic genetics of fish.

Method

This research was conducted at SMK Negeri 6 Lhokseumawe and SMK Negeri 1 Muara Batu because only 2 schools have majors in Aeronautical Fishing Vessels, especially in Lhokseumawe and North Aceh. This research involves a quantitative approach where research that prioritizes objective phenomena studied with statistical tests (Macdonald & Headlam, 2008). While this type of research is applied research with the aim of applying, testing, and evaluating the application of theory in solving practical problems (Sugiyono, 2010).

The method used in this study is an experimental method with a pre-experimental form and the research design used is One-Group Pretest-Posttest Design (Sugiyono, 2018). Convenience sampling is used for the determination of samples because students majoring in aeronautical fishing vessels encountered in class X are limited to 35 students, 30 from SMK Negeri 6 Lhokseumawe and 5 from SMK Negeri 1 Muara Batu.

The parameters measured in this study were critical thinking skills, self-management of students, and the correlation between the two. The instruments used in this study were instruments for collecting research data, namely: critical thinking skills test kits and student self-management questionnaires. The test set is in the form of multiple choice with the reason that it is used for data collection of critical thinking skills and has been adjusted to the existing criteria and indicators of critical thinking skills. Self-management data was taken through a questionnaire in the form of a questionnaire that included indicators of performance management and adoption relationship management from Xue and Sun (2011) using a Likert Scale. Tools to support the process of conducting research on lesson plan and student worksheet, and electronic modules.

Data on students' critical thinking skills were collected by conducting a pretest and posttest through a written test in the form of multiple-choice questions

with reasons. Self-management data was taken through a questionnaire in the form of a questionnaire that included indicators of performance management and adoption relationship management from Xue and Sun (2011) using a Likert Scale.

The data analysis technique of this research consists of statistical techniques. The scores obtained from the research parameters are percentage using the formula proposed by Sugiyono (2010) Equation 1.

$$Percentage\ value = \frac{Score\ obtained}{Max\ Score} x100 \qquad \text{……….. (1)}$$

The results of expert validation and test questions of critical thinking skills were then continued with validity and reliability tests to ensure that the instruments prepared were really good at measuring symptoms and producing valid data. Followed by the difficulty and discrimination test to determine the quality of the questions and further action to revise the questions if there are deficiencies. The data obtained from the pretest and posttest were analyzed through the normality test to see the normality of the data distribution and homogeneity was tested to see whether the standard variation of the data distribution was the same. The value of critical thinking skills obtained from the calculation is then categorized as in Table 1.

Table 1. Guidelines for the Measurement of Critical Thinking Skills

Value Interval	Categories
90-100	Very High
80-89	High
60-79	Medium
45-59	Low
0-44	Very Low

(Hapsari, 2016)

The results of the value of critical thinking skills were also analyzed to obtain a gain score. The gain score is used to see the improvement of critical thinking skills by using the formula from Meltzer (2002) Equation 2.

$$g = \frac{posttest\ score - pretest\ score}{maximum\ possible\ score - pretest\ score} \qquad \text{…… (2)}$$

Criteria:
Low   : $g < 0.3$
Medium : $0.3 \leq g \leq 0.7$
High   : $g > 0.7$

Paired sample t-test was used to determine differences in critical thinking skills before and after learning and analyzed with the help of the SPSS version 20 program at a significant level = 0.05 with the criteria if ($p < 0.05$) then ha is accepted. The self-management value obtained from the calculation is then categorized as in Table 2.

Table 2. Guidelines for Self-Management Measurement Categories

Value Interval	Categories
76 - 100	Good
56 - 75	Enough
41 - 55	Less Good
0 - 40	Not Good

(Arikunto, 2013)

The data obtained from the pretest and posttest were analyzed through normality test and homogeneity test. Paired sample t-test was used to determine differences in self-management before and after learning and analyzed with the help of the SPSS version 20 program at a significant level = 0.05 with the criteria if ($p < 0.05$) then ha is accepted. Pearson correlation test was used to find the relationship between self-management variables and students' critical thinking skills. Analysis of the relationship between these is calculated using correlation, where the correlation test is a technique used to measure the strength of the relationship between two variables. The formula used is Equation 3 (Sugiyono, 2010.

$$r_{xy} = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{\{N\sum x^2 - (\sum x)^2\} - \{N\sum y^2 - (\sum y)^2\}}} \qquad \text{……….. (3)}$$

