



## The Implementation Of Discovery Learning Model To Enhance Student's Actualization in Knowledge Discovery

Bitta Pigawati,<sup>✉</sup>, Yudi Basuki<sup>1</sup>

<sup>1</sup> Fakultas Teknik Universitas Diponegoro, Semarang, Indonesia

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### Abstrak

Paradigma pendidikan universal memperlakukan peserta didik sebagai subjek merupakan penghargaan terhadap peserta didik sebagai manusia yang utuh. Peserta didik memiliki hak untuk mengaktualisasikan dirinya secara optimal dalam aspek kecerdasan intelektual, spiritual, sosial, dan kinestetik. Diperlukan penentuan model pembelajaran yang sesuai dalam mengimplementasikan metode pembelajaran student centered learning bagi peserta didik. Penelitian ini bertujuan mengevaluasi penerapan model discovery learning. Subjek penelitian adalah mahasiswa peserta kuliah geologi lingkungan Departemen Perencanaan Wilayah dan Kota Fakultas Teknik Undip. Hasil penelitian menunjukkan model discovery learning lebih optimal dilakukan pada topik perkuliahan yang sifatnya kompleks dan memerlukan pemahaman yang mendalam.

### Abstract

*The general paradigm of education to treat learners as subjects has been regarded as a respect for the learners as a whole human being. Learners have the right to perform optimal self-actualization in the aspects or intellectual, spiritual, social, and kinesthetic quotient. Based on that, a learning model which can be used to implement student centered learning method for learners should be established. The research was aimed to evaluate the implementation of discovery learning model. The subjects were the students enrolled in environmental geology class, Urban and Regional Planning Department, Faculty of Engineering, Diponegoro University. The result shows that discovery learning model is more optimal to be applied in complex lecturing topic which needs deeper understanding.*

<sup>✉</sup> Corresponding author :  
Address: Departemen Perencanaan Wilayah dan Kota  
Semarang, 0247460054/0247460701  
E-mail: [bitta.pigawati@gmail.com](mailto:bitta.pigawati@gmail.com)

## INTRODUCTION

Learning in an interaction process between learners and educators and/or learning sources in a learning environment (Regulation of Minister of Education and Culture of Indonesia No 49, 2014). Learning effective if it can produce changes in aspect, cognitive, affective and psikomotoric (Robert,R., Dick,W. 1996). Teachers are central to the process of learning as central information and knowledge as an object while students passively receive information from teachers. (Weinstein and Mayer.1986) defines learning strategies as "behaviors and thoughts that a student is involved in during learning". Undergraduate program is focused to provide graduates who are qualified based on following criteria:

- a. Mastering basic knowledge and skills of particular expertise to discover, understand, explain, and formulate problem solving recommendations in the area of expertise.
- b. Applying the knowledge and skills according to their expertise in productive activities and service to the community with the attitude and behavior in accordance with the order of life.
- c. Acting and behaving in accordance with their field of expertise to work and live together as society.
- d. Being able to adapt the development of science, technology advancement, and / or art that becomes their expertise. (Government Regulation of Republic of Indonesia No 17, 2010).

Undergraduate Study Program of Department of Urban and Regional Planning (DPWK), Faculty of Engineering, Diponegoro University has the objective to provide competent graduates who are in line with the universal paradigm of education. The alumni of Undergraduate Study Program of Department of Urban and Regional Planning are expected to be independent individuals (independent beings) who act as interacting and supporting elements in social system (social beings), and as a leader in realizing a better life on earth. For that reason, there is a need to determine a model in the learning method for students as young generations which have the role as the element that determines the future of the nation. To achieve the objective, Undergraduate Study Program of Department of Urban and Regional Planning has the efforts to develop student learning methods.

The learning method is defined as a way

of delivering learning materials to the learners to achieve the goals set ( Ngalimun, 2016). There are two approaches to learning ie teacher-centered approach and student-centered approach. Teacher-centered approaches is the direct learning strategies (direct instruction), or expository deductive learning, while student-centered approaches is a strategy of discovery and inquiry or inductive learning strategy (Killen, R. 2015).

The methods that are based on *Teacher Centered Learning* (TCL) have been replaced by models based on *Student Centered Learning* (SCL). Learning, according to the Law on National Education System No 20 year 2003, has been defined as the interactions between educators, learners and learning resources in particular learning environment. By describing every element involved in learning, the characteristics of student centered learning can be considered.

