Students concept mastering analysis on astronomy: Case study in physics education department Universitas PGRI Semarang

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Abstract. The course of astronomy as a new course in the curriculum that must be taken by physics teacher candidate at PGRI University of Semarang. Astronomy in front of students is known as part of science-based science that gives curiosity about the science of religion and technology. Mastery of Astronomy concept of teacher candidate is analysis with the aim to take a picture of mastery of concept and process of astronomy lecture which is a new course as the base of development of astronomy learning device based on KKNI. This research method is descriptive quantitative and qualitative. Technique of collecting data is done by triangulation through analysis of test result, astronomy lecture observation, and questionnaire response of physics teacher candidate. Data analysis technique is done descriptively. The results obtained that the results of the test document analysis obtained the test instrument subjects more dominant astronomy on aspects of concept understanding, no test items that measure the realm of analysis and creation. Analysis of test results obtained that the ability of the most dominant students in the realm of knowledge and the lowest ability in the realm of application. The results of observation suggest that astronomical learning is applied by lecture, discussion and assignment methods. Lecturers give lectures related to content, student discussions to discuss more in-depth Astronomy content and assignment to students to make logbook about celestial phenomena. The results of the student questionnaires give a positive response to astronomical learning that provides contextual knowledge in life.

1. Introduction
Course Astronomy is a compulsory subject 2 credits in physics education program UPGRIS. This subject discusses several subjects such as solar system, photometry of celestial mechanics, Observation of celestial bodies. This course has only been applied for two academic years since it was previously the subject of Earth Sciences and Space Science. Each subject matter is reviewed together with reference to the introductory Astronomy textbook. The teaching materials that are often discussed together during this course as a field of research and development of the K-12 educational research, move forward as a growing and vibrant community of scholars [1,2]. The outcome has been total investigation into the theory of teaching. This new approach has been responsible for the creation of a 'laboratory' which stimulates research into teaching theory and practice [3,4].
The model discussed here has been used in the didactical design of the actual lab and raises questions for an investigation of student learning [5]. Implementation of laboratory activities in astronomy learning is very important to implement. Learning for this course has been done both face-to-face and independent [6]. Face-to-face activities are conducted to convey theories and the introduction of ways to observe the sky of previous observations, whereas independent activities are used as both independent and group observations of celestial bodies. In addition to direct face to face, students get the material taught. Learners encounter science in a variety of contexts beyond the science classroom which collectively could be influential on student attitudes and abilities [7].

From the perspective of teaching, the great laboratory astronomy provides the most prominent connection between astronomy and other branches of science [8]. Learning outcomes for students to get practice on the same sorts of tasks that will be given to them when they take their examinations [9]. This explicitly emphasizes the importance of doing the activity in the class and actively engages the fill in the information. the changes in pre-service Science teachers' astronomy achievement, attitudes towards astronomy and skills for spatial thinking in terms of their years of study. Another purpose of the study was to find out that there was correlation between pre-service teachers' astronomy achievement, attitudes towards astronomy and skills for spatial thinking [10].

There are two types of scientific concepts: factual concepts and theoretical concepts. The concept of material states such as solid, liquid, and gas is a factual concept, for example can be observed in the environment. Theoretical concepts such as atoms, electrons, electric currents, and the like do not find any real example in the environment. The meaning of the concept comes from scientists' imagination of abstract concepts. To explain the factual concept may not be difficult. Understanding abstract concepts of physics requires a high-level thinking process. Students generally learn abstract concepts by using practice tools and then represented by mathematical analysis without being able to know the physical meaning of the abstract phenomenon. This is the cause of student difficulties in studying abstract concepts of physics.

Astronomy presents a very close discussion in everyday life. However, Astronomy in the learning process is only discussed theory, many abstract concepts are difficult to understand by students so it takes the science of science or hands-on activities to facilitate students' scientific thinking. In addition, students' higher-order thinking skills can be more easily trained by establishing the scientific reasoning of the students. This study explains how far the mastery of student concepts about astronomical content. This research as a preliminary study to seek astronomy lecturing process that can equip physics teacher candidate students have high concept mastery, scientific reasoning and high-order thinking. Thus the students are ready to organize the learning process in school.

2. Research method
This research uses descriptive quantitative and qualitative methods [11]. The subject of research is physics education study program at PGRI University Semarang consist of 27 students of 7th semester of academic year 2017/2018. The study was conducted for 3 weeks in November 2017. The study was conducted through observation on the implementation of learning process of Astronomy concept related to the mastery of student concept to Astronomy. Observation of the learning process followed by a questionnaire on student responses regarding the mastery of the concept of Astronomy to obtain primary data. Then performed the analysis of test instruments and analysis of test results regarding the mastery of the concept of Astronomy as a secondary data.

