Students' Thinking Characteristics in Concepts Understanding on Basic Statistics Courses That Reviewed From The Extended Level Triad ++

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Abstract

The level of thinking that each student has is certainly different. By classifying this, of course, it can extract the level of thinking and the method used in this case. The purpose of this reasearch is to describe the characteristics of the students' thinking process on Tadris Mathematika students (Mathematics Department Students) of UIN Syekh Ali Hasan Ahmad Addary Padangsidimpuan in understanding the concept of basic statistics courses that reviewed from the Extended level triad ++. This research is a qualitative descriptive research with a sample of third-semester students of the Mathematics Department of UIN Syekh Ali Hasan Ahmad Addary Padangsidimpuan. By giving tests and dividing into low, medium and high. And then an interview was conducted. The results of the research showed that the thinking process of UIN Syekh Ali Hasan Ahmad Addary Padangsidimpuan students in understanding the concept of the Basic Statistics Course was reviewed from the Extended Level Triad ++ divided into 4 levels of thinking, namely Intra Level, Inter Level, Semitrans Level and Trans Level.

Keywords: *Thinking Characteristics; Concept Understanding; Extended Level Triad ++.*

Abstrak

Level berpikir yang dimiliki oleh setiap mahasiswa tentunya berbeda. Dengan mengklasifikasikan tersebut tentunya dapat mengekstaksi level berpikir dan metode yang digunakan dalam hal tersebut. Tujuan penelitian ini adalah mendeskripsikan karakteristik proses berpikir mahasiswa Tadris Matematika UIN Syekh Ali Hasan Ahmad Addary Padangsidimpuan dalam pemahaman konsep matakuliah statistik dasar ditinjau dari E*xtended level triad ++*. Penelitian ini adalah penelitian deskripstif kualitatif dengan sampel mahasiswa semester tiga Tadris Matematika UIN Syekh Ali Hasan Ahmad Addary Padangsidimpuan. Dengan pemberian tes dan membagi menjadi rendah, sedang dan tinggi. Dan selanjutnya dilakukan wawancara. Hasil Penelitian bahwa proses Berpikir Mahasiswa UIN Syekh Ali Hasan Ahmad Addary Padangsidimpuan dalam dalam pemahaman konsep Matakuliah statistik dasar ditinjau dari *Extended Level Triad ++* terbagi menajadi 4 level berpikir yaitu Level Intra, Level Inter, Level semitrans dan Level Trans.

Kata Kunci: Karakteristik Berpikir; Pemahaman Konsep; *Extended Level Triad ++.*

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INTRODUCTION

Activities in the learning process such as reading, writing, and telling that are implemented by humans require various processes to run well, one of which is the thinking process (Cahya Rohim & Rahmawati, 2020). This thinking process greatly affects the results of learning that have been obtained (Setyawan & Dewi Koeswanti, 2021). However, in its implementation, many do not realize that learning consists of various complex thought processes. A good, continuous and systematic thinking process can have a good impact on the learning process, especially in solving problems in a material or subject matter (Setiana & Purwoko, 2020). Mathematics is one of the materials that really needs a series of thinking processes in determining its solution.

Mathematics is one of the subjects that has an important role in various disciplines and advances human thinking (Putri Yani & Matondang, 2024). The important role of mathematics in life can be seen in the use of mathematical theories to calculate and interpret solutions to all existing life problems. So that this condition directly makes mathematics learning need to be learned by students starting from the most basic level. Mathematics learning is a learning activity that emphasizes a person's ability to solve problems (Fajriyah, 2022). This is supported by another opinion that states that mathematics material is an abstract material that has different characteristics from other sciences so, requiring reasoning skills in learning it in this regard, learning mathematics as a whole is learning to solve problems (Fajar Rizqi et al., 2023). The process of solving problems in mathematics includes understanding problems, analyzing solutions and checking answers requires a thinking process (Rambe & Afri, 2020).

Based on the results of observations at UIN Syekh Ali Hasan Ahmad Addary Padangsidimpuan, it is known that there are 30 students in the third semester of the mathematics study program. Another condition is also seen, that during the learning process, not all students understand the material explained, especially in analyzing basic statistical problems. The relationship between the goals of learning mathematics certainly has an impact on solving problems in daily life. This is in line with what was conveyed by (M Tuah Lubis, 2022) in the

process of teaching formal mathematics, teachers should start by exploring informal mathematical knowledge that students have gained from the life of the community around their residence.