There are seven steps in the implementation process of Student Centered Learning, namely: *Motivation, Establishing Trust, Assessment, Accepting Resistance; Awareness, Problem Solving, Contracts*. (Brandes et. al, 2001). Student Centered Learning method includes several learning models such as Small Group Discussion and Discovery Learning model (Kember, D. 1997).

Environmental Geology subject is one of the basic subjects in Undergraduate Study Program of Department of Urban and Regional Planning (DPWK), Faculty of Engineering, Diponegoro University. Environmental Geology subject discusses geological information application through spatial design for regional development and environmental management by providing information about the characteristic of geologic environment of an area based on the unity of geologic resources as supporting elements and geologic hazards as threatening elements. Therefore, the result of environmental geology analysis provides an overview of an area's restraint to be developed. The area mentioned above is the area which has the potential to be the space and room for human activities. The restraint of an area to be developed is an overview of its levels of difficulties in organizing the activity space and land use options. The subject has adopted Student Centered Learning Method using small group discussion model.

Small Group Discussion is one of active learning elements and one of various SCL models. The students enrolling for the subject have been asked to form small groups to discuss lectu-

re materials or self-obtained materials (Panduan Pengembangan Kurikulum Berbasis Kompetensi Pendidikan Tinggi/Competency-Based Curriculum Development Guide for Higher Education, 2008).

Students are put in groups of 5-10. Lecture gives assignment and students work together to finish the assignment. One of main assignments in the subject is preparing Environmental Geology Information by merging information from geological thematic maps, topographic maps, remote sensing imagery and other thematic maps while environmental geology analysis can be conducted by using quantitative scoring method and overlaying thematic maps manually and using Geographic Information System as well as interpreting remote sensing imagery.

By applying the method, students are expected to have competency in organizing geologic information. According to Bloom's Taxonomy, the competency lies in the second level (Understand) which includes *Explain idea or concepts; classify, describe, discuss, explain, identify, locate, recognize, report, select translate* (Patricia, Armstrong, 2016). In line with the universal paradigm of education, besides skills, students should be able to actualize themselves optimally in the aspects of intellectual, spiritual, social, and kinesthetic quotients. Students should be given opportunity to discover knowledge independently, therefore, a learning model which supports small group discussion and focuses on students' actualization to discover knowledge is urgently needed.

Basically, the decision to apply appropriate learning method will facilitate the achievement of expected competencies. The effective and optimum learning process must be supported by a wide range of aspects, such as students, teaching materials, (method selections / learning models) as well as learning facilities. The correlation between these aspects has been the foundation to achieve the objectives that have been determined. Students as the center of the learning process are involved in lecture material and can utilize the learning tools so it can be expected that students are able to think critically and be creative and innovative.

Small Group Discussion model that has been applied in Environmental Geology learning process has referred to these objectives. However, in its application, the learning process has not yet reached the optimal target. To enhance students' ability to seek and discover knowled-

ge, Small Group Discussion model should be accompanied by Discovery Learning model. During the implementation of Discovery Learning Model, the educator has the role as facilitator in giving the opportunities to the students to learn actively, which in line with the opinion that an educator should be able to facilitate and provide learning activities according to the objectives (Syah, M. 1996). The basic competency of Environmental Engineering subject ranges from C2 (able to explain/provide information) and C4 (able to analyse) (Pigawati, B. 2015).

## METHODOLOGY

The research on the implementation of Discovery Learning Model to enhance students' actualization in Knowledge Discovery used evaluation method to assess the effectiveness of discovery learning model on Environmental Geology subject. The population of the research was the students enrolled in Environmental Geology Undergraduate Study Program of Department of Urban and Regional Planning (DPWK), Faculty of Engineering, Diponegoro University. The instrument used was questionnaire which was based on descriptive-quantitative analysis technique. Through the method, some facts and issues found during the implementation of discovery learning method were described.

The conceptual framework of the research can be seen in figure 1.

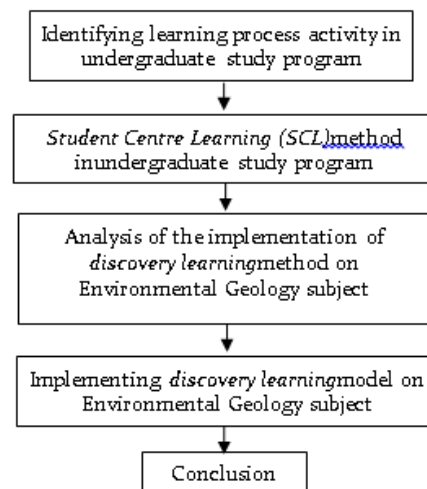


Figure 1 Conceptual Framework

The stages of the research on Student Centered Learning Development by implementing discovery learning model are described as follows:

1. Preparation stage : identifying problems, formulating goals and collecting supporting

- literature review
2. Analysis stage : data collection, analyzing the implementation of the combination of two learning models namely small group discussion and discovery learning on Environmental Engineering subject, continued with analyzing/evaluating the result of the implementation.
  3. Concluding and recommendation stage.

## RESULT AND DISCUSSION

### A. The Foundation Analysis of Discovery Learning Model Application

Modern learning more active involvement of students in the learning process independently, ie through learning activities are oriented to the invention (discovery) and search (inquiry) for learning this model has many positive effects for students ( Hasan, A.F. 2014 ).

One of SCL learning models is a Small Group Discussion. Small Group Discussion is one element actively studied and is part of many SCL learning models (Kember, D, 1997). Using this method, students participating in the study were asked to make small groups (5 to 10) to discuss the material provided by the lecturer or material obtained by the members of the group. The Discovery Learning Method is a learning theory which is defined as a learning process that occurs when students are not presented with a lesson in its final form, but they are expected to organize it by themselves. Bruner stated that "Discovery Learning can be defined as the learning that takes place when the student is not presented with a lesson in the final form, but rather is required to organize it. Bruner is the basic idea of Piaget's opinion which states that children should play an active role in the classroom learning. Bruner uses a method he called Discovery Learning, where students organize the material to be examined with a final form (Dalyono, 1996).

Discovery Learning method is to understand the concept, meaning, and relationships through an intuitive process to finally come to a conclusion (Budiningsih, 2005). Discovery occurs when an individual is involved, especially in the use of mental processes to find some of the concepts and principles. Discovery is done through observation, classification, measurement, prediction, determination and inferi. As a learning strategy, Discovery Learning has the same principle of the inquiry and Problem Solving. *Inquiry means to know how to find out things and to know how to solve problems. To in-*

*quiry about something means to seek out information, to be curious, to ask questions, to investigate and to know the skills that will help lead to a resolution of a problem (E. Seif, 1979 ).*

There is no difference of principle on these three terms (discovery, inquiry and problem solving) , except that Discovery Learning puts more emphasis on the discovery of concepts or principles that were previously unknown. The difference in the discovery is that the discovery problem that confronted to students is sort of problem that is engineered by the teacher, while in the inquiry, the problem is not engineered, so students have to put all their mind and skill to discover in such problems through the research process. Problem Solving puts more emphasis on problem-solving ability. However, the learning principle which is clearly visible in Discovery Learning is the learning material to be delivered not in its final form but students as learners are encouraged to identify what they want to know followed by finding the information then organized or constructed what they know and they understand in a final form. By applying the method of Discovery Learning, students as learners gradually increase the self-discovery ability of the concerned individual. The use of Discovery Learning method wants to change the passive learning condition to active and creative ones, the teacher-oriented learning to student-oriented, and change the Expository mode where students only received the overall information from the teacher, to the Discovery mode where students find information by themselves. Availability of learning resources is the importance of a connection with the inquiry learning model application. *"Equipment and supplies are organized and available in such ways as to stimulate students' investigation". (W.W. Welch, 1981 : 34-35).*

In this study, the evaluation of the application of discovery learning course on Environmental Geology at Undergraduate Study Program of Department of Urban and Regional Planning (DPWK), Faculty of Engineering, Diponegoro University was based on questions to the learners in a questionnaire form. These questions were given to find the source of the discovery of a learning topic. The questions were divided into two, one was based on the discovery sources, or the Lecture Material from teacher and the students' discovery which consists of the Internet, group discussion and Literature study, and the other was based on the analysis of the two groups. Then based on the percentage of dis-



covery sources, a composition analysis was done. If more students answered that the discovery source comes from the Lecture Material, it means that the discovery learning method has not worked as expected yet, and vice versa, if more students responded that the discovery source comes from the student activities such as small group discussion, the internet and literature, it shows that the discovery learning method can be said to have run optimally. Of the two groups of questions, a comparison on the discovery source was performed to analyze how the discovery was done. Questions also were started from the simplest ones such as the definition of the course, the definition of basic topics such as what it is sedimentary rocks, and so on to the more complex questions such as geologic hazard, landform and others. This was conducted to measure on what stage of discovery learning method has progressed so far.

