Elaboration of Active Knowledge Sharing Learning Model to Improve High Order Thinking Skills Integrated 4C

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ABSTRACT---- ***This research is an experimental study through elaborates the Active Knowledge Sharing (AKS) learning model to improve students' High Order Thinking Skills (HOTS). The low ability of students to analyze, evaluate, and create is due to the lack of application of questions that deliver students to solve problems that contain HOTS. The four stages in the AKS will serve as a reference for students' HOTS integrated 4Cs. The sample was a student in Chemical Engineering at the State Polytechnic of Ujung Pandang. The increase in the average aspects of HOTS (analysis, evaluation, and create) in the experimental class (N-gain = 94%) higher than the control class (N-gain = 57%). In the experimental class, the average score for HOTS of students was 37.7 and there was an increase in the average score in the posttest final measurement of 96.5 or an increase of 59 points with the average high-level thinking ability of students in the very good category. This indicates that the AKS learning model is effective in increasing the ability of HOTS as well as having an impact on students' 4Cs abilities.***

Keywords--- Active knowledge sharing, HOTS, 4C

1. INTRODUCTION

The demands of global competitiveness in creating competitive advantage are increasing rapidly, including the development of the competitiveness of human resources in facing challenges in the 21st century [1][2]. Some of the skills that are urgently needed in the 21st century as an absolute challenge for students and college graduates are abilities in the form of critical thinking skills, creative thinking, collaboration and communication termed the 4Cs, namely Critical Thinking, Creativity, Collaboration and Communication [3] [4]. Some of the material in the subject of current learning still makes it difficult for students to understand it if they do not have the right analytical skills in representing their knowledge and ideas when solving a problem given by the lecturer regarding the material. It appears that students' thinking abilities, especially in High Order Thinking Skills (HOTS) are still classified only in the Low Order Thinking Skills (LOTS) order.

Based on the research of [5] that HOTS such as logical thinking, critical thinking and reasoning skills are basic skills for everyday life, in addition to academic achievement. In line with the expression [6] reveal that High Order Thinking Skills are the ability to critical thinking, creative thinking and solve problems. Therefore, thinking at a high level is very important to be applied in a learning that can be synergized with an appropriate learning model. The main point is based on increasing High Order Thinking Skills as an ability or skill of students that really needs to be developed through collaboration or sharing with other students in solving a problem because it will have an impact on students' motivation to increase their curiosity in mastering the material provided by the lecturer. In the end, students will not only understand and master what and how something happens, also provide understanding and mastery of a phenomenon about why something can happen. In addition, without the habit of practicing problem solving skills by students, material related to concepts will make it difficult for students to understand them [7] [8].

The desire to share knowledge by students in Chemical Engineering at the State Polytechnic of Ujung Pandang is still relatively low, although only 2 or 3 students seem to share knowledge through small discussions, especially on Industrial Management material, it is more dominant that students only focus on one question form. When faced with other problems, where the questions given are changed, students will be confused and less able to solve problems and are not creative in finding problem solving solutions. The low level of HOTS is due to errors in coding, process skills, transformation, and student understanding as well as difficulties in interconnecting problem solving implementation strategies or problems [9]

One of the learning models that can provide opportunities for students to play an active role in learning as well as form teams in the form of collaboration (team building) is Active Knowledge Sharing [10] [11]**.** This model will reduce students' individualism in learning through sharing their knowledge with other students, both from group members and from other group in learning. The competition still occurs but is lighter (softer) because it raises students' motivation to learn through sharing knowledge, thus generating ideas through sharing each other's ideas and then forwarding them to reasoning of these ideas [12]. The elaboration will be done by integrating questions in the form of HOTS which will eventually stimulate students' analytical thinking to have HOTS as a form of increasing the level of student thinking dimensions from Low Order Thinking Skills to High Order Thinking Skills. This study will provide solutions to increase student knowledge, especially HOTS through the elaboration of the AKS learning model which will have an impact on students' ability to improve thinking skills with four main dimensions (4C) as aspect that integrated in Active Knowledge Sharing learning model, namely Critical Thinking, Creativity, Collaboration and Communication based on Bloom's taxonomy and synergized with the ability to analyze, evaluate, and create.

