Pupils Inter-dialogue in the Context of Problem Solving Polyhedron Geometry in Junior High School: Phenomenological Studies

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Abstract. The research aimed to describe pupils inter-dialogue during learning polyhedron. It based on learning obstacle. In didactical obstacles are found problems of conceptual interrelation, thinking continuity, and limitation experience of pupils in the polyhedron concept. So, the researchers designed a didactical design to minimize the learning obstacle by creating a more organizer and solve learning trajectory. The design implementation done on the pupils of grade VIII in Bandung during 3 continuous meetings. Inter-dialogue is expected to emerge when didactic design is designed so pupils dialogue with group friends to find solutions for solving problems. Dialogue that produces critical questions is commonly known as Socratic dialogue. The main idea in Socratic dialogue is the teacher’s task is not to give knowledge or provide information to pupils but the task of the teacher designing a learning situation where pupils will ask critical questions. The researcher using phenomenological studies to uncover pupils experience. By using Nonaka theory, the researcher found the pupils knowledge. The results showed the pupils intra-dialogue system in solving the polyhedron geometrical problem of phenomenological studies.

1. Introduction

The fundamental of learning is a teaching and learning process that is not only focused on the results of pupil achievement but in the learning process. The way pupils thought can provide changes in behavior in daily life. Learning can be said as a process of interaction between teachers, pupils and material so that the desired behavior is formed in the presence of stimulus. Thus interaction named as a system which will eventually lead to a goal. Objectives, learning materials, approaches, models, strategies, methods, media and evaluation are components of the learning process. Learning component that systematically connects with pupils and learning cycle in a contextual framework. Threaded in the conclusions of dialogue that presents a variety of interactions forming experiences.

In process, dialogue can be either a written or direct conversation between two or more people, a literature and theatrical of the conversation. Dialogue can be used as a narrative, philosophical or didactic, regard to Socratic dialogue. The involvement of teachers in reading and analyzing historical dialogue is very valuable, but needed to articulate and give examples of why this happened [1]. By using of classical dialogue in teacher education takes the form of sharing experiences and ideas to review mathematical concepts, such as infinite concepts or to highlight meta-mathematical problems, such as definitions and proofs [1].
Dialogue in geometry can be said as an investigation. According to Robert Kegan [1] dialogue in geometry to guide the process then observe it. Therefore, to improve one's communication, one must gradually develop the ability to become participants as well as observers of their own conversation activities. There will be difficulty in understanding. As a progress, observation and understanding of thinking and perception is currently highly recommended. This is related to communication skills in the form of dialogue, which means that the investigation to observe pupil conversation activities brings with it the teacher's need to have a framework for understanding conversations, various conversational models, and several ways to sort out conversations that occur. Teachers will be encouraged to evolve learning communication skills, communication skills training, and evolution towards awareness. So that learning will take place that can bring dialogue between pupils.

Ryve et. al. argues that the analytical approach allows researchers to conceptualize and analyze effective mathematical dialogue by focusing on how individual pupil projects act as an important component of their collaboration [2]. However, besides Ryve A et. al. providing analytical constructs such as focused/contextual events/projects as a tool to regulate the analysis of whether pupils communicate or dialogue effectively, they do not suggest an explanation of why pupils succeed in forming common interactional focus and effective communication. This study aims to contribute to understanding how pupils' visual thinking abilities during interaction and acting when they succeed in forming a focus of general interaction and effective dialogue.

In particular, Godino and Batanero suggest differentiating between didactic mathematics which is defined as the field of scientific and scientific research which aims to identify, characterize and understand the phenomena and conditioning processes of mathematics teaching and learning and mathematics education defined as complex and heterogeneous social systems that include theory, development, and practice regarding mathematics teaching and learning [3]. Knowledge is a dynamic human process where there is a justification of personal belief in truth [4-5]. Knowledge was divided into two types, namely tacit knowledge and explicit knowledge [6]. Tacit knowledge lies in the mind of someone who is in accordance with the understanding, expertise and experience that has been experienced alone, difficult to define because it contains personal understanding stored in each other's minds. Whereas explicit knowledge is knowledge that has been translated and written in the form of documentation so that it is easier to understand. There are several forms during the process of sharing knowledge or commonly called conversion knowledge. Conversion knowledge consists of four processes, as follows: 1) Socialization (tacit to tacit); 2) Externalization (tacit to explicit); 3) Combination (explicit to explicit); 4) Internalization (explicit to tacit) [7].