### B. The Analysis of the Discovery Learning Application on Environmental Geology Subject

Analysis and evaluation of the discovery method application on Environmental Geology subject at Study Program of Department of Urban and Regional Planning (DPWK), Faculty of Engineering, Diponegoro University is done by comparing the students' Sources of Knowledge on the lecturing topic. Topics of lectures were organized by the understanding of the environmental geology ranging from the basics such as the type of rocks to the more complete understanding like the benefits of environmental geology for urban and regional planning. The materials/topics of environmental geology lecture which become the benchmark of the evaluation of discovery learning methods are:

- Metamorphic Rocks
- Sedimentary Rocks
- Rock Formations
- Geological Processes
- Geologic Hazards
- The benefits of Environmental Geology for urban and regional planning.

### C. The Implementation of Discovery Learning Method to Discover the Definition of Metamorphic Rocks

Defining metamorphic rocks is an example of a simple question. Theoretically, this question only requires the ability to discover the answer by reading and observation. The distribution of respondents' answers can be seen in

the following table.

**Table 1** The Knowledge Discovery of Metamorphic Rocks

No	Sources of Knowledge	Percentage
1	The Internet	37.09.00
2	Small Group Discussion	13.08
3	Lecture Material	24.01.00
4	Literature	24.01.00
<b>Total</b>		<b>100.00.00</b>

According to the table above, most students found their definitions with the help of the Internet (37.9%), group discussion (13.8%), Literature (24.1%) while the percentage of those using Lecture material as the source was 24.1%. From this table, it can be analyzed that for a simple understanding like defining metamorphic rocks, the use of discovery learning method is still not optimal. In this understanding, the teaching methods should be directed to the effort of finding the definition of metamorphic rocks through group discussion.

### D. The Implementation of Discovery Learning Method to Discover the Definition of Sedimentary Rocks

Defining sedimentary rocks is an example of a simple question and acts as the basic of environmental geology. This question, in theory, only requires the ability to discover the answer by simply performing reading and observation. The distribution of respondents' answers can be seen in the following table.

From this table, it can be analyzed that, for a simple understanding like defining sedimentary rocks, the use of discovery learning method is still not optimal because there are many source of definitions through Lecture Material (40%). In this understanding, the teaching methods should be directed to the effort of finding its own definition of the sedimentary rocks through the group task or field trips.

**Table 2** The Knowledge Discovery of Sedimentary Rocks

No	Sources of Knowledge	Percentage
1	The Internet	30.0
2	Small Group Discussion	23.3
3	Lecture Material	30.0
4	Literature	16.7
<b>Total</b>		<b>100.0</b>

### E. The Implementation of Discovery Learning Method to Discover the Definition of Rock Formations

Defining rock formations is an example of question that is more complex than defining metamorphic rocks and sedimentary rocks. This question requires the ability to discover the answer from reading and observation. The distribution of respondents' answers can be seen in the following table.

**Table 3** The Knowledge Discovery of Rock Formation

No	Sources of Knowledge	Percentage
1	The Internet	30.0
2	Small Group Discussion	23.3
3	Lecture Material	30.0
4	Literature	16.7
<b>Total</b>		<b>100.0</b>

From this table, it can be analyzed that, for a simple understanding like defining rock formations, the use of discovery learning method is still not optimal because the sources of understanding were gained from teaching materials (30%). In this understanding, the teaching methods should be directed to the effort of finding its own definition of the rock formations through the group task or field trips.

### F. The Implementation of Discovery Learning Method to Discover the Definition of Geological Processes

Finding the definition of geological processes is an example of more complex question than defining the metamorphic rocks and sedimentary rocks. The discovery and understanding of this definition already requires higher knowledge. This understanding is also important to deliver the students to their understanding of the environmental geology in terms of urban and regional planning. This question not only requires the ability to find the answer to simple as through reading and observation but also their knowledge on the subject. The distribution of respondents' answers can be seen in the following table.

It can be analyzed that, for a more complex understanding like giving the definition of geological processes, the use of discovery learning method is still not optimal because the sources of understanding was obtained from Lecture Material (36.7%). Therefore, the teach-

ing methods should be directed to the effort of finding the definition of the geological processes through group task or field trips.



**Figure 2.** Small Group Discussion

**Table 4** The Knowledge Discovery of Geological Processes

No	Sources of Knowledge	Percentage
1	The Internet	23.3
2	Small Group Discussion	26.7
3	Lecture Material	36.7
4	Literature	13.3
<b>Total</b>		<b>100.0</b>

### G. The Implementation of Discovery Learning Method to Discover the Definition of Geological Structure

As the definition of geological processes, the finding of geological structure definitions is also an example of a more complex question compared to finding the definition of metamorphic rocks and sedimentary rocks. The discovery and understanding of this definition requires higher knowledge. This is also important to help the students understand the importance of environmental geology for urban and regional planning. This question not only requires the ability to find the answer to simple as through reading and observation but also deeper understanding on the material. The distribution of respondents' answers can be seen in the following table.

**Table 5** The Knowledge Discovery of Geological Structure

No	Sources of Knowledge	Percentage
1	The Internet	23.3
2	Small Group Discussion	26.7
3	Lecture Material	36.7
4	Literature	13.3
<b>Total</b>		<b>100.0</b>

This table shows that, for a more complex understanding like finding the definition of geological structure, the use of the discovery learning method (small group) has started to be optimal because the understanding of the definition was obtained from the group discussion (56.7%). Therefore, the teaching method should be more addressed to the efforts of defining geological structure through group task or field trips.

#### H. The Implementation of Discovery Learning Method to Discover the Definition of Geologic Hazard



**Figure 3.** Excursion Discovery Learning

As the definition of geological processes, the discovery of geological hazards definition is also an example of more complex question compared to discovering the definition of metamorphic rocks and sedimentary rocks. The discovery and understanding of this definition requires higher knowledge. This understanding is also important to assist the students having deeper knowledge about environmental geology for urban and regional planning. This question not only requires the ability to find the answer to simple as through reading and observation but also deeper understanding on the material. The distribution of respondents' answers can be seen in the following table.

**Table 6** The Knowledge Discovery of Geological Hazard

No	Sources of Knowledge	Percentage
1	The Internet	6.7
2	Small Group Discussion	43.3
3	Lecture Material	40.0
4	Literature	10.0
<b>Total</b>		<b>100.0</b>

It can be seen from the table that, for a more complex understanding like the definition of geological hazard, the use of discovery

learning method (small group) has started to be optimum since the source of understanding was obtained from the group discussion (43.3%). Therefore, the teaching method should be more addressed to the efforts of defining geological structure through group task or even field trips

#### The Implementation of Discovery Learning Method to Discover the Definition of The Benefits of Environmental Geology

The discovery of the benefits of environmental geology is one example of more complex questions. The discovery of the answer to this question requires a process of review, discussion, and reflection which is not simple compared to previous questions. The discovery of the benefits is a major achievement of the course of environmental geology for urban and regional planning. Students are expected to recognize, understand and present the benefits of the geological environment for urban and regional planning.

**Table 7** The Discovery of the Benefits of Environmental Geology

No	Sources of Knowledge	Percentage
1	The Internet	10.0
2	Small Group Discussion	40.0
3	Lecture Material	36.7
4	Literature	13.3
<b>Total</b>		<b>100.0</b>

It can be explained from the table above that the most of the discovery was obtained by doing group discussions. This suggests that, for more complex questions, the process of the discovery can be done by discovery learning model which can be obtained by discussing the benefits of environmental geology subject.

#### I. The Success of Discovery Learning Method in Environmental Geology Subject

The success of discovery learning methods in the course of environmental geology is based on indicators of the percentage of how the discovery of the definition of topics in the lecture by means of Small Group Discussion. The group discussions reflect the process of the discovery of a topic with little intervention from teachers/lecturers. The large percentage of the group discussion shows that the discovery of lecture topic is done through discovery learning methods.

In previous subgroup analysis based on Table 4.1 to Table 4.6, it can be seen that in the

basic topics turned out the use of methods of discovery learning was not optimal. This can be seen in Table 4.1 and Table 4.2 showing that the percentage of understanding of metamorphic rocks and sedimentary rocks obtained through group discussions is still below 20%. In a more complex understanding, group discussion began to increase its percentage. This can be shown in Table 4.3 and Table 4.4 on the understanding of rock formations and geological processes. In a more complex understanding, the discovery learning method again turned out to be optimal as indicated by the high percentage of learning group discussion (40-50%) which can be seen in Table 4.5 to Table 4.7.

## CONCLUSION

The application discovery learning methods students are conditioned to think critically and creatively to find their own conclusions based on the observation that they do so as to enable students to build discovery and investigation experience through group discussions and literature available, but not always optimal use in each lecture topic. Based on the result of the analysis, it can be concluded that discovery learning method has not always been suitable to be applied in every lecturing topic. Discovery learning method using Small Group Discussion model is more optimum to be applied in complex lecturing topics which need deeper understanding on the cases like geologic structure, geologic hazard, and benefits of environmental geology in urban and regional planning. In simple topics, the use of discovery learning by students is less than optimal. Students prefer to use lecture materials to understand the topic.

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