2. RESEARCH METHOD

This research is a research using a quasi-experimental design with the application of the Active Knowledge Sharing learning model to vocational students in Chemical Engineering at the State Polytechnic of Ujung Pandang with two classes, namely the experimental class and the control class. The experimental class is class 3B where the treatment is given by applying the Active Knowledge Sharing learning model while the control class, namely class 3A is given a learning model following the learning process in accordance with the Lecturer's RPS. The elaboration of the Active Knowledge Sharing learning model in this study aims to improve HOTS based on 4C abilities, namely Critical thinking, Creativity, Communication and Collaboration. In the end, students are not only able to carry out various knowledge including using critical and creative abilities as well as collaborate by building collaboratively. The phases or stages of the Active Knowledge Sharing (AKS) learning model to improve High Order Thinking Skills (HOTS) are as follows:

1. Response phase

   This phase is the initial stage where students are given a series of questions that are done individually (each member of the group) to answer the questions given by the lecturer. The response stage can be a critical or transitional stage, where students use their understanding and prior knowledge (Low Order Thinking Skills) to transform into an early stage of High Order Thinking Skills, namely the ability to analyze.

2. Reasoning phase

   The reasoning phase is the stage where each group collects the answers it gets and then discusses it carefully among group members to formulate clearly and precisely the questions that exist. At this stage, the lecturer will provide an analogy for everything to stimulate students in HOTS, so that critical thinking and creative thinking skills can be stimulated much better.

3. Perception equalization phase

   The perception equalization phase is the stage where students discuss the answers of each group member then collaborate with other groups to equate the answers and conduct small discussions to identify the answers obtained during communication and collaboration with team members and other.

4. Evaluation phase

   At this phase, the lecturer gives questions or problems that hone students' critical and creative thinking skills by modifying the questions given at the initial stage to determine students' individual analytical skills through the integration of questions that match the HOTS indicator.

The improvement of students' ability in solving HOTS questions is strongly supported by three important aspects according to Bloom's taxonomy which was revised by Anderson and Krathwol namely analysis, evaluation, and create. The HOTS questions grid in this research can be seen in Table 1 below.

Table 1. HOTS Question Grid

Indicator	*Measured Aspect*	*Level Cognitive*	*No. Question*
Analysis	*Students are able to separate the material into its constituent parts and detect how a part relates to one other part, as well as being able to use appropriate formulas and identify/formulate the questions given.*	*C4*	*1, 2*
Evaluation	*Students are able to make decisions based on standard criteria, such as checking work results and criticizing or giving opinions on a case as a whole*	*C5*	*1, 2*
Create	*Students are able to put elements together to form a coherent whole towards the completion of a case as a whole and are able to draw conclusions and make drawings/graphs.*	*C6*	*1, 2*

3. DATA ANALYSIS AND DISCUSSION

4.1 Data analysis

After the application of the Active Knowledge Sharing (AKS) learning model, the results of the average HOTS of students in the control class had a pretest of 54, after the posttest there was an increase in the average higher order thinking ability of students by 80 or around 57, 6%. The average increase in HOTS of experimental class students at the pretest was 38 and an increase after the application of the AKS learning model was 96 or an increase of 94.2%. This increase is seen in three aspects, namely analysis, evaluation and create.

Table 2. Description of Test Data for Control Class and Experiment Class

Statistical Description	*Control*		*Experiment*	
	Pretest	*Posttest*	*Pretest*	*Posttest*
Mean	*54*	*80*	*38*	*96*
Minimum	*54*	*66,7*	*38*	*87,5*
Maximum	*80*	*91,7*	*96*	*100*
Standard Deviation	*15,2*	*7,5*	*12,53*	*3,79*
Gain (%)	*57.6*		*94.2*	

Based on the table above, it can be seen that the highest score in the control class rose from 80 at the pretest to 91.7 after the posttest, while the minimum score from 54 at the pretest became 66.7 at the posttest. For the experimental class, the minimum score increase at the pretest was from 38 to 87.5 at the posttest. As for the highest score obtained by students in the experimental class, it rose to 100 which previously the maximum value was only around a score of 38. For the increase in the average percentage in the control class, it increased from pretest to posttest by 57.6%, while in the experimental class it increased by 94.2%. If the average increase is compared between the pretest and posttest scores, the increase in the experimental class is higher than the control class with a difference of 36.6%.

