Problem Based-Learning Model Development and Giving Reward to Improve Conceptual Understanding and Problem Solving Ability of the Students at IAIN

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ABSTRACT

This is the preliminary research about the development of problem-based learning model and the reward giving on elementary linear algebra courses at IAIN Padangsidimpuan. This research applied descriptive qualitative approach. Then, the data were analyzed by using the models of Miles and Huberman’s type of data presentation. The results of the study described that: 1) needs and context analysis was a linear algebra learning model that was implemented by using expository method that focused on explaining the material and giving the examples and the assignment in the form of exercise, 2) review of literature is learning activity in which the lecturers and students used the book written by Anton Hower in teaching and learning of elementary linear algebra which was only based on the textbook which only presented some basic theories and examples of questions and exercises, 3) the development of conceptual dan theoretical base is a learning model which was based on problem solving and reward giving that started from problem formulation up to solving it as well as giving the reward in every step that was done.

Keywords: Preliminary Study Based on Problem Solving, Reward, and Elementary Linear Algebra.

1. INTRODUCTION

The purpose of learning math is to sharpen the ability of logical thinking and systematic basis. Learners or students are strongly encouraged to think in order to understand the concepts that they had learned. Government Regulation number 22 in 2006 stated that mathematical subjects need to be given to all students ranging from elementary school to college that means to provide learners with the ability to think critically, analytically, systematically, and creatively, as well as able to work together. Competency is necessary so that learners can have the ability to acquire, manage, and utilize the information to survive in the continuous, uncertain and competitive circumstances. In every opportunity, learning math should be started with the introduction of the issue related to the situation (problem solving). By formulating the issues in learning mathematics, the learners/students can master math concepts easily.

Problem-based Learning, abbreviated as PBL, is one of the innovative learning models that can provide active learning conditions to learners. Problem Based Learning is a learning model that involves students to solve a problem through the stages of scientific methods so that learners can learn the knowledge that is associated with the problem and at the same time have the skills to solve problems. Wena said that problem-based learning strategies is a learning in which the students confront the problem of practical problems as a foothold in learning, in other words students learn through problems [1]. Students don not only record and understand the material, but also think actively and can eventually make a conclusion. Through this learning model, students are hoped to be able to solve a scientific problem.

It is also stated by Eggen that Problem Based Learning (PBL) is a set of teaching models that uses the problem as a focus to develop problem solving skills, material and arrangements themselves [2]. Problems are given to students and will be completed in small groups, and they work together or independently. Lecturers will direct the students to solve the problem given. When the lecturers apply this model, students are encouraged to choose the strategy of problem solving. Students are also trained to develop divergent thinking ability.
through problem-solving of alternative options. The steps that will be taken by students in a problem-based learning process are: (1) finding the problem, (2) collecting the facts, (3) devising the strategies for problem solving, (4) implementing the strategy chosen, (5) discussing the results that the student have already acquired. The step that the students undertake is an opportunity to build their knowledge.

In the last few years, this problem-based learning through research and experimentation showed significant influence especially in cognitive development. Tan gives some conclusions of research and experiment as a result of the application of problem-based learning [3]. Problem-based learning is capable to bridge over the existence of a gap between theory and practice (particularly in the field of medical education). Problem-based learning is also found to increase the transfer of the concept over the new problem, the integration of the concept of intrinsic interest, and learning skills. Tan also outlines how this problem-based learning, when compared to traditional learning, is able to assist students in the construction of knowledge and the ability to think. Furthermore, problem-based learning can strengthen real world skills such as independent and collaborative study, problem solving and decision making. It is supported by Sanjaya saying that it is “a series of problem-based learning in which the learning activities emphasize on the process of formulating problems and solve it scientifically” [4].