Data processing is done quantitatively and qualitatively starting from the examination and selecting the result data of the questionnaire, observation and test. Data of research result are grouped according to aspect of requirement and problem to facilitate categorization and analysis. Data analysis by describing and connecting the concept mastery to get various description of problems faced in learning the concept of Astronomy to seek recommendation as an alternative solution to solve the problem.
3. Result and discussion

3.1. Analysis of concept testing instruments

The results of the test instrument analysis for the midterm exam and final term exam as in figure 1. The results of the test document analysis such as figure 1 obtained the test instrument of the more dominant subject of astronomy on the aspects of conceptual knowledge and concept comprehension, no test items that measure the realm of analysis, synthesis and creation. This test instrument shows that the test used to measure the mastery of the concept of astronomy at the level of application of the concept.

![Figure 1. Analysis of test instruments.](image)

3.2. Analysis of concept mastery test results

The analysis of concepts master test results for formative exam, midterm exam and final exam as in figure 2. Analysis of the test results as shown in figure 2 shows that the students’ ability is the most dominant in the realm of knowledge and the lowest ability in the application area. Many students get information from class discussions, articles and observation levers. The ability to understand and apply the concept is still low category while the ability of analysis, synthesis and create can’t be measured.

![Figure 2. Analysis of concept mastery test results.](image)
3.3. Observation results on mastery of concepts

The result of observation on mastery of astronomy concept on students is obtained as in table 1. The result of learning process observation can be obtained information about student concept mastery that is on concept knowledge aspect, concept comprehension and concept application. Students are trained to be able to apply the concept. The results of observation suggest that astronomical learning is applied by lecture, discussion and assignment methods. Lecturers give lectures related to content, student discussions to discuss more in Astronomy content and assignment to students to make logbook about celestial phenomena.

Table 1. Results of concept mastery observations.

| No | Indicator of Observation Sheet | Result of Observation |
|----|--------------------------------|-----------------------|
| 1  | Concept Knowing                | Students know information, data and concepts. |
| 2  | Concept Understanding          | Students are able to translate and communicate concepts. |
| 3  | Concept Applying               | Students are able to calculate and measure. |
| 4  | Concept Analysis               | Students have not been able to connect several magnitudes in Astronomy. |
| 5  | Concept Synthesis              | Students can’t synthesize the concept of astronomy. |
| 6  | Concept Creating               | Students do not find the renewal of the concept. |

3.4. Analysis of questionnaire results on teacher and student response

The result of response to the mastery of astronomy concept on the students is obtained as in table 2. The results of the student questionnaires give a positive response to astronomical learning that provides contextual knowledge in life. Students give very positive on the cognitive domain. Students have passion, motivation and enthusiasm in following astronomy learning. Students need learning media and practice package of astronomy science to improve the mastery of student concept to be more optimal. Learning media in astronomy lectures have not been widely used. The use of modules, star binoculars, stellarium software, video observations of celestial bodies have not been used in astronomical learning. Various learning media are very helpful mastery of student concepts [12,13,14,15]. Astronomy learning activities should be added to science practice activities that provide hands-on learning experiences to students. Simple learning media as well as secondary data from various software is needed in astronomy learning. Students can search for additional material from various articles on astronomical discussions. Students and lecturers can interact in a discussion of the observation of celestial bodies independently [16,17,18].

Table 2. Results of student responses to mastery of concepts.

| No | Indicator of Response | Result |
|----|------------------------|--------|
| 1  | Concept Knowing        | Students are enthusiastic and enthusiastic about gaining knowledge about astronomy. |
| 2  | Concept Understanding  | Students are quite able to understand the concept of astronomy because it is very close to everyday life. |
| 3  | Concept Applying       | Students are able to complete exercises on various forms of problem solving. |
| 4  | Concept Analysis       | Students have not been included in concept analysis. |
| 5  | Concept Synthesis      | Students have not been involved in concept synthesis. |
| 6  | Concept Creating       | Students have not been involved in creative concepts. |

Assessment of students conducted during the learning process is the cognitive assessment of the mastery of the concept of astronomy and the results of independent field observation activities. Assessment of the learning process is by assessing student activity during face-to-face activities and the ability of students to observe the process of celestial objects. Assessment of celestial observation tasks is a student observation report completed with drawings. Astronomy learning activities need to be integrated with learning media and science practice in order to master the concept, scientific reasoning and high-order thinking can be optimal. Learning media used to provide student enrichment...
materials, quiz feeding, and observation results of celestial bodies. Concepts are the basis for thinking and communicating [18,19,20].

Mastery of concepts allows students to classify objects. Concepts form the basis of ideas that guide students' thinking. If the basic thinking of students is weak then it will affect the mastery of concepts and scientific reasoning. Therefore, the mastery of the concept of students needs to be addressed so that students can develop and connