European Journal of Education Studies
ISSN: 2501 - 1111
ISSN-L: 2501 - 1111
Available on-line at: www.oapub.org/edu

doi: 10.5281/zenodo.3345924 Volume 6 | Issue 3 | 2019

DISCOVERY LEARNING METHOD FOR TRAINING CRITICAL THINKING SKILLS OF STUDENTS

Fahmi[1],
Iswan Setiadi[2i],
Diah Elmawati[3],
Sunardi[4]
[1,2]Master Program of Natural Science Teacher,
Lambung Mangkurat University,
Banjarmasin, Indonesia
[3,4]Science Teacher at Junior High School 1,
Banjarmasin, Indonesia

Abstract:
Teachers are not only required to teach knowledge to students but also skills. Among those demanded in the current era are critical thinking skills, where when students see a problem they are able to solve it and are able to remember what the problem is, how to solve it, and what the results might be. Classroom learning will be interesting and able to train student critical thinking skills if they are taught how to conduct research starting with simple stages to find a conclusion or knowledge. Departing from this, learning by using the method of discovery learning takes a large role with the concept of discovery which is the basis of the method to train student critical thinking skills.

Keywords: discovery learning method, critical thinking, science learning

1. Introduction

The teaching-learning process that occurs at this time is not yet many teachers who create conditions and situations that enable students to carry out critical thinking processes (Fahmi, 2018). This is demonstrated in teaching and learning activities in schools. Teachers usually explain what has been prepared and provide routine and procedural practice questions, then students record or copy and memorize the formulas or rules of science that are delivered without understanding the meaning and essence (Fahmi, 2016; Zaini, 2016).

The strategy that is most often done by teachers to activate students is to involve students in discussions with the whole class, which is alternating interaction with teachers (Setiadi, 2018). Based on the conditions of the learning activities, students are

[i] Correspondence: email ibnusuwandy@gmail.com

not trained to think critically. Even though one of the long-term goals of science learning is to develop critical thinking. As Fruner and Robinson (2004) stated that to improve critical thinking skills in science learning must be focused on understanding concepts with various approaches rather than procedural skills that would not make students think deeply.

Facione (2012) states that there are three specific strategies for learning critical thinking skills, namely building categories, determining problems, and creating a supportive environment. Learning methods that have these characteristics include learning with the discovery method. This is based on the discovery learning process described by Plomp and Nieveen (2007), namely orientation, composing hypotheses, testing hypotheses, making conclusions and evaluating (controlling). The series of activities in the discovery learning process is a structured activity in critical thinking skills. Thus the science learning process with discovery can stimulate students to think critically (Watson and Galser, 2012).

Efforts to improve in order to improve critical thinking skills with discovery learning are focused on giving students the opportunity to actively build knowledge, meaning that knowledge is found, formed, and developed by students both individually and in groups using cooperative learning. This is because learning is a social process that cannot occur without the interaction between students (Balim, 2009). Learning activities and working cooperatively in small groups can accommodate the development of science thinking critical skills.

2. Discussion

2.1 Critical Thinking Skills

Critical thinking is a directed and clear process used in mental activities such as solving problems, making decisions, persuading, analyzing assumptions, and conducting scientific research (Johnson, 2010). The purpose of critical thinking is to achieve deep understanding that leads to continuous learning over a long period of time.

According to Sivasubramaniam (2015), that high-level thinking (Higher Order Thinking) in it includes critical thinking and problem solving. Higher-order thinking skills are more challenging in learning or teaching are also more valuable because the skills (skills) are needed by each individual to solve problems. Saido et al. (2015), the main purpose of science education is to help students develop high-level thinking skills to face challenges in everyday life.

Watson and Glaser (2008) mention there are five indicators to measure critical thinking skills, namely:

a. Inference, which distinguishes between truth and error from conclusions taken from observational data or facts provided.
b. Recognition of assumptions, namely recognizing unwritten assumptions or presuppositions in the statements given.
c. Deduction, which is determining whether the conclusion must follow the information in the report given.

d. Interpretation, which is deciding whether generalizations or conclusions based on the data provided can be accounted for.
e. Evaluation of arguments, which is to distinguish between arguments that are strong and relevant or not relevant to a particular issue.

