

# IMPLEMENTATION OF TRANSFORMATIVE LEARNING THEORY IN IMPROVING THE CONCEPTUAL KNOWLEDGE OF PHYSICS STUDENT OF INSTITUTE OF TEACHERS' EDUCATION

Mara Bangun Harahap<sup>1\*</sup>

<sup>1</sup>Physics Department, Faculty of Mathematics and Natural Sciences, State University of Medan,  
Medan, Indonesia

\*Corresponding author: marabharahap@gmail.com

**Abstract-** In this paper discussed how to improve the conceptual knowledge of physics student of Institute of Teachers' Education (Lembaga Pendidikan Tenaga Kependidikan: LPTK) using transformative learning theory. Physics student of LPTK have difficulty increase conceptual knowledge of physics, due to the difficulty in transforming the concept. In this paper described how to facilitate this change (transformation concept) use of transformative learning theory. The discussion in this paper provide input for faculty and students in conceptual learning. Discussions focused on developing a theoretical model of learning based on the theory of transformative learning in improving the conceptual knowledge of physics students of LPTK.

**Keywords:** conceptual knowledge, conceptual learning, transformative learning theory, transforming the concept.

## 1. INTRODUCTION

Course materials Quantum Physics in the program S1 (undergraduate) and of course in the program s2 (post graduate) and s3 (doctor program) college Institutions of Institute of Teachers' Education (Lembaga Pendidikan Tenaga Kependidikan: LPTK) in Indonesia and abroad is a material that is difficult to learn [by teaching experiences and research results the researchers [15,8,7] and according to the study: [1,20,17,18,4,22,5,13,7]. It looks conclusions [13] about the difficulty of understanding the material relevant to the quantum physics of quantum physics learning research in Indonesia. Morrison concludes that there are three reasons why the study of quantum physics more difficult than studying classical physics. First; Students often encounter opposition in understanding the quantum phenomenon that is clearly different from classical physics phenomenon commonly used in everyday life. Second; Quantum physics works on the territory of one level of reality, namely quantum physics is more abstract than classical physics. Third; Quantum physics is inherently mathematical, meaning that mathematics is the language of quantum physics. Thus, without mastering mathematics as the language of quantum physics and unskilled apply such language to solve problems (problems) of a quantum system, it will be difficult to understand quantum physics.

Based on the experience of teaching and research chief researcher [14,16,8] revealed that the main problem students in understanding the concept of quantum physics is the difficulty of students to change the conception of classical physics becomes the conception of quantum physics is the scientific conception. Even the common conception (interpretation of the concept) mixed in with the classical physics of quantum physics misconception. The difficulty of students is in line with the first factor mentioned above Morrison, the students often encounter opposition in understanding the quantum phenomenon that is clearly different from classical physics symptoms commonly found in everyday life. In addition, based on experience and the results of the study the researchers [16,15,8] in line with the third factor of the difficulty of studying quantum physics proposed Morrison above, the capability students applying mathematics as the language of quantum physics in solving the problems of quantum physics system is simple, they cause difficulties students understand quantum physics. On the issue of the application of mathematics in physics, was the ability to apply mathematics in solving problems of quantum physics is the ability to solve problems of physics that has been categorized as formal problems of physics according to Piaget's theory of cognitive development [6]. This capability is called formal capability in quantum physics. The research team proposing this previous research proposal is basically the study of the development of problem-solving based learning model systematically (PSSS) to enhance the ability of formal lectures quantum physics without researching

the scientific conception [15]. In addition, researcher [15] has been developing a model of social-cognitive constructivist learning to improve the scientific conception of students in basic physics lectures. In that study, the basic physics of matter also alluded to quantum physics.

Until now learning model that also effectively improve the scientific conception and formal capabilities within quantum physics lectures. Now it is urgent/urgent need for an effective learning model to enhance and scientific conceptions and formal capabilities within quantum physics lectures. In other words, the main problem faced in teaching quantum physics today is to apply an effective learning model to enhance and scientific conceptions and formal capabilities within quantum physics lectures. Based of problem that the authors propose the development of Cognitive Constructivist Learning Model-Based Social Problem Solving Method Systematic (*Penyelesaian Soal Secara Sistematis* [PSSS]) oriented in a transformative learning theory and Capabilities Enhance Scientific Conception Formal Students in the Class of Quantum Physics. The author's knowledge (through print and electronic literature search/internet) there has been no such model both in Indonesia and overseas. Learning model developed using the framework of cognitive-constructivist learning model that has been developed social researchers (Harahap) in previous studies and use PSSS method which is based on the results of previous research is conducted to the researchers, as well. oriented transformative learning theory Getting Cognitive Constructivist Learning Model-Based Social Problem Resolution Method Systematic (PSSS) oriented transformative learning is effective in improving the scientific conception at once formal and ability of students in lectures quantum physics.

## **2. LITERATURE REVIEW**

### **2.1 The Conceptual Knowledge of Physics Student of Institute of Teachers' Education**

There are seven issues that can be identified from the results of research on the use of teaching and learning activities that promote the conversion of conception [3]. First, it is difficult for students to change their existing ideas. Second, cognitive conflicts and events that do not conform may not result in the conversion of conception. Third, many learners who have modified their ideas in teaching in the classroom, perhaps resuming his original idea in school settings a few months later. Fourth, the concepts of teachers/ educators can influence the changing conception occurs, if any. Fifth, the order of teaching activity is still debated. Sixth, the study of changing conceptions of teaching to illuminate mismatch (mismatches) in science education between what we know about how students learn, on the one hand, and our classrooms, schools and education systems in the practice of science, on the other hand. The seventh or last, another factor that has to be clarified (illuminated) on the sale situation changing conception is the kind of science that is taught in the classroom.

### **2.2 Model of Teaching**

Based on a review of literature in the form of research: [1,7,20,18,22,4,13,19,5,17], it turns learning model proposed development is a relatively new model of learning, which are not studied in Indonesia and even in foreign countries. Novelty which meant the researchers are no previous studies that develop models for effective learning to enhance and scientific conceptions and formal capabilities of students in learning quantum physics. Learning model developed from the results of research on the theoretical basis of learning and learning based on constructivism. The cornerstone of the theory of constructivism learning model is based on Piaget (called cognitive constructivism) and Vygotsky (called social constructivism) [3,12], as well as transformative learning theory.

Preparation of the learning model based on the "shape" model of learning by [2,4] as follows:

Cognitive Constructivist Learning Model-Social Based Transformative Learning Theory

**SYNTAX:** The model consists of four phases. The first phase is the phase invitational, the phase of its curious learners, by creating a situation that raises a question mark and inviting disclosure preconceptions learners. In this phase learners conception designed disclosure by filing a written or oral questions about the events or phenomena that can later be experimented by learners in groups or demonstrated by the teacher. In the second phase, activities of data collection, which is required for testing the concept that has been proposed to learners of events and / or phenomena in question in the first phase. Learner activities carried out by the group is an experiment. However, if the equipment and facilities available in the laboratory experiment is not sufficient, then selected the demonstration

activities. In these experiments the learners check explanation (conception) that have been advanced in the first phase. At this stage the possibility of a conflict of cognitive and self-regulation (based on cognitive constructivist view). The second phase termed the exploration phase. In the second phase is also already happening collaborative learning (corresponding view of the social constructivist), that is, when a small group (experimental) they have started negotiating the conception of each, both conceptions that have been raised before the experiment and a new conception after checking experimentally turned out conception initially not accurate.