2. Method
The research method used in this study is a qualitative research method in the form of Didactical Design Research. Didactical design research has 3 stages, namely 1) an analysis of didactic situations before learning in the form of Didactic Design Hypotheses and Anticipation of Pedagogical Didactics; 2) didactic-pedagogical or metapedadidactic situation analysis; and 3) retrospective analysis that links the results of didactic situation analysis to hypotheses with the results of the metapedadidactics analysis [8]. Metapedaddidactic provides a theoretical framework whose analysis includes logical cohesion, intact unity, and flexibility that is able to resolve the complexity of the learning process in the classroom that cannot be predicted. In this study, there are two types of subjects, namely the subject of identification of didactic obstacles and the subject of didactic design implementation. The subject of identification of didactic was class VIII pupils in one of the private junior high schools in Bandung which consisted of 32 pupils. Following is the research procedure.
3. Result and Discussion

Based on the results of implementation, the design developed has considered the learning path both in terms of concepts and continuity of thinking. The stages made in Lesson Design according to predictions. It can be seen from the pupil’s response. The pupils’ characteristics are divided into two. When a design is presented, pupils who are accustomed referring to printed books will solve problems as like on those books, while pupils who are not imitative will be happy because pupils are truly given freedom of thought and opinion during group discussions. These characteristics are increasingly visible when the implementation has entered the 3rd meeting. In addition, it can also be shown that there is a pupil response that is in accordance with what has been predicted, and there is also an unexpected response. The response beyond this prediction can be used as an addition to the predictions of the response to the didactic design revision. So that, there is a continuity thinking in pupils.

The didactic design is based on the research results and the results of studies conducted by researchers through the process of repersonalization and recontextualization. Even the end of this study explains the categorization of pupil thinking based on the conversion of Nonaka knowledge. The first meeting had 14 pupils having a socialization model of thinking, 4 pupils had a socialization and externalization model of thinking, 2 pupils had a socialization model of thinking, externalization, and combination. In the second meeting there were 6 pupils having a socialization model of thinking, 7 pupils had a socialization and externalization model of thinking, 4 pupils had a socialization model of thinking, externalization, and combination, 3 pupils had socialization model thinking, externalization, combination, and internalization. Whereas in the third meeting there were no pupils who still had a socialization model of thinking but 9 pupils had a socialization model of thinking, externalization, and combination, 6 pupils had a socialization model of thinking, externalization, and combination, 4 pupils who had a model thinking method socialization, externalization, combination, and internalization. Even in this third meeting there were 1 pupil who had experienced a spiral, socialization, externalization, combination, internalization and returned to the socialization model. One of these pupils even from the second meeting, the pupil had gone through a series of Ways of Thinking – Ways of Understanding mental action triadic [9] until these pupils found new mental actions.

4. Conclusion

The way of thinking for each pupil has different models. At the stage of socialization pupils are in a homogeneous group, pupils are not accustomed to problem solving problems in the form of concepts, do not empathize with others, and have difficulty in conveying their tacit knowledge. Characteristics of pupils in the externalization category in the form of pupils come from heterogeneous groups and pupils are able to translate tacit knowledge. Characteristics of pupils in the combination stage, pupils are able to collect, transfer, disseminate, and construct explicit knowledge. While the characteristics of pupils in
the internalization stage are the acquisition of new tacit knowledge based on the learning process and the resolution of the problem solving context problems that have been implemented.

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Acknowledgments
This research was supported by our colleagues from Universitas Pendidikan Indonesia, all teachers and headmaster for giving us permission and help during this research.