Critical thinking is defined as the ability to think rationally and logically. Critical thinking is an active process that involves, analyzes, learns and observes problems to get final conclusions. A professional critical thinker asks important and critical questions to explore the possibility of solutions, gather concrete ideas and abstracts from different sources, conclude a reasonable and logical relationship between different opinions, and solve problems through systematic information gathering. Some researchers have suggested different skills for the development and promotion of critical thinking. These skills consist of: analyzing, applying standards, discrimination, seeking information, logical reasoning, predicting and changing knowledge (Fattahi and Haghverdi, 2015).

According to Shukri and Mukundan (2015), the emphasis on learning on critical thinking is as follows:

1) Encourage students to be more interactive in learning.
2) Encourage students to expand their focus on learning about certain parts.
3) Critical thinking activities can foster awareness of students to take a reading and literature study approach.
4) Need to recognize instruction in critical thinking skills through teaching literature to emphasize students' critical thinking.

According to Nugent and Vitale (2008) in Fahim and Pezeshki (2012), there are several formal reasoning processes in critical thinking, namely:

1) Problem Solving, involves identifying problems, exploring alternative interventions, implementing selected interventions, and the end result is a solution to problem solving.
2) Decision Making, involves significant information, uses reasoning methods, and the end result is decision making.
3) Diagnostic Reasoning, involves gathering information, linking information collected with standards, identifying the importance of information gathered, and the end result is a diagnosis of conclusions.
4) The Scientific Method, involves identifying problems to be investigated, collecting data, formulating hypotheses, testing hypotheses through experiments, evaluating hypotheses, and the end result is acceptance or rejection of the hypothesis.

Sapitri, et al. (2015) explained that the process of critical thinking begins with sensory processing such as through writing, drawing, sound, followed by perception (eg reading, listening and understanding) for a problem that encourages understanding a new term as well as remembering and understanding the same thing before. The theories of critical thinking show that critical thinking involves the abilities of analysis, interpretation, inference, explanation, and evaluation (Philosophy, 2008). This shows that to improve and improve the critical thinking power of students, passive teaching

and learning styles must be transformed into active teaching and learning styles. When teachers interact with students, the teacher can develop the habit of asking questions that require students to think critically. In this way, students are able to process new information, link it to topics that have been studied previously and practice asking questions that can further enhance critical thinking power.

Critical thinking skills will provide more precise direction in thinking, working, and helping more accurately in determining the relevance of an event and the possibility that will occur next. Therefore critical thinking skills are needed in problem solving or finding solutions (Dam and Volman, 2004).

The development of critical thinking skills is the integration of various components of capability development, such as observation (observation), analysis, reasoning, judgment, decision making, and persuasion. The better the development of these skills, the better the attitudes and actions in solving problems. People who think critically will search, analyze and evaluate information, make conclusions based on facts and then make decisions. The characteristic of people who think critically according to Watson and Glaser (2012) is that they will always look for and explain the relationship between the issues discussed with the problem or other relevant experiences.

In general, teaching and learning activities in the classroom have not focused on the process of training critical thinking skills. Learning that occurs, only refers to how students are able to work on problems or assignments from the teacher quickly and precisely and are able to answer test questions (Fahmi, 2018). This makes learning centered on the teacher so that deep understanding becomes the goal of critical thinking students are often ignored. When students are not trained to think deeply, then the skills to imbibe every concept that is learned and applied in action will experience difficulties (Facione, 2012).

The need for deep thinking is the basis for students to train their critical thinking skills, demanding that teachers build a teaching and learning process that involves students in full. The teacher must arrange learning scenarios with certain methods for students to find something from the process of observation and direct action. This is expected so that they are trained to think more critically which can be seen in their attitudes and actions in doing each task given.

2.2 Discovery Learning Method

Discovery is a learning method developed based on constructivism. Balim (2009) defines discovery learning as a learning process that occurs when learning material is not presented in its final form, but it is expected that students organize themselves. Furthermore, Gallenstein (2005) revealed that discovery is finding concepts through a series of data or information obtained through observation or experiment.