Description:
rxy   = Correlation coefficient between variable x and variable y, the two correlated variables
$\sum xy$ = The number of times the x score and y score
$\sum x$ = Total score x as a whole
$\sum y$ = Total score of y
$\sum x2$ = Sum of the squares of the score x
$\sum y2$ = Sum of squares of y scores
N   = Number of Students

Determination of correlation was analyzed with the help of SPSS version 20 program, at a significant level = 0.05, with the criteria if ($p < 0.05$) then ha is accepted (correlated). The category of the magnitude of the correlation coefficient using the analytical method obtained from the above equation can be seen in Table 3. using the correlation coefficient.

Table 3. Interpretation of Correlation Coefficient Size Correlation Interpretation

Correlation Measure	Interpretation
0.90 to 1.00 (-0.90 to -1.00)	Very High Positive (negative) Correlation
0.70 to 0.90 (-0.70 to -0.90)	High Positive (negative) Correlation
0.50 to 0.70 (-0.50 to -0.70)	Correlation Positive (negative) Medium
0.30 to 0.50 (-0.30 to -0.50)	Low Positive (negative) Correlation
0.00 to 0.30 (-0.00 to -0.30)	Negligible Correlation

Source: Guilford (1973)

The results of data analysis are validated by experts to ensure the accuracy of the data and other factors that affect the research can be controlled.

Result and Discussion

The improvement of students' critical thinking skills as a whole displays an average n-gain of 0.61 in the medium category. If the n-gain is a percentage, the overall depiction of improving students' critical thinking skills can be seen in Figure 1.
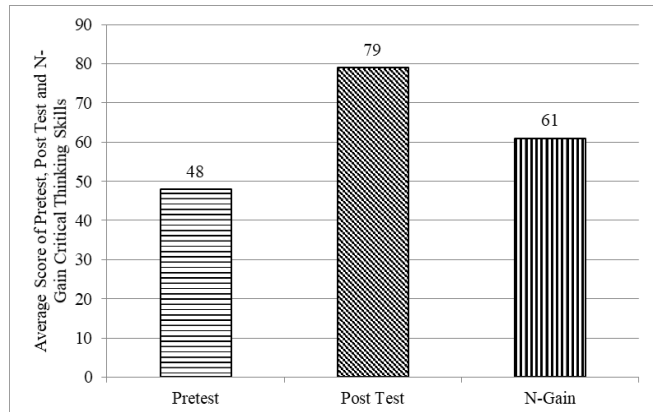

Figure 1. Average Pretest, Post Test and N-Gain Scores for Critical Thinking Skills Overall

The results of previous studies, flipped classroom learning generally uses video as a teaching medium, this study uses an electronic module which in addition to containing materials, exercises, and assignments, also contains learning videos, notes and interactive games related to learning. The results of the previous pretest, posttest and n-gain data indicate that the implementation of flipped classroom learning using electronic modules can improve students' thinking skills. Supported by Johnson et al. (2015) which states that flipped classroom learning can build students' individual learning skills (autonomous learning skills) and critical thinking skills (critical thinking skills).

Critical thinking skills are related to intellectual potential and environmental experience (Ornstein & Hunkins, 2004). The results of Kong's research (2015) that flipped classroom learning in general can support students to develop critical thinking skills. The use of school e-learning for learning preparation can support students to acquire basic knowledge and critical thinking processes efficiently outside the classroom without the constraints of time and location. This implies the need for careful planning of technology support in flipped classroom learning for the development of critical thinking skills.

Based on the analysis of critical thinking skills scores, it is known that the highest critical thinking skill criteria is focus where the indicator is understanding the

problems in the questions given with an average acquisition of 88. While the lowest criterion is inference where the indicator is choosing the right reasons to support the conclusions made by the average acquisition is 69. The results of the pretest and post-test of students' critical thinking can be observed in Figure 2.
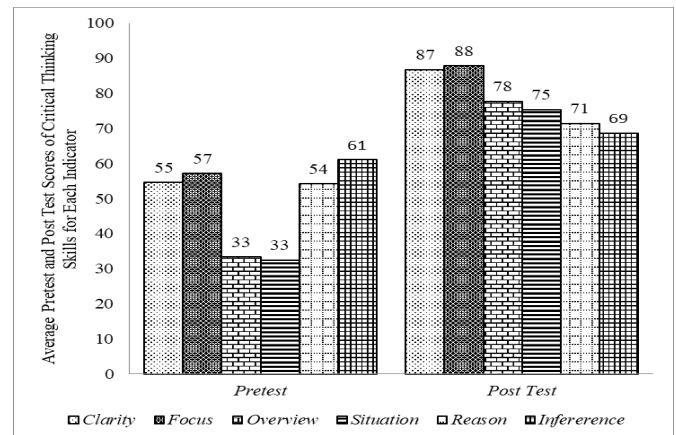
Figure 2. Average Score of Pretest and Post Test of Critical Thinking Skills for Each Indicator

Sarimanah (2017) mentions that the first step of critical thinking is to focus on the problem by finding out what the real problem is and how to prove it. The next step is to formulate the arguments that support the conclusion so that it can be accepted. If the reasons stated are correct, it must be shown how strongly the reasons can support the conclusions made. The situation is also an important thing that must be considered because thinking activities are also influenced by the environment or situations around them. In addition, the terms in the argument must be clear so that conclusions can be made correctly and the last thing to do is to thoroughly examine what has been found, studied, and concluded.

Based on Figure 2, the average value of the pretest to the post-test experienced a difference after the implementation of flipped classroom learning on reproduction and basic genetics of fish because the results of the Paired Sample Test where the significance was 0.000 <0.05. In addition, the posttest average score of 79 on critical thinking skills is in the medium category. The recapitulation of the average difference between the pretest and posttest scores can be seen in Table 4.

Table 4. Recapitulation of the Average Difference between Pretest Scores and Post Test Scores for Critical Thinking Skills

| Critical Thinking Skills	Average Score	Sig.	Description
Pretest	48	0.000	Significant
Post Test	79	0.000	Significant

Description:
Paired Samples Test (Significant, sig < 0.05)

Based on these data, the difference between pretest scores and post-test scores is due to learning by using electronic modules combined with flipped classrooms to build and train students' thinking skills with the student worsksheet design as the results of research by Johnson et al. in 2015 that flipped classroom learning can build students individual learning skills (autonomous learning skills) and critical thinking skills (critical thinking skills).

Saminan et al., (2016) suggested that during the learning process students are required to actively think so that at the end of the lesson they are familiar with critical thinking skills. Students who are active to ask and answer questions make it easier for them to answer the test because the concepts have been understood.

Self-management is one of the factors that influence the success of the learning process of students because with good self-management, learning activities will be more systematic so that it affects the improvement of their learning achievement. Self-management data was taken through a questionnaire that includes indicators of performance management and adoption relationship management from Xue and Sun (2011) which contains 21 statements. Self-management questionnaires were given to students before being given treatment (pretest) and after being given treatment (post-test). As for the data analysis of students' self-management questionnaires, the average score of performance management indicators is higher than relationship management with a ratio of 85:83. The data can be seen in Figure 3.
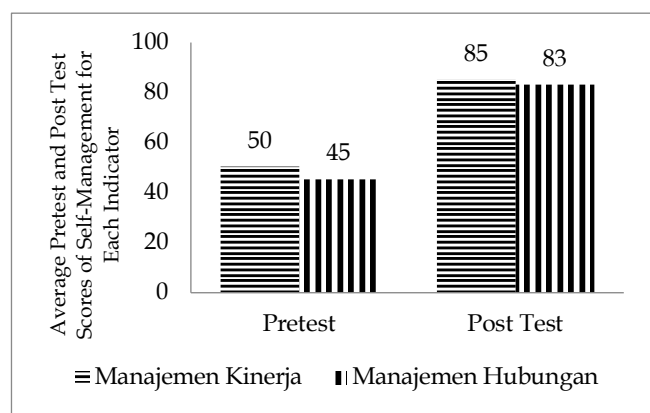
Figure 3. Average Pretest and Post Test Scores of Self-Management for Each Indicator

Based on Figure 3. the highest self-management indicator is performance management with a score of 85. Students are getting used to doing more systematic learning activities either independently or in class during flipped classroom learning. The electronic module motivates and assists students in achieving their curiosity about the basic reproduction and genetics of fish. They have studied the material independently before being actively involved during class learning. Students are also active during learning both during

discussions and presentations because they have already studied the ongoing material. The New Media Consortium (NMC) report on flipped classroom learning that can build students' individual learning skills (autonomous learning skills) and critical thinking skills (Johnson, et al., 2015).

Individual learning ability is part of self-management. Self-management plays a very important role in improving the quality of student learning achievements that can be realized properly (Nurwijaya, 2018). The ability of students to self-regulate is expected to have an impact on the optimal development of their capacity. The ability of students to manage themselves and have good character for themselves can achieve the achievement of educational goals (Chudari, 2017).

Meanwhile, the average measurement result of the relationship management indicator is lower than the performance management indicator, which is 83. This is because students are still not used to recognizing each other personally. This can happen because of the limited time to interact considering they have only known each other during face-to-face school for a few months. Although research results show people who can manage their emotions and personal relationships well have higher life satisfaction and enjoy better health. Efforts to improve the quality of life in accordance with the development of positive psychology (Xue and Sun, 2011).

Based on Figure 3. the average score of student's self-management between the pretest and the post-test overall is different because the results of the Paired Sample Test where the significance is 0.000<0.05. In addition, the posttest average score of 84 on self-management which the good category. The recapitulation of the average difference between the pretest and posttest scores can be seen in Table 5.

Table 5. Recapitulation of the Average Difference between Pretest Scores and Post Test Scores for Self-Management

Self-Management	Average Score	Sig.	Description
Pretest	48	0.000	Significant
Post Test	84	0.000	Significant

Description:
Paired Sample Tes (Significant, sig<0.05)

Based on Table 5. shows the significant level of the average score of the pretest and posttest there is a significant difference. This is because learning using electronic modules combined with flipped classrooms makes students more interested in participating in the learning process and makes it easier for students to master fish reproduction and basic genetics. In line with Du's research (2020) the flipped classroom learning model can improve students' self-management learning

abilities, stimulate student's self-study motivation, and activate students independent learning behavior.

Activities outside the classroom for students when studying and completing exercises and assignments on basic reproductive and genetic material in fish through electronic modules independently and activities in class through discussions and presentations which are part of the flipped classroom learning syntax make students more systematic in managing themselves complete activities during learning.

The correlation data between self-management and the results of students' critical thinking skills were measured to see if there was a relationship between the two. The recapitulation of the correlation test of critical thinking skills with students can be seen in Table 6.

Table 6. Recapitulation of the Correlation Test between Self-Management and Students' Critical Thinking Skills

Self-Management	Critical Thinking Skill	Correlation (r)	Sig.	Description
84	79	0.793	0.000	Signifikan

Description:
Pearson Correlation (Significant, sig < 0.05)

The research data shows the results of a positive and significant correlation relationship (Table 6.), meaning that the higher self-management, the higher the critical thinking skills of students. The results of the correlation analysis show that there is a correlation between self-management and critical thinking skills of students of 0.793 with a high positive correlation category meaning that self-management has a high relationship with critical thinking skills where the higher self-management, the higher critical thinking skills. In line with the research results of Fahim et al. (2014) There is a positive (significant) relationship between critical thinking and independent learning where self-learning integrates self-management with self-monitoring. Self-learning capacity is needed to carry out critical thinking reflection.

Flipped classroom allows students to learn independently and responsibly, encouraging students to be actively involved during learning so that classroom learning is more effective (Betihavas, et al., 2016; Gilboy, et al., 2015; Nouri, 2016). If the results of previous research on flipped classroom learning generally use video as a teaching medium, this research will use an interactive electronic module. Flipped classroom learning can build students' individual learning skills (autonomous learning skills) and critical thinking (critical thinking skills) (Johnson, et al., 2015).

Individual learning ability is part of self-management. Self-management plays a very important role in improving the quality of student learning achievements that can be realized properly (Nurwijaya, 2018). The ability of students to manage themselves and

have good character for themselves can achieve the achievement of educational goals (Chudari, 2017). Self-management is an important aspect and cannot be separated from students, because it is one of the factors that determine the level of critical thinking skills themselves.

Conclusion

The results showed critical thinking skills was increased which 0.61 with the medium category, there were differences in students critical thinking skills and self-management after the implementation of flipped classroom learning on reproduction and basic genetics in fish which the value of ρ is $0.000 \leq 0.05$, and there was a correlation between self-management and critical thinking skills of vocational students which 0.793 with high positive correlation category.

Acknowledgments

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