In the implementation of problem-based learning activities, rewards need to be given to support a variety of positive things towards learners/students, and to become force or motivation in order to learn better. The granting of this reward in the process of teaching and learning is a form of motivation-oriented learning success or achievements of learners/students. According to the opinion of Chaplin's, a reward is an arbitrary stimulus, in which the situation or the oral statement can generate satisfaction or increase the likelihood of an act which is in learning [5]. It's also stated by Usman that reward is a motivation to achieve the goal, the success to achieve a satisfying thing. The motivation is regarded as the reward or recompense that creates a happy, exciting, and satisfying feeling [6].

Giving the reward to students is very important so that they feel like getting the attention and encouragement. When it is done, it is better if it is related to their ability. Giving reward in the education course gets serious attention, so that the students are familiar and appreciated in respect. The purpose of the granting of this reward in any context is useful as reinforcement in justifying their positive behavior. In addition, the reward as well as a stimulus is to return them to positive behavior with a support and trying to do better. Therefore, an educator needs to give a reward in teaching and learning activities. While the implementation of learning in a class reward forms can be applied in the study of verbal expression i.e. giving praise, giving rewards in the form of material or gifts that support educational activities, looking and smiling, writing students’ names on the board, showing kindness, supposing them as students as well as giving them motivation.

Elizabeth said that the reward was a pillar of the discipline and a form of appreciation for a good result, and the award does not need to be a kind of the material, but in the form of words of praise, a smile, a pat on students’ back which means proud [7]. Good and wise reward will lead to the virtues of inner peace to imposes, a sense of self-esteem, giving a strong encouragement and sympathy for the recipient. Thus, giving good reward is good to be applied in the process of teaching and learning that is combined with the model-based learning problems.

Based on the observations and interviews of researchers in the field on elementary linear algebra, learning process still implement conventional learning patterns where the students get the treatment on an individual basis, organizing the material laid out in accordance with the order of the syllabus that has been compiled, structured tasks and exercises are arranged individually on each lecture. A reference for structuring the material fully follow the subject matter components that are listed in the guidelines in the syllabus of courses on a course of study and textbook reference mandatory subjects that are concerned. Through that model of learning, the students cannot assimilate knowledge with problem-solving experience. The mindset of students will not develop and their critical thinking does not appear in the learning process.

Teachers and lecturers teach math by training students some symbols and emphasizing on the giving of information and application procedure [9]. Learning with conventional methods provides fewer opportunities of students to become active and creative [10]. In line with the various research results, it is concluded that this learning like still takes place in developing countries [11]. If this condition still exists, the implication of active learning and its purposes will not be achieved in the courses of linear algebra.

2. METHOD

This study was a kind of research and development research that was done to develop a product. In this research, the use of this design was taken from Plomp’s model [12]. The simpler definition was given by Sugiono who said that research and development is a method used to produce a particular product, and test the effectiveness of the product [13]. This research used descriptive qualitative approach. The research was done in IAIN Padangsidimpuan. The research was conducted
from July to December in 2018. This research used the subjects who were from students of IAIN Padangsidimpuan in 2018, math education courses consisting of 1 class with 40 students. Researchers took the subjects using purposive sampling techniques. The instruments used in this research were the observation and interview. Data analysis techniques applied the models of Miles and Huberman with analysis of the presentation of the data and the conclusion.

3. RESULT AND DISCUSSIONS

Based on the preliminary research stage, this study aims to analyze the main problems underlying the importance of problem-based learning model and giving reward on elementary linear algebra courses. It also aims to prepare the conceptual framework which is used as a reference to conduct further study. These stages are distinguished into three parts, namely (a) need and context analysis, (b) literature reviews and (c) development of a conceptual and theoretical framework for further study.

3.1. Need and Context Analysis

Data analysis of this research were obtained from direct observation and interviews toward some of the existing colleges in Padangsidimpuan city along with IAIN Padangsidimpuan students of mathematics program. The colleges are including IAIN Padangsidimpuna, Graha Nusantara University, Muhammadiyah University of South Tapanuli, the college of Education and teachers training of South Tapanuli. The purpose of this activity is to get information and an overview of existing problems on the application of curriculum, instructional model, learning materials, and textbooks, students’ characteristics, activities, students’ motivation and students’ learning in the learning process.