A further statement was put forward by Hosnan (2014) that discovery learning is a method for developing active learning methods by finding oneself, investigating on their own, then the results obtained will be faithful and durable in memory. Through learning discovery, students can also learn analytical thinking and try to solve their

own problems. Yuliani and Saragih (2015) state that in learning with discovery, students are encouraged to learn mostly through their own active involvement with concepts and principles and the teacher encourages students to have experience and conduct experiments that enable them to find principles - principle for themselves.

According to Suprihatiningrum (2014), there are two ways in Discovery Learning learning, namely:

1) Pure Discovery, namely discovery learning without instructions or direction.
2) Guided Discovery Learning is learning that requires the role of the teacher as a facilitator in the learning process.

The form of Discovery Learning methods can be implemented in one-way communication or two-way communication depending on the size of the class, which is explained in more detail as follows:

1. One-way system. One-way approach based on one-way presentation by the teacher. The presentation structure in an effort to stimulate students to do the discovery process in front of the class. The teacher raises a problem, and then solves the problem through discovery steps.
2. Two-way system. Two-way systems involve students in answering teacher questions. Students do discovery, while the teacher guides them in the right or right direction.

3. Characteristics and Learning Objectives of Discovery Learning

According to Hosnan (2014), the characteristics or characteristics of Discovery Learning are (1) exploring and solving problems to create, combine, and generalize knowledge; (2) student-centered; (3) activities to combine new knowledge and existing knowledge.

The Discovery Learning method has the purpose of training students to be independent and creative, including the following:

1) Students in the discovery process have the opportunity to be actively involved in learning. The fact shows that many students participation in learning increases when discovery is used.
2) Students learn to find patterns in concrete and abstract situations, also students predict (extrapolate) additional information provided.
3) Students also learn to form question and answer strategies that are not ambiguous and use question and answer to obtain information that is useful in finding.
4) Learning with discovery helps students form effective ways of working together, sharing information, and hearing and using other people's ideas.
5) There are several facts that show that skills, concepts and principles learned through discovery are more meaningful.
6) Skills learned in discovery learning situations in some cases are easier to transfer for new activities and are applied in new learning situations.

3.1 Steps to Implement Discovery Learning Learning Methods

According to Veermans (2003) the learning steps in the discovery learning model include Orientation, Hypothesis Generation, Hypothesis Testing, Conclusion and Regulation, which are detailed as follows:

A. Orientation

The teacher provides phenomena related to the material taught to focus students on the problems being studied. The phenomenon displayed by the teacher makes the teacher know the students initial abilities. The orientation phase involves students to read introductory and/or background information, identify problems in phenomena, connect phenomena with previously acquired knowledge. The orientation syntax trains the ability of interpretation, analysis and evaluation on aspects of critical thinking skills. Products from the orientation stage can be used for other stages, especially the hypothesis generation and conclusion stages.

B. Hypothesis Generation

Information about phenomena obtained at the orientation stage is used at the stage of hypothesis generation. The stages of hypothesis generation make students formulate hypotheses related to problems. Students formulate problems and look for goals from the learning process. The hypothesis generation syntax trains the ability of interpretation, analysis, evaluation and inference. Problems that have been formulated are tested at the hypothesis testing stage.

C. Hypothesis Testing

The hypothesis produced at the hypothesis generation stage is not guaranteed. Proof of hypotheses made by students is proven in the hypothesis testing stage. Stages of hypothesis testing students must design and carry out experiments to prove hypotheses that have been formulated, collect data and communicate the results of experiments. The syntax of hypothesis testing trains the ability of self-regulation, evaluation, analysis, interpretation and explanation.

D. Conclusion

Student activities at the conclusion stage are reviewing hypotheses that have been formulated with facts that have been obtained from testing the hypothesis. Students decide the facts as a result of testing the hypothesis whether in accordance with the hypothesis that has been formulated or the student identifies a mismatch between the hypothesis and the facts obtained from testing the hypothesis. The conclusion stage makes students revise the hypothesis or replace the hypothesis with a new hypothesis. The conclusion syntax trains concluding abilities, analysis, interpretation, evaluation and explanation.

E. Regulation

Stages of regulation relate to the process of planning, monitoring and evaluation. Planning involves the process of determining goals and ways to achieve these goals. Monitoring is a process to find out the truth of the steps and actions taken by students regarding the time of implementation and the results based on the plans that have been made previously. The teacher confirms the conclusions and clarifies the inappropriate results to find the concept as a product of the learning process. The regulation syntax

trains evaluation skills, self-regulation, analysis, explanation, interpretation and conclusions.

The discovery method makes learning able to emphasize direct experience so that students are able to understand important structures or ideas for a discipline, through active involvement of students in learning. Teaching materials presented in the form of questions or problems that must be resolved. So students gain knowledge that they have not known through notification, but through self-discovery. Takaya (2008) suggests that the learning process will run well and creatively if the teacher provides opportunities for students to find a concept, theory, rule, or understanding through the examples found in their lives.

The use of the discovery learning method, wants to change the conditions of learning that passively become active and creative. Changing learning is teacher oriented to student oriented. Changing the expository mode, students only receive information as a whole from the teacher to discovery mode, learners find their own information. In applying the discovery learning method the teacher acts as a mentor by providing opportunities for students to learn actively, the teacher must be able to guide and direct the learning activities of students in accordance with the objectives.

Previous research has been carried out (Saragih and Yuliani, 2015; Martaida et al., 2017; Khabibah et al., 2017) showing that the use of discovery learning in the learning process is able to hone students critical thinking skills. The research results become a reference that research to improve the learning process using the discovery learning method is important to do.

4. Conclusion

The application of discovery learning methods in the learning process is able to train students' critical thinking skills, because what is found in the search process will be more memorable and easier to form an understanding. Therefore, research on this matter is important to continue to do to prepare a generation that is ready to compete in the arena of global competition. If students understand important things in what they do, they will be motivated to be better afterwards.

Bibliography

Balım, A., G. 2009. The Effects of Discovery Learning on Students Success and Inquiry Learning Skills. *Egitim Arastirmalari-Eurasian Journal of Educational Research*, 35, 1-20.

Dam, G., T. and Volman, M. 2004. Critical Thinking as A Citizenship Competence: Teaching Strategies. *Learning and Instruction.* 14, p. 359–379.

Facione, P., A. 2012. Critical Thinking: What It Is and Why It Counts. *Insight Assessment Measuring Critical Thinking Worldwide.* Measured Reasons and The California Academic Press, Millbrae, CA.

Fahim, M. and Pezeshki, M. 2012. Manipulating Critical Thinking Skills in Test Taking. *Macrothink Institute. International Journal of Education.* ISSN 1948-5476, March 19, 2012, Vol.4, No.1. http://dx.doi.org/10.5296/ije.v4il.1169

Fahmi. 2016. Strategi Pembelajaran *Contextual Teaching and Learning* untuk Meningkatkan Keterampilan Berpikir Tingkat Tinggi. *Prosiding Seminar Nasional Pendidikan IPA Mengembangkan Keterampilan Berpikir Tingkat Tinggi*. S2 IPA Unlam Press.

Fahmi. 2018. Pengembangan Perangkat Pembelajaran untuk Melatihkan Keterampilan Berpikir Kristis Peserta Didik SMP pada Materi Klasifikasi Benda. *Tesis*. Program Studi Magister Keguruan IPA PPs ULM. Tidak Dipublikasikan.

Fattahi, F. and Haghverdi, H. R. 2015. Does Inquiry Based Learning Enhance Student's Critical Thinking: A Case Study of Iranian EFL Learners. *International Journal Language Learning and Applied Linguistic World. Volume 9 (3), July 2015; 134-141. EISSN: 2289-2737 & ISSN: 2289-3245*. http://www.ijllalw.org

Filsaime, D. K. 2008. *Menguak Rahasia Berpikir Kritis dan Kreatif*. Jakarta: Prestasi Pustaka Karya.

Furner, J., P. and Robinson, S. 2004. Using TIMSS to Improve the Undergraduate Preparation of Mathematics Teachers. *IUMPST: The Journal Curriculum*. Vol. 4.

Gallestein, N., L. 2005. Engaging Young Children in Science and Mathematics. *Journal of Elementary Science Education*, Vol. 17, No. 2, pp. 27-41. Department of Curriculum and Instruction, College of Education and Human Services, Western Illinois University.

Hosnan, M. 2014. *Pendekatan Saintifik dan Konstektual dalam Pembelajaran abad 21: Kunci Sukses Implementasi Kurikulum 2013*. Bogor: Ghalia Indonesia.

