**Using Hypothetical Learning Trajectory (HLT) in Scientific Learning Approach**

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**Abstract.** The scientific learning approach is the official learning approach used in the 2013 curriculum. The stages of the scientific approach are: observing, asking, collecting data, associating, and communicating. The preparation of hypothetical learning trajectory (HLT) is considered important as part of learning planning. In the scientific approach, HLT is thicker to occur at the stage of observing, asking, and associating.

**INTRODUCTION**

Indonesia implements a 9-year compulsory education program as an effort to achieve the country's goals of educating the nation's life. 9-year compulsory education is defined as the obligation of every citizen to attend basic education. Most Indonesian people interpret basic education as formal education in elementary and junior high school. Formal education taught in schools has been structured neatly and grouped according to subjects - existing subjects, one of them is mathematics. This requires that mathematics be a thing that must be learned.

Mathematics is a universal science that is useful for human life and also underlies the development of modern technology, and has an important role in various disciplines and advancing human thinking [1]. Lambertus [2] also explained that mathematics is a basic science that is useful for helping people solve various problems both in mathematics itself, other sciences, and problems in everyday life. So that many benefits obtained by studying mathematics.

Studying mathematics is like disciplining the mind, developing logical and critical reasoning [3]. To achieve the maximum development of punishment through mathematics, structured activities are needed in the form of mathematics, mathematics needed is structured knowledge [4]. Structured activities in mathematics at school can be sought by the teacher. Gelatin students can help mathematics correctly. The design must be in accordance with the needs, both in terms of material and learning flow that is suitable for students. A design called learning flow is often referred to as a hypothetical learning path (HLT).

Learning trajectory is a description of how students think and learn in certain mathematical material, and an estimate that is connected (by way of thinking and learning students) through a collection of learning tasks designed (by the teacher) to realize mental processes or activities that It is estimated that it can move students to progress their progress (development regression) to a mathematical material being studied [5]. In simple terms, HLT is an estimate of the way of thinking and learning of students as outlined in the design and collection of learning tasks on certain mathematical metrics. HLT is equipped with predictions of student responses to learning tasks or activities.

HLT according to Simon [6] as follows: “*The hypothetical learning trajectory is made up of three components: the learning goal taht defines the direction, the learning activities, and the hypothetical learning process a prediction of how the students’ thinking and understanding will evolve in the context of the learning activities.”* The first thing that becomes a reference in HLT is the learning objectives that will be achieved through learning activities and predictions as well as anticipating student responses according to their thoughts and understanding. Learning activities in HLT can use a variety of learning approaches and methods, one of which is the scientific approach.

The scientific approach became popular in Indonesia since the implementation of the 2013 Curriculum. In accordance with Minister of Education and Culture Decree No. 55 of 2013 concerning Standard Processes the 2013 curriculum uses a scientific approach as a basic approach that needs to be strengthened with discovery learning, research-based learning ( inquiry learning), and project based learning (project based learning). Scientific approach is a learning process designed in such a way that students actively construct concepts, laws, or principles through the stages of observing to identify or find problems, formulate problems, form hypotheses, collect data with various techniques, analyze data, draw conclusions and communicate concepts, laws, or principles found [7].

The scientific approach to the 2013 curriculum gives a new color in the world of classroom learning. This is in accordance with the new principles contained in the 2013 curriculum, including: 1) from students being told to be students to find out, 2) from the teacher as the only learning resource to learning based on various learning sources, and 3) using a textual approach towards the process as strengthening the use of the scientific (scientific) approach. Kurnik [8] states that the basic methods of competitive thinking and research are analysis and synthesis, analogy, abstraction and concretization, generalization and specialization, induction and deduction. Students carry out various methods to obtain new knowledge, while the teacher is in charge of assisting and facilitating the ongoing learning process.

In particular, the steps in implementing the scientific approach have been summarized in Permendikbud No.65 of 2013 [9] concerning the standard process as follows: 1) observing, 2) asking, 3) collecting data, 4) associating, 5) communicating. In the implementation of the 2013 curriculum teachers must be able to plan or design learning at a minimum to bring the core of the scientific learning approach, namely students find out independently their knowledge. This of course must be adapted to the way of thinking and learning students (learning trajectory). Then, what is the use of HLT in the scientific learning approach?.

**DISCUSSION**

The purpose of planning learning in class is so that planned activities can help students achieve the set learning goals. In planning learning, the teacher must first master the subject matter and also understand the characteristics of students. This is important, because learning will be student-centered, so students themselves will later construct knowledge by utilizing their initial knowledge (knowledge they already have). The teacher can take advantage of this student's initial knowledge to compile the learning path. In accordance with the opinion of Simon & Tzur [10] which states that "The generation of HLT begins with identifying a learning goal for students, which is based on knowledge of the students' current mathematical knowledge."

As mentioned earlier, HLT consists of three components, namely: learning objectives, learning processes, and learning process hypotheses to predict how students' thoughts and understanding will develop in the context of learning activities. Predictions of student responses must be prepared in an effort to plan anticipatory actions. In the stages of the scientific approach, the HLT component enters these stages. The following will be explained in the order of the stages of the scientific approach.

**Observing**, namely the activities of students identifying through the senses of sight (reading, listening), smells, listeners, taste buds and feelers when observing an object with or without tools. Alternative observing activities include observing the environment, observing images, videos, tables and graphs of data, analyzing maps, reading various information available on mass media and the internet and other sources. The things observed must be appropriate and lead to learning objectives (HLT component 1) and also in accordance with the students' initial knowledge, so that these observations can be used for the next stage. The form of learning outcomes from observing activities is that students can identify problems.

**Asking**, which is the activity of students expressing what they want to know, is good with regard to an object, event, a particular process. In the questioning activity, students make questions individually or in groups about what they have not yet known. Students can ask questions to teachers, resource persons, other students and or to themselves with teacher guidance so students can become independent and become habits. Questions can be asked orally and in writing and must be able to motivate students to remain active and happy. The form can be in the form of sentence questions and hypothesis sentences. Learning outcomes from questioning activities are students can formulate problems and formulate hypotheses.

But in reality, it is not uncommon for students to have difficulty asking, in their sense of curiosity has not emerged from the things that have been observed before. HLT compilation can help teachers to overcome this. The learning process hypothesis that is formed in predicting student responses can be used to encourage students to raise questions. Prediction and anticipation of student responses have been prepared before learning takes place, making it easier for teachers to condition the learning process.

**Collecting data**, namely the activities of students seeking information as material to be analyzed and concluded. Activities to collect data can be done by reading books, collecting secondary data, field observations, trials (experiments), interviews, distributing questionnaires, and others. The result of the activity of collecting data is that students can test the hypothesis.

**Associating**, which is the activity of students processing data in the form of a series of physical and mental activities with the help of certain equipment. Forms of data processing activities include classifying, sorting, counting, dividing, and arranging data in a more informative form, and determining data sources so that they are more meaningful. Student activities in processing data for example creating tables, graphs, charts, concept maps, counting, and modeling. Then students analyze the data and compare or determine the relationship between the data that has been processed and the existing theories so that conclusions can be drawn and / or found important principles and concepts that are meaningful in adding cognitive schemes, broadening experience, and insight into knowledge. Learning outcomes from reasoning / associating activities are students can deduce the results of the study from the hypothesis.

At this stage, students' mental cognitive activities are very influential. The ability of teachers to facilitate this stage is very necessary. It cannot be denied that each student has their own line of thinking and understanding. So that it is possible that various ideas will emerge from students. The HLT that has been compiled sometimes does not match what happens in the classroom. However, the preparation of the HLT from one learning to another can help teachers to understand more deeply about the characteristics of their students. This is in accordance with the opinion of Wijaya [11] that HLT can be useful as a guide to the implementation of learning while providing various alternative strategies or scaffolding to help students overcome difficulties in understanding the concepts learned.

**Communicating**, namely the activities of students describing and conveying their findings from observing, asking questions, gathering information, processing information or data, and associating those aimed at other people both verbally and in writing in the form of diagrams, charts, images and the like with the help of technological devices simple and or information and communication technology. learning outcomes of communicating activities are students can formulate and account for proof of hypothesis.

Basically, the preparation of the HLT before implementing learning is very necessary for the smooth process of learning itself. Or at least HLT can help teachers prepare various anticipations for student responses that are formed on students' thoughts and understanding. This is in line with the opinion of Wijaya [12] who said that HLT as an anticipation prepared by the teacher for students' mental activities that might arise in achieving learning goals.

**CONCLUSION**

HLT preparation as part of planning learning is the right step. The learning process, which is one component of the HLT, can use a variety of methods and existing learning. During scientific learning, HLT is used during meetings, asking questions, and associating. Nonetheless, the use of HLT, especially part of the predictions of student responses is very useful for the smooth running of the entire learning process on scientific approval.

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