Basic statistics material is one of the materials in mathematics that requires a thinking process in solving problems (Sriwahyuni & Maryati, 2022). In its implementation, in the completion of the work, errors experienced by students are still found, both conceptual errors, and mistakes in work (Hastari et al., 2020). This error was found to be almost different from every student who worked on it (Amanda et al., 2024). This happens because each student has a different thinking process. Cognitive development in early childhood is an exciting and important journey that forms the foundation of their intellectual growth (Siregar & Lubis M Tuah, 2023).

The difference in the thinking process of students in solving the problem of understanding basic statistical concepts faced needs to be observed so that it can be improved in the learning process (Reksamunandar, 2020). One of the theories that can be used to observe this thinking process is the extended level triad ++ theory which divides the level of development consisting of pre-intra, intra, semi-inter, inter, semi-trans, trans and extended trans levels (Nugroho et al., 2022). The division of levels based on extended triad++ can make it easier to find out what stage of thinking process students are occupying (Widada & Herawaty, 2018).

Providing concept understanding problems in solving basic statistical problems also facilitates the process of problem solving exploration so that the thinking process can be implemented optimally (Ardiansyah et al., 2024). This optimization can make it easier to know the stages of the thinking process so that in future teaching it can adjust to the thinking process owned by students (Luh Ade Rasvani et al., 2021). So the purpose of this study is to describe the characteristics of the thinking process of students of Tadris Mathematics UIN Syekh Ali Hasan Ahmad Addary Padangsidimpuan in understanding the concept of basic statistics courses reviewed from the Extended level triad ++.

RESEARCH METHODS

This type of research is qualitative descriptive research. This study aims to describe the thinking process of students of Mathematics Tadris UIN Syekh Ali Hasan Ahmad Addary Padangsidimpuan in understanding the concept of basic statistics courses reviewed from the Extended level triad ++. According to (Ningrum et al., 2024) descriptive research is the most basic form of research aimed at describing or describing existing phenomena, either natural or man-engineered. The application of this research was implemented at UIN Syekh Ali Hasan Ahmad Addary Padangsidimpuan in the mathematics study program for the third semester, in the 2022/2023 academic year. The time for conducting the research is carried out from August 2023 to December 2023. By giving tests and dividing into low, medium and high. And then an interview was conducted. As well as triangulation of the data so as to reach conclusions.

RESULTS AND DISCUSSION

Based on the results of the research presented, it can be concluded that the mathematical thinking process of students obtained at the intra level amounted to 1 person or 6.25%, inter level students amounted to 4 people or 25%, and semi-trans level students amounted to 4 people or 25% while trans level students amounted to 2 people or 12.5%, this identifies that each student has a variety of thinking processes in solving the given problem. Analysis in determining the mathematical thinking process in the Extended Level Triad++ based on genetic decomposition divided based on APOS theory.

Table 1. Students' Thinking Level based on Extended Level Triad ++

NO	Name	*Extended Level Triad* ++
1	DNN	Intra Level
2	PA	Inter Level
3	ANN	Inter Level
4	SD	Semitrans Level
5	HT	Semitrans Level
6	NN	Trans Level
7	RD	Trans Level

This research was selected by 7 research subjects so that the levels of Extended Level Triad ++ students of UIN Syekh Ali Hasan Ahmad Addary Padangsidimpuan were obtained. The seven research subjects based on the level of thinking of Extended Level Triad ++ UIN Syekh Ali Hasan Ahmad Addary Padangsidimpuan students can be seen in Table 1.

Intra Level

DNN subject is at the Intra level based on the results of the analysis. The subject's thinking process begins in understanding the problem through the identification of the problem in the given problem. This can be seen where the subject is able to determine enough things to know but the subject is not confident in determining that the things known are enough to answer the question asked.

Student in this case is able to try various possible problem solutions even though they are not perfect. In the answer examination stage, the subject uses an imperfect conclusion formation thought process. This can be seen where the subject does not feel confident in the steps in answering the question in accordance with the opinion (Widada, 2015) that the intra level has genetic decomposition, only takes actions or processes separately and cannot determine the relationship between actions, processes or objects. So, the subject at the Intra level can be concluded to be at the Specializing stage the subject is quite able to identify and try strategies against the given problem.