Johnson, E, B. 2010. *CTL Contextual Teaching & Learning; Menjadikan Kegiatan Belajar-Mengajar Mengasyikkan dan Bermakna.* Kaifa Learning. Ujungberung, Bandung.

Khabibah, E. N., Masykuri, M., Maridi 2017. The Effectiveness of Module Based on Discovery Learning to Increase Generic Science Skills. *Journal of Education and Learning.* Vol.11 (2) pp. 146-153. DOI: 10.11591/edulearn.v11i2.6076

Martaida, T., Bukit, N., Ginting, E. M. 2017. The Effect of Discovery Learning Model on Student's Critical Thinking and Cognitive Ability in Junior High School. *IOSR Journal of Research & Method in Education (IOSR-JRME)* e-ISSN: 2320–7388, p-ISSN: 2320–737X Volume 7, Issue 6 Ver. I (Nov. – Dec. 2017), PP 01-08www.iosrjournals.org

Plomp, T. and Nieveen, N. 2007. An Introduction to Educational Design Research. *Proceedings of the seminar conducted at the East China Normal University, Shanghai (PR China).* November 23-26, 2007.

Saido, G. M., Siraj, S., Bakar, A., Al_Amedy, O.S. 2015. Higher Order Thinking Skills Among Secondary School Students in Science Learning. *The Malaysian Online Journal of Educational Science, 2015 (Volume 3 – Issue 3)*. http://www.moj-es.net.

Sapitri, A., Djulia, E., Sipahutar, H. 2015. The Correlation Among Student's Metacognition, Critical Thinking, Parents and Teacher's Guidance About Reproduction Health and The Perception of Sexual Behaviour of High School

Student. *Proceeding 6th International Conference on Science and Mathematic Education, COSMED 2015.* Penang. Malaysia.

Setiadi, I. 2018. Pengembangan Perangkat Pembelajaran IPA SMP untuk Melatihkan Keterampilan Berpikir Kritis Peserta Didik pada Topik Interaksi Makhluk Hidup dan Lingkungannya. *Tesis*. Program Studi Magister Keguruan IPA PPs ULM. Tidak Dipublikasikan.

Shukri, N. A. and Mukundan, J. 2015. A Review on Developing Critical Thinking Skills through Literacy Text. *Advances in Language and Literacy Studies. ISSN: 2203-4714, Vol. 6 No. 2, April 2015*. http://dx.doi.org/10.7575/aiac.alls.v.6n.2p.4.

Sivasubramanian, P. 2015. Knowledge and Higher Order Thinking Skills. *Proceeding 6th International Conference on Science and Mathematics Education, COSMED 2015.* Penang. Malaysia.

Suprihatiningrum, J. 2014. *Strategi Pembelajaran*. Yogyakarta: Ar-Ruzz Media.

Takaya, K. 2008. Jerome Bruner's Theory of Education: From Early Bruner to Later Bruner. *Journal Interchange,* Vol. 39/1, 1–19, DOI: 10.1007. /s10780-008-9039-2. @Springger 2008

Veermans, K. H. 2003. Intelligent Support for Discovery Learning. *Ph.D Thesis*. Enschede: Twente University Press (TUP).

Watson, G. and Glaser, E. M. 2008. *Watson-Glaser Critical Thinking*. USA: Pearson Education, Inc.

Watson, G, and Glaser, E. M. 2012. *Watson-Glaser Critical Thinking Appraisal: User-Guide and Technical Manual, UK Supervised and Unsupervised Versions 2012*. Pearson Education Ltd.

Yuliani, K. and Saragih, S. 2015. The Development of Learning Devices Based Guided Discovery Model to Improve Understanding Concept and Critical Thinking Mathematically Ability of Students at Islamic Junior High School of Medan. *Journal of Education and Practice.* Vol.6, No.24. www.iiste.org

Zaini, M. 2016. Urgensi Penelitian Pengembangan dalam Menggali Keterampilan Berpikir Kritis. *Prosiding Seminar Nasional Pendidikan IPA Mengembangkan Keterampilan Berpikir Tingkat Tinggi*. S2 IPA Unlam Press.