The result of the interview indicates that the linear algebra implemented during the learning process uses the method of expository which focuses on explanation of the material and giving examples as well as assignments in the form of exercise. In another occasion, lecturers teach in the form of group discussions and presentation of students, and later it is continued with the explanation from the lecturers. In this learning activity, the lecturers, as a source of information, are still dominant and the have not been able to engage students in active learning. On the other hand, teachers are more actively and creatively to get information and find the answers to the questions that are presented in learning, so that students are less critical. If this condition exists, the implication of effective learning activity implementation in achieving the objectives of the courses linear algebra will not be achieved. Such things can be seen from the stance of their activities, less interest, reaction to repetitive learning model even boredom. However, research shows that problem-based teaching methods have some weaknesses, such as not providing a learning environment that enables students to be active, reduce the liveliness of students and lack students’ responsibility.

3.2. Curriculum Analysis

At this stage there has been a study about linear algebra courses. This analysis needs to study the scope of content, learning objectives; selection of appropriate strategies of reference to develop a model of learning that is expected. The expected activities are as follows: analyzing the problem, observing and studying linear algebra courses in progress, learning about teen development theories, theories of learning and the theory of the learning model.

Based on the results of the analysis of curriculum applied in IAIN Padangsidimpuan, it is found that elementary linear algebra courses have 3 credits. It is held 2 times a week in face-to-face with a lecture technique. Thus, students are forced to learn all the material with the guidance of the lecturer, and it seems just to complete the curriculum without regard to quality standard content. Elementary linear algebra lecturer only focuses on the expository method and uses a textbook only. In this book, the text is more likely to be a discussion in theory that is difficult for the students to understand. From an analysis of the curriculum and materials applied in the math program, it is made as a reference for lecturers to arrange the material. The books that the lecturers and student use as support system of problem based learning models and giving reward to determine the desired product in learning.

3.2.1. Concept Analysis

In the process of learning that is done in IAIN Padangsidimpuan with elementary linear algebra courses, students are forced to be wise and careful to use the time, so all concepts or materials discussed can be figured out. The material discussed in elementary linear algebra courses includes systems of linear equations, matrices, determinants and vector in two- or three-dimensions space. The materials demand the students much to develop their critical thinking ability and can solve the problem.

The results of the research shows that the ability of students to understand the concepts of linear algebra has not been as expected due to the common understanding that is not in accordance with the concept given by lecturers such as the completion of the system of equations linear equations with some variables with an understanding and settlement way on how to do the elimination and substitution as they studied at the High
School or Madrasah Aliyah level. Students also have not been able to associate the concept of that one with other concepts, such as material relating to vector in association with the direction, force, acceleration, etc. Therefore, the impact of the learning results to the achievement is less satisfying.

### 3.2.2. Students and Lecturers Analisys

In creating a conducive atmosphere and academic disciplines, the roles between students and lecturers are as indicators of students’ achievement. It includes the preparation program supported by the infrastructure supporting the facilitator of learning, teaching and learning as well as the availability of learning materials, and it becomes the basis of how to build a healthy interaction around academic surroundings.

From the result of the observations, it is found that in the activity of elementary linear algebra lecture, there is a two-way interaction i.e. lecturers give explanations and students are listeners. In this case, there has not been a multi ways interaction which means that the students interact with students, lecturers, and vice-verse. In fact, in the learning process, the lecturers sometimes tend to be more creative, while the students look passive. Thus, the interaction between lecturers with students in the learning process is not effective. If the learning process is more dominated by the lecturers or teachers, the effectiveness of learning would not be achieved. Lecturers or teachers as educators do not dominate activity, but help to create conducive conditions and provide the motivation and guidance so that students can develop their potential and creativity, through the interaction of teaching and learning. According the opinion of Basiyruddin in more learning advanced interaction, the process of interaction between the teachers and students can be done in a variety of forms or methods, and it is expected by using the right and appropriate method, then the expected results of the process learning will be more optimal and right on target [14].

