

The Effectiveness of Contextual-Inquiry Lesson Plan on Higher Order Thinking Skills

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ABSTRACT

Teaching and learning strategy are important in teaching-learning processes to produce effective and efficient learning, and achieving the learning goals. Contextual inquiry is one of the models that can accommodate students to express their own opinions when dealing with all problems they faced during learning process. The purpose of this study is to test the effectiveness of application of contextual inquiry lesson plan on students' higher order thinking skills. This study is quasi-experimental research using pretest-posttest designs. The research subject is determined through random sampling method. Data collected through pretest and posttest and measured by using essay tests. The data statistically analyzed by using independent sample t-test using SPSS 22. for Windows. The result shows that there was a significant difference between experiment class and control class in higher order thinking skills (tcount= 1,549; p =0,125). The result concludes that there is influence of contextual inquiry lesson plan on students' higher order thinking skills.

Keywords: *higher order thinking skills, effectiveness, contextual-inquiry, learning model*

1. INTRODUCTION

Teaching and learning strategy are important in teaching-learning processes to produce effective and efficient learning, and achieving learning goals. There are many learning models used to convey information to students in mastering knowledge, skills and attitudes. The model used to motivate students to be able to use their knowledge to solve problems will be different from the model used to encourage students expressing their own opinions in dealing with all problems. However, although they models have different purpose, the main goal are similar, that is to make learning more effective and efficient [1].

Inquiry-based learning has been known as one of learning approaches used to improve students' science achievement. Contextual inquiry is a varied process and comprises the activities to observe, to formulate relevant questions, to evaluate books and other sources of information critically, to design an investigation, to review what is known, to conduct experiments with the use of instruments to obtain data, to analyze and interpret data, and also to make prediction and communicate the results [2]. Inquiry-based learning

approach is underpinned with a constructivist learning, in which students build an understanding by using their own views or pre-existing knowledge. Therefore, since learning is an interaction between new and pre-existing knowledge, students construct their own conceptions through intellectual development activities [3,4].

According to prerequisite study at Biology Department of Faculty of Mathematics and Natural Sciences in Universitas Negeri Medan, students' learning outcome in microbiology course was low. It was reflected from the mean score of final test achieved by students in academic year 2014/2015, which was not yet able to reach 'B' level (80-89). Further, some students tend to show the lack of response during learning process in microbiology course. Lecturers implied that the processes of experimenting, learning, and test, that focusing on improving students' higher order thinking skills was rarely done in this course.

The problems need to be solve in order by faculty to improve students' learning achievement. One of the ways is by selecting the best method to make students actively engage in learning, such as by applying contextual inquiry model in learning. Using contextual-

inquiry model known able to improve students' achievement and higher order thinking skills or HOTS. Newman distinguishes between lower and higher order thinking. He concludes that lower order thinking demands only routine or mechanical application of previously acquired information such as listing information previously memorized and inserting numbers into previously learned formulas. In contrast, higher order thinking, according to Newman, challenges the student to interpret, analyze, or manipulate information [5]. However, according to Pohl, higher order thinking skills are cognitive level of analyzing (C4), evaluating (C5), and creating (C6) [6].

Applied researches to train HOTS in the classroom generally related to the teaching strategy and its measurement (assessment) methods. Inquiry-based learning models and cooperative learning have been proven able to train students' higher order thinking skills. However, some require carefulness in compiling appropriate lesson designs. The biggest challenge is how to compile a lesson design that can train students during learning to be able to apply higher-order thinking frameworks in solving scientific cases they face through a series of planned and systematic training processes. Including discussion or practicum methods in learning and combining them with certain models is not necessarily possible train HOTS which is immutable, if the lesson design is only arranged based on the syntax of the model, and is not designed with a good learning architecture. The application of inquiry learning model is recognized and proven in various studies to be quite effective in training students to think at higher levels. The learning model that is able to encourage students to ask quality questions and also express quality responses is a learning model that can be used to train HOTS. Christine Chin from the National Institute of Education Singapore conducted a number of research related to how to improve the skills of students in making quality questions. The results of his research show that the ability to ask questions is a reflection of the level of thinking of students [7-11].

2. METHOD

This research conducted at Biology Department, Faculty of Mathematics and Natural Sciences, Universitas Negeri Medan, located at Jalan William Iskandar Pasar V – Postal code 20221. The research held from February 2017 to June 2017. This research was quasi experiment using pretest-posttest designs, to test the effectiveness of contextual inquiry-lesson plan which was previously developed before, by testing whether there was a significant difference in higher order thinking skills between control class and experiment class. The sample was Biology education undergraduate students who were currently taking microbiology course. Experimental class and control

class was determined through random sampling method. Experimental class (42 students) taught according to inquiry contextual-lesson plan and control class (40 students) was taught by using direct learning. The data analyzed by using inferential statistics to test the hypothesis. Normality test and homogeneity performed as prerequisite tests. The hypothesis was statistically tested by using independent sample t-test at significance level 0.05 using SPSS 22.0.

3. RESULT AND DISCUSSION

1.1. Result

Pretest results showed that mean scores of students' higher order thinking skills in contextual inquiry class was 62.86 ± 8.98 with maximum score achieved was 80 and minimum score achieved was 45. Mean score of students' higher order thinking skills in control class was 59.05 ± 13.17 , with maximum score achieved was 80 and minimum score achieved was 35. Analysis by using Levene's homogeneity test showed that both of the classes have similar means scores statistically ($t_{count} = 1.549$; $p = 0.125$). Therefore, the initial ability of students before being treatment was not significantly different or relatively the same. Further, normality test results showed that both pretest data of students in experiment class ($Z = 0.804$; $P = 0.538$) and control class ($Z = 1.074$; $P = 1.199$) were normally distributed.

Posttest results showed that mean scores of students' higher order thinking skills in contextual inquiry class was 70.36 ± 11.76 with maximum score achieved was 90 and minimum score achieved was 50. Mean score of students' higher order thinking skills in control class was 66.62 ± 15.55 , with maximum score achieved was 85 and minimum score achieved was 20.

Hypothesis testing result revealed there was significant difference in mean scores of higher order thinking skills between students in contextual inquiry class and students direct learning class in microbiology course ($t_{count} = 4.908$; $p = 0.000$). Therefore, it could be conclude that contextual inquiry lesson plan was feasible to use in microbiology course because it could increase students' higher order thinking skills. The difference higher order thinking skills in both classes before and after treatment displayed in **Figure 1**.

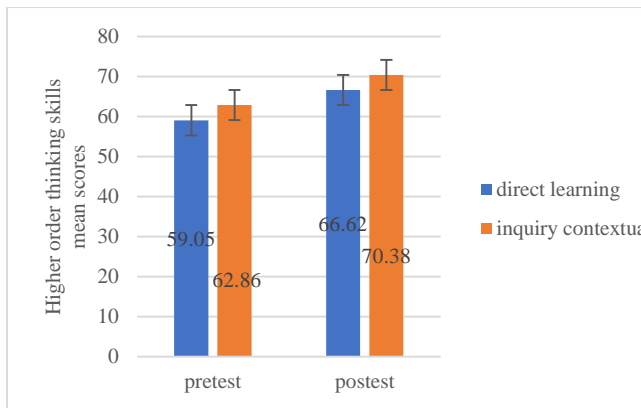


Figure 1. The difference higher order thinking skills in control and experiment classes before and after treatment

1.2. Discussion

The result revealed that there was a significant difference in higher order thinking skills between students taught by using direct learning and students taught by contextual inquiry model in microbiology course. Choosing the best method for learning is important because not all courses could be produce the optimum benefit in learning with the same method that applied in other courses. The used of contextual inquiry have been used in learning for a long time, and usually generate satisfying results in learning various courses. In physic course, the used of inquiry-based learning could increase ability of undergraduate physic students in mastering physic content and scientific reasoning [12]. In undergraduate chemistry classroom, process-oriented guided inquiry learning intervention provides positive affective experiences to students who are new to chemistry or have limited prior chemistry knowledge [13]. Further, it is reported also able to improve cognitive skills, scientific work and attitudes of undergraduate students in non-science majors when learning natural science course [14].

The used of inquiry-based learning in microbiology course also has been done previously by others. The implementation of a contextual inquiry-based student worksheet have been reported able to enhance higher order thinking skills of biology undergraduate students while learning water microbiology course [15]. The improvement of students' higher order thinking skills in contextual inquiry class might cause by the type of activities provide in contextual inquiry lesson plan. In contextual inquiry learning, they were allowed to formulate hypotheses, make observations, analyze data, evaluate explanations from the evidence, and communicate their findings and ideas. Higher order thinking skills according to Bloom's revised taxonomy were ability to analyzing, evaluating and creating. Therefore, if student perform all those activities

provided in contextual inquiry lesson plan correctly, is possible they could gain better understanding of microbiology concept, which in the end also improving their higher order thinking skills.