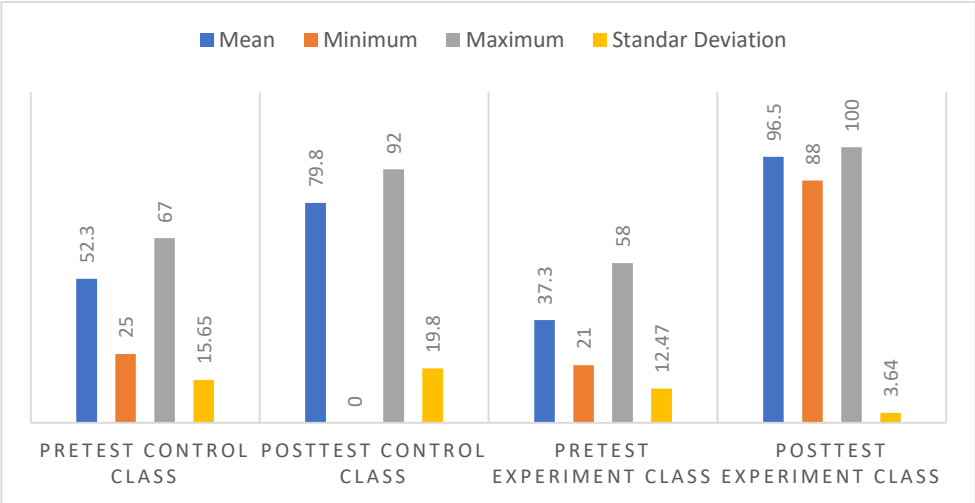

Figure 1. Comparison Diagram of Control Class and Experiment Class

Figure 1 is a chart to see the increase through the average score of students' HOTS in the control class and the experimental class which indicates that the increase in scores obtained by the experimental class students is higher than the control class.

Normality test was conducted to determine whether the analyzed data came from a normally distributed population or not. The test technique used is Saphiro Wilk at a significant level of 0.05. Predominantly, the control and experimental data for the pretest and posttest were not normally distributed, so that the hypothesis testing that will be used refers to nonparametric statistical testing. The level of similarity of variance between experimental class and the control class to accept or reject the hypothesis by comparing the *p* value on Levene's statistic with 0.05 ($p > 0.05$).

The results of the homogeneity test of the research variables are known that the Lavene statistic value for the pretest is 0.285 (homogeneous) and the posttest is 0.040 (not homogeneous). From the results of the calculation of the significant price of the pretest data greater than 0.05 ($p > 0.05$), it can be concluded that the data in this study has a homogeneous variance, while in the posttest analysis that the data is not homogeneous. This indicates that HOTS of the control class and experimental class students is different after being given treatment.

The effect of applying the AKS learning model in improving students' HOTS used the Mann-Whitney test analysis using SPSS, the conclusion of the study was significant if $p < 0.05$. The summary of the Mann-Whitney test is shown in the following table 3.

Table 3. Summary of Mann-Whitney Test Results

	Pretest	***Posttest***
Mann-Whitney U	*95.00*	*22.00*
Wilcoxon W	*326.00*	*275.00*
Z	*-3.341*	*-5.163*
p	*0.001*	*0.001*

Based on the table above, the results of the Mann-Whitney test on the pretest and posttest are $p < 0.05$ with a significance level of 5%, which means that there is a difference in the average scores of students' HOTS in the two classes. This indicates that there is a significant increase in the HOTS scores of students in the experimental group after the application of the AKS learning model compared to the control class.

The increase in the average pretest and posttest scores was calculated using the normalized average gain formula. Based on the normality gain test, it can be concluded that the increase that occurred after the application of the AKS learning model was in the high category of 0.94 (94%), while the control class was in the medium category of 0.57 (57%). The comparison of HOTS gain of students in the control class and the experimental class can be seen in the Figure 2.