### 3.2.3. Environtment Analisys

Sahroni argues that one important aspect of success in the learning process that is implemented by teachers is t environmental conditions [15]. Effective learning conditions are conditions that are really conducive, a condition that is completely appropriate and supports the continuity of the learning process, and for that we need to understand a few things which have an important role in the creation of conducing conditions of learning.

Based on the results of interviews conducted to the lecturers and students, it is found that in the process of learning, there are things and media that mean of supporting learning such as a good room in terms of lighting, fresh air temperature, display photos in the form of adequate pictures in order to support learning. However, there are many broken and useless tools to support learning such as in focus without any repairs. Therefore, a study is carried out by using the available equipment from safe environment and surroundings.

### 3.2.2.1. Review of Literature

On elementary linear algebra courses, there are a number of materials covered in accordance with the syllabus applicable i.e. system of linear equations, systems of linear equations, matrix, homogeneous type of matrix operations, determinant, the function of the determinant, the expansion and cofactors and vector in the vector space of dimension two- and three-dimensional space.

In relation to the material discussed in semester III i.e. elementary linear algebra courses and literature analysis, from the observation and interview conducted, it is found that there are books which are used in the learning which are only based on textbooks and they just present some theories and examples of questions. Therefore, the use of this textbook is perceived ineffective to be used as material or reference to create problem-based learning model and as reference to give reward as well as deciding it as teachers and students’ handbook. Theories about problem-based model are realized in learning step of work principles, whereas the theory about learning model is as a basis in the application of the rules of the development model of learning. The achievement of learning objectives refers to the purpose of the university curriculum (KKNI).

### 3.2.2.2. Product Analisys

Analysis of the products is done by analyzing the models applied in learning. The purpose of this analysis is to know about the existence of a product or system model and supporting materials used in the learning process. Problem-based model is an approach to learning that is started by completing an issue, but to resolve the problem, the learners require new knowledge to be able to get it done. Problem-based learning approach is a concept of learning that helps teachers or lecturers to create learning environment that begins with an important and relevant issue for learners, and allows learners to acquire a more realistic learning experience.

Problem-based learning involves learners in the learning process that is active, collaborative, learner-oriented, which develop problem-solving abilities and capabilities of independent study that are required to face the challenges in their life and career in a very complex environment. To achieve optimum learning outcomes, learning with Problem-based learning approach needs to be well designed starting from the
preparation of the issues corresponding to the curriculum that will be developed in class, the issue of learners, the equipment that may be needed, and assessments that are used. Teachers who are implementing this approach should develop themselves through the experience of managing their class, training through informal education or formal education. Therefore, problems-based teaching that will be applied must be appropriate with following syntax:

- Formulating the problem and giving the reward,
- Analyzing the problems and giving the reward,
- Formulating a hypothesis and giving the reward,
- Collecting data and giving the reward,
- Testing the hypothesis and giving the reward,
- Concluding and giving the reward.

Based on the model of the problem-based learning, and the giving of reward, it will give more effective teaching and learning to develop critical thinking and improve students’ motivation in learning.

Based on research conducted at the stage of preliminary research, there are some problems that can be addressed in each stage including:

- Need and context analysis,
- The study of linear algebra that has been conducted nowadays using the expository method focuses on the explanation of the material and giving examples of questions as well as assignments in the form of exercise. In another occasion, lecturers tend to apply very minimal learning in the form of group discussions and presentation of students that is later continued with the explanation from the lecturers. In this learning activity, the teaching learning process is still in the form of teacher-centered; the lecturers are a source of information and have not been able to engage students in active learning.