4. CONCLUSION

The research conclude that there was significant differences in mean scores of higher order thinking skills between students in contextual inquiry class and students in direct learning class in microbiology course. Therefore, the contextual inquiry lesson plan that developed previously was feasible to use in microbiology course because it could increase students' higher order thinking skills.

REFERENCES

- [1] W. Sanjaya, Strategi pembelajaran berorientasi standar proses pendidikan. Jakarta: Prenada Media Group, 2009
- [2] C. Lotter, W. Harwood, and J. Bonner, "The influence of core teaching conceptions on teachers' use of inquiri teaching practices", *Journal of Research in Science Teaching*, vol. 10, no. 102, pp. 1-5, 2006. DOI: <https://doi.org/10.1002/tea.20191>
- [3] P.R., Burden, and D.M. Byrd, *Methods for effective teaching: meeting the needs of all students*, 5th ed. Boston: Allyn & Bacon, 2010
- [4] M.K. Sağlam, and M. Şahin, "Inquiry-based professional development practices for science teachers", *Turkish Science Education*, vol. 14, no. 4, pp. 66-76, 2017. DOI: 10.12973/tused.10213a.
- [5] F.M. Newman, "Higher order thinking in teaching social studies: A rationale for the assessment of classroom thoughtfulness", *Journal of Curriculum Studies*, vol. 22, pp. 41-56, 1990. DOI: <https://doi.org/10.1080/0022027900220103>
- [6] M. Pohl, *Learning to think, thinking to learn: Models and strategies to develop a classroom culture and thinking*. Cheltenham, Vic: Hawker Brownlow, 2000
- [7] C. Chin, "Students' questions: Fostering a culture of inquisitiveness in science classrooms", *School Science Review*, vol. 86, no. 314, pp. 107-112, 2004

- [8] C. Chin, "Using self-questioning to promote pupils' process skills thinking", *School Science Review*, vol. 87, no. 321, pp. 113–122, 2006
- [9] C. Chin, D.E. Brown, and B.C. Bruce, "Student-generated questions: A meaningful aspect of learning in science", *International Journal of Science Education*, vol. 24, no. 5, pp. 521–549, 2002. DOI: <https://doi.org/10.1080/09500690110095249>
- [10] C. Chin, and L.G. Chia, "Problem-based learning: Using students' questions to drive knowledge construction", *Science Education*, vol. 88, pp. 707–727, 2004. DOI: <https://doi.org/10.1002/SCE.10144>
- [11] C. Chin, and G. Kayalvizhi, "Posing problems for open investigations: What questions do pupils ask?", *Research in Science and Technological Education*, vol. 20, no. 2, pp. 269–287, 2002. DOI: <https://doi.org/10.1080/0263514022000030499>
- [12] K. Suma, "Efektivitas pembelajaran berbasis inkuiri dalam peningkatan penguasaan konten dan penalaran ilmiah calon guru fisika", *Jurnal pendidikan dan pengajaran*, vol. 43, no.6, pp. 47 – 55, 2010. DOI: <http://dx.doi.org/10.23887/jppundiksha.v43i1.1701>
- [13] D. Vishnumolakala, D. Southam, M. Treagust, Mocerino and S. Qureshi, "Students' attitudes, self-efficacy and experiences in a modified process-oriented guided inquiry learning undergraduate chemistry classroom", *Chem. Educ. Res. Pract.*, vol. 18, no. 2, pp. 340-352, 2017. DOI: <https://doi.org/10.1039/C6RP00233A>
- [14] R. Cahyani, N.Y. Rustaman, M. Arifin, and Y. Hendriani, "Kemampuan kognisi, kerja ilmiah dan sikap mahasiswa non ipa melalui pembelajaran inkuiri berbantuan multimedia", *JPII*, vol. 3, no. 1, pp. 1-4, 2014. DOI: <https://doi.org/10.15294/JPII.V3I1.2894>
- [15] Y.A. Nasution., T. Gultom, and Hasruddin, "The development of contextual inquiry-based student worksheet to enhance higher order thinking skills for the topic of water microbiology", *Advances in social science, education and humanities research*, vol. 200, pp. 1-10, 2018. DOI: <https://doi.org/10.2991/aisteel-18.2018.2>