Inter Level

PA and ANN subjects are already at the Inter level in carrying out the thought process. Subjects at this inter level, the thinking process begins by identifying the problem in the given question. This can be seen where the subject is able to determine sufficient conditions and necessary conditions and is able to determine that the things that are known are enough to answer the things asked.

The next thought process the subject is able to determine the relationship between what is known and what is asked, the concepts and materials needed in answering but are not able to use the concept of transformation in looking for

alternative answers. This can be seen where the subject is able to reflect on the answer by making various possible answer sketches. Mathematical thinking is designed to provide positive encouragement to students through strategies that tend to lead to success in problem solving as a goal to be achieved. The subject expands the answer based on the known information from understanding the problem however, the subject does not understand the concept of Reflection so it has no basis in determining the shadow. The subject does not have conceptual understanding if in solving problems does not use the concepts learned without logical reasons.

Subjects at the inter level have been in two stages of the mathematical thinking process. The first stage of Specializing consists of identifying problems and developing various strategies. The second stage of Genaralizing consists of reflecting on ideas and expanding the possibilities of the results made.

Semitrans Level

SD and HT subjects are at the Semitrans level. Both subjects at this level are already able to identify problems well. This can be seen when the subject reads the information on the question, processes and writes it directly. The information that has been obtained is also necessary and used.

The next stage of thinking, the subject has been able to compile the information that has been obtained into a strategy in answering questions. This can be seen where the subject can give different possible answers. The subject then selects the possibilities used and reflects them into cartesius coordinates and determines each coordinate of the pattern. This shows that the subject reflects well on the problem in the problem using the steps that the subject has planned and uses the right calculation algorithm to answer the problem.

The process of thinking expands the answer shown by the subject being able to determine the shadow of the pattern using the concept of Reflection. This process begins with the subject first identifying the concept of reflection used in determining the shadow and analyzing the properties of the reflection that can be used. However, in the process of drawing conclusions, the subject in determining

the proof of the nature of the shadow is not perfect because here the subject memorizes the procedure for working on the problem instead of finding a solution by understanding the concept of reflection. Difficulties in mathematical thinking of students who often experience a crisis of confidence reveal what has been known or what has been thought. So, the mathematical thinking process in semitrans level subjects is obtained in 3 stages, namely Specializing, Generalizing, and Conjecturing.

Trans Level

The subjects at the Trans level are NN and RD. The thinking process begins with the subject understanding the command of the question requested. The subject can mention what is known, what is asked, the relationship between what is asked and what is known, and whether it is enough to answer what is asked. The subject is able to determine the relationship between what is known, asked, concepts and alternative steps to solve the problem.

The subject's thinking process is good in determining possible answers in open-ended questions. This shows that the subject has thought about expanding the scope of the results obtained through the various possibilities given. Open ended can explore students' mathematical comprehension skills, in addition to learning with an exploratory approach. The thinking stage analogizes to a similar case, the subject can determine the shadow of the object well. This can be seen that the subject is able to use the steps that have been made before and use the right calculation algorithm to answer the problem in terms of determining the shadow.

The subject is also able to think and find reasons why the results obtained can appear. This can be seen where the subject is able to check again and feel confident in the steps that have been prepared. So the subject at the Trans level has gone through 4 stages of the mathematical thinking process, namely Specializing, Generalizing, Conjecturing and Convicing. Although at the Convicing stage, the entire thought process has not been passed, the subject is only able to find the reason why the answer can be obtained.

CONCLUSION

Based on the results of the research that has been implemented, it can be concluded that the thinking process of UIN Syekh Ali Hasan Ahmad Addary Padangsidimpuan Students in Open-Ended Problem Solving Basic statistics courses are reviewed from the Extended Level Triad ++ During Ethnomathematics-Based Learning it is divided into 4 levels of thinking, namely Intra Level, Inter Level, Semitrans Level and Trans Level. Subjects at the Intra level can be concluded to be at the Specializing stage, the subject is quite able to identify and try strategies against a given problem. Subjects at the inter level are in two stages of the mathematical thinking process. The first stage of Specializing consists of identifying problems and developing various strategies. The second stage of Generalizing consists of reflecting on ideas and expanding the possibilities of the results made. The mathematical thinking process in semitrans level subjects is obtained in 3 stages, namely Specializing, Generalizing, and Conjecturing. Subjects at the Trans level have gone through 4 stages of mathematical thinking processes, namely Specializing, Generalizing, Conjecturing and Convicing.

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