Review literature, The learning and teaching that was done by lecturers and students used the book written by Anton Hower in elementary linear algebra which is only based on the textbook which only conveys some theories and give examples of questions. Therefore, the use of this text book is perceived not adequate to be used as a reference material in order to create problem-based learning model and giving the reward, along with setting the subject matter in the book that the lecturers and students use.

To achieve optimal learning outcomes, learning with Problem-based learning approach needs to be well-designed starting from preparation of the issues corresponding to the curriculum that will be developed in class, issues of learner, the equipment that may be needed, and assessments that are used. Teachers who are implementing this approach should develop themselves through the experience of managing their class and training through informal education or formal education. Therefore, problems-based teaching that will be applied must be appropriate with following syntax.

4. CONCLUSION

Based on results of research and discussion, the research can be concluded that the preliminary research of problem-based learning model development and the giving of reward is a model of learning which engages students to solve a problem through the stages of scientific method so that learners can learn the knowledge related to the problem and at the same time they have the skills to solve problems. The development that is conducted is a mix of problem-based learning model with the giving of the reward in each of the steps that contains on the syntax. Therefore, based on various problems found in field, the researchers assume that the model that is developed and implemented will be able to make the process of learning becomes more active, more engaging, and more motivating. Thus, it can improve the understanding of concepts and problem solving.

REFERENCES

[1] Wena, Made (2008). Strategi Pembelajaran Inovatif Kontemporer. Jakarta: Sinar grafika Offset
[2] Eggen Paul, (2012). Strategi dan Model Pembelajaran.Jakarta : PT.Indeks
[3] Tan, Oon-Seng, (2004). Enhancing Thinking Through Problem – Based Learning Approach, in : International Perspective. Singapura : CENGAGE Learning
[4] Sanjaya, Wina, 2006. Strategi Pembelajaran Berorientasi Standart Proses Pendidikan, Jakarta: Prenada media
[5] C.P. Caplin, (1989). Kamus Lengkap Psikologi. Terj. Kartini Kartono, cet. Ke-1, in: Jakarta: Rajawali
[6] Usman Najati, Muhammad, (2005). Psikologi Dalam Al-Qur’an, terj. M. Zaka Al-Farisi, Bandung: Pustaka Setia
[7] Elizabeth B, Hurlock, (1990). Perkembangan anak. Terj. Med. Metasari Tjandrasa, Jakarta : Erlangga
[8] Anvisa, (2014). Interkoneksi Dalam Pembelajaran Aljabar Linear Elementer Dalam Islam, in: Jurnal Potensial, vol 12 Edisi 2, Desember 2014
[9] Treffers, A., (1991). Didactical Background of a mathematics Program for Primary Education. In L. Streifland (Ed), Realistic Mathematics Education in Primary School, in : Utrecht: Freudenthal Institute, Utrecht University
[10] Soedjadi, R. (1994). Memantapkan Matematika Sekolah sebagai Wahana Pendidikan dan
Pembudayaan Penalaran. In: Surabaya: Media Pendidikan Matematika Nasional.

[11] Feiter, L.P de & Van Den Akker, J . (1995). 
Towards More Effektive Teacher Development in Southern Afrika, in : Amsterdam: VU University Press

[12] Plomp, Tjeerd. (2013). Educational Design Research: An Intoduction to Educational Design Research, in : Netherlands: Slo

[13] Sugiyono. (2011). Metode Penelitian Pendidikan (Pendekatan Kuantitatif, Kualitatif Dan R&D). Bandung : Alfabeta.

[14] Basyirudin Usman, (2005). Metodologi Pembelajaran Agama Islam. Jakarta: CiputatPress

[15] Saroni, Muhammad. (2006). Manajemen sekolah. Jogjakarta. Penerbit AR-RUZZ

[16] Bertheussen, Bernt Arne; Myrland, Øystein. (2016), Relation Between Academic Performance and Students’ Engagement in Digital Learning Activities, in : Journal of Education for Business, 91 (3): 125-131.