The third phase is the phase of submission of explanation and solutions as well as discussions. In the third phase, the learning process is dominated by collaborative learning. Learners in this phase was asked to express his conception of events or phenomena that prompted the first phase of the classes. Act as a class discussion of each conception disclosure. Collaborative learning environment take precedence and be kept consistent throughout the discussion. How that may be used is to declare to the learners that the discussion is not intended to seek the most appropriate response, but rather is to establish inter-personal communication, ie by observing or interpret answers each learner involved in class discussions. Everyone has the right and must be filed (proposed) conception. If the answer put forward in answering the question in the first phase is different from the test results through experiments or demonstrations during the second phase, then the learner concerned should be able to ask eksplansi and solutions to the differences in the class discussion. Expected in the third phase of construction of a new idea has occurred.

The fourth phase is the phase retrieval action. The process of constructing a new look or a new conception on the third phase will prepare learners to take action on what they have learned. Least learners should be able to make decisions about still wearing the old conception or conception should change radically, and the risk must implement the new conception on any events and other phenomena related to those asked in the first phase. The action taken by the learner (change of conception or not) can be monitored by the answer on the incidence and/or other related phenomena, in the next lesson. For teachers, the fourth phase is the phase of determining whether teachers should provide further clues to the problems encountered in the classroom or not.

Quantum physics problem solving methods (formal capability) used methods Systematic Problem Resolution (PSSS) [21]. The problem-solving method includes steps: ANALYSIS, PLAN, and ASSESSMENT COMPLETION. In step analysis conducted activities: Read the question carefully; Make a scheme or an image (which consists of: Noting the provisions given in the scheme and asked and Recording units and dimensions); Estimating answers (sign, magnitude, and its unit); Dividing the problem into smaller problems that can be solved; and make assumptions if necessary. In step PLANS do activities: Start with the amount sought/ask; Finding relationships (equations), which contains the amount of it (which consists of: Looking for a relationship that includes the amount given as well Combining these relations to reach a settlement); Noting the requirements for entry into force of those relationships; Develop remedy. In step COMPLETION do activities: Perform mathematical transformation (which consists of the following activities: Changing the general relations in a special relationship to the matter and Changing units and dimensions into the same system); Calculating to obtain answers; Examination of the terms of enforceability. In step ASSESSMENT do activities: Checks if the answer in line with forecasts and reality; Check if each part has been completed; Writing answers and final conclusions. In this research, a cognitive constructivist learning model-based social problem-solving method systematically. Learning Model Constructivist Cognitive-Based Social Method Resolution Problem Systematic is a learning model that embraces the view constructivism cognitive and social and contains four phases of activities, namely: Invitational, Exploration, Filing explanation and solution as well as the retrieval action and using methods Completion Problem Systematic and finish formal questions of quantum physics.

Mezirow transformative learning theory used in each phase to change the conception (see for example: [9]). Based on the theory Mezirow, shifting paradigm / perspective transformation is the result of several conditions and processes: an activating event that exposes the limitations of a student's current knowledge/approach; opportunities for the student to identify and articulate the underlying assumptions in the student's current knowledge/approach; critical self-reflection as the student considers where these underlying assumptions came from, how these assumptions influenced or limited understanding; critical discourse with other students and the instructor as the group examines alternative ideas and approaches; opportunities to test and apply new perspectives [11].

### 3. DISCUSSION

By applying the theory of transformative learning in the phases of the learning model that builds on the framework of cognitive and social constructivist theory, suspected would happen alteration mistaken conceptual knowledge (misconceptions) into a true conceptual knowledge.

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### 4. CONCLUSIONS

In this paper, developed a theoretical model of learning. Learning model was developed based on the theory of constructivism and transformative learning theory. Physics student of LPTK have difficulty increase conceptual knowledge of physics, due to the difficulty in transforming the concept. In this paper described how to facilitate this change (transformation concept) use of transformative learning theory. The discussion in this paper provide input for faculty and students in conceptual learning. Discussions focused on developing a theoretical model of learning based on the theory of transformative learning in improving the conceptual knowledge of physics students of LPTK.

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