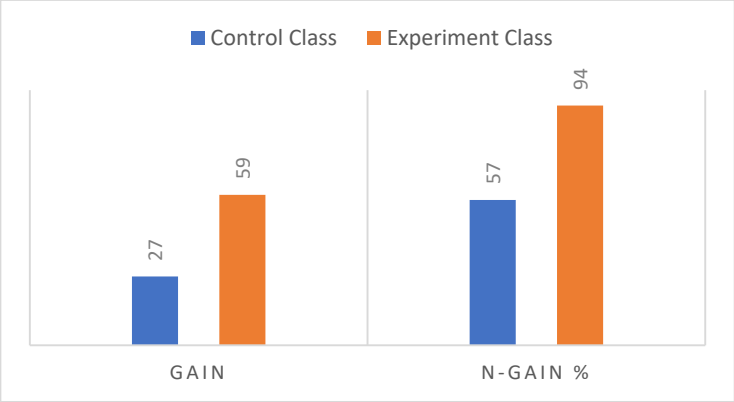

Figure 2. Comparison of *N*-Gain Diagram of Higher Order Thinking Skills for Control Class and Experiment Class

The improvement of students' HOTS is based on the HOTS category which consists of 3 scales, namely high, medium and low. This increase is useful to see the difference in the results of students' higher order thinking skills (HOTS) after the application of the AKS learning model. The results of the processed data are presented in the following figure 3.

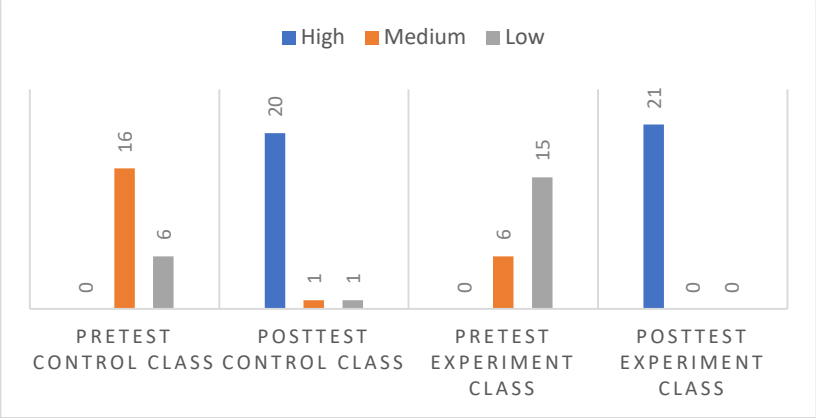

Figure 3. Comparison of Higher Order Thinking Skills for Control Class and Experiment Class

Based on the picture above, it can be seen that in the control class there was an increase in students' high-level thinking skills in the "High" category from 0 students to 20 students and the "Medium" category from 16 students to 1 student, and the "Low" category from 6 students to 1 student. Meanwhile, students' High Order Thinking Skills in the experimental class before the application of the AKS learning model were not in the "High" category, 6 students were in the "Medium" category and 15 other students were in the "Low" category. After the application of the AKS learning model in the experimental class, students' HOTS experienced a significant increase in the "High" category as many as 21 students, and there were no more students in the "Medium" and "Low" categories. Although both classes showed an increase in students' HOTS, the increase in the experimental class was more significant. This indicates that the AKS learning model provides an improvement in the high-level of thinking skills of Chemical Engineering students at the State Polytechnic of Ujung Pandang on Industrial Management material.

The results of the effect size test on the model validation test were carried out based on the Cohen formula. From the calculation results, it is found that the effective contribution of treatment is the application of the integrated AKS learning model and High Order Thinking Skills (HOTS) in improving students' higher order thinking skills of d = 6.559 and the effect size is based on r = 0.955. The test results are in the category of large effects or mean that the application of the AKS learning model is effective in improving students' HOTS. Meanwhile, in the control class, it can be seen that the application of the AKS learning model also provides an effective contribution to students' HOTS of d = 1.577 and the effect size is based on r = 0.612, this result is in the medium effect category. Based on the results of data analysis, it can be concluded that the application of the AKS learning model is more effective in improving students' HOTS.

4.2 Discussion

The application of the Active Knowledge Sharing learning model to improve HOTS appears to have a relationship between the phases of the AKS learning model and 4C skills which can be seen in table 4.

Table 4. Relationship of Active Knowledge Sharing Learning Model with 4C Skills

Phase	***Skills***
Response	*The stage of explaining the material is then followed by giving a series of questions that are done individually intended to grow analytical skills, so that students can awaken students' critical thinking and communication skills. This stage is a transition stage, where the students' initial knowledge transformation in the category of Low Order Thinking Skills leads to High Order Thinking Skills (analyze).*
Reasoning	*This stage emphasizes discussion activities (Communication) comprehensively in discussions between groups after carefully formulating questions for each group of students (Collaboration). Giving questions that require analogous thinking stimulates students in HOTS, so that critical and creative thinking skills can be stimulated much better. Students' evaluation abilities will appear in activities in determining appropriate (logical) answers to solve problems/cases given through the use of new ways or new ideas created from the problem-solving process they go through, thereby generating (creating) new knowledge associated with them. with previous student knowledge.*
Perception Equalization	*At this stage, students' critical abilities are formed to start activities in solving problems at a higher level or order, so that students begin to be able to enter the initial evaluation stage to solve problems and begin to use their creative thinking power to identify answers obtained during communication and collaboration. .*
Evaluation	*This stage is the distribution of questions or problems that hone students' critical and creative thinking skills by modifying the questions given at the initial stage to determine the analytical skills of individual students through the integration of questions that match the HOTS indicator.*

The results of the analysis of improving students' HOTS in the aspects of analysis, evaluation and creation. It can be seen in table 5 below.

Table 5. The Improvement of Mean Pretest and Posttest Scores for Experiment Class and Control Class

Level HOTS	*Mean Score Control Class*		*Mean Score Experiment Class*	
	Pretest	*Posttest*	*Pretest*	*Posttest*
Analysis	*3*	*4*	*2*	*4*
Evaluation	*2*	*3*	*1*	*4*
Create	*1*	*4*	*1*	*4*

Table 7 above shows three indicators of the HOTS level or higher order thinking which indicates that students still have difficulty answering questions on indicators at all HOTS levels. Students were still difficult to distinguish between concepts and detect relationships between parts of one and the others. Another difficulty is seen that students are still not able to use the appropriate formula in solving problems in a case or question given by the lecturer and are still low in identifying/formulating the questions given by the lecturer. This is in line with the research results of Hadi & Faradillah (2020) that among several HOTS indicators, students still have difficulty solving problems that lead to aspects of analyzing or reasoning. This is caused by the learning process that does not fully activate students in solving HOTS problems. Meanwhile, according to Eliza (2020), HOTS can be increased if students actively seek answers to explore in depth the concept of existing problems by analyzing each answer obtained and evaluating it to create the right solution to the problem.

After the application of the AKS learning model in the experimental class, there was an increase in analytical skills from an average score of 2 to 4. While in the control class the average score was 3 to 4. This explains that students have been able to sort the material into parts and able to use the appropriate formula in answering problems (solving problems), also able to identify or formulate the direction of questions from the given case. On the 4C skill side, what appears is the ability to think critically where students reason on a case through collaboration between group members on alternative solutions in answering questions/cases.

At the HOTS level, the evaluation reflected that students before applying the learning model were still at the level of results and were lacking in checking work results or giving opinions. After the process of implementing the AKS learning model in the experimental class there was a change in evaluation ability with an average score of 1 to 4, while in the control class from an average score of 2 to 3. This indicates that most students are able to make decisions. based on standards or criteria, able to check work results, criticize or give opinions on a case as a whole. On the skill side, students' communication and collaboration skills are reflected which lead to knowledge sharing activities.

At the HOTS level, it appears that students still have difficulty in generalizing the results or ideas from the analysis and evaluation that have been carried out where the ability to make logical conclusions according to the case is still very weak. After the application of the Active Knowledge Sharing (AKS) learning model, students begin to be able to analyze and evaluate cases until finally they are able to create the right solution through the formation of a control chart correctly accompanied by logical conclusions from the given case. At this stage, the generalization ability of students is increasing. The increase in the average score before implementation is the average score from 1 to 4 in the experimental class. In the control class, the average increase in creative ability scores is 1 to 4.

From the results of the analysis, it can be seen that both the experimental class and the control class experienced an increase in the average score in answering HOTS questions in the aspects of analysis, evaluation and creation. Although there was an increase in HOTS scores in both classes, the increase in the experimental class (*N*-gain = 94%) was higher than the control class (*N*-gain = 57%). This indicates that the Active Knowledge Sharing (AKS) learning model is effective in increasing the High Order Thinking Skill involve students' 4C abilities.

4. CONCLUSION

The results of this study can be concluded that the ability of students' High Order Thinking Skills (HOTS) increases through the elaboration process that is applied through the Active Knowledge Sharing (AKS) learning model. The four phases in the application of the AKS learning model have integration with students' 4C abilities, namely collaboration, communication, critical thinking and creativity which are enhanced by giving cases or questions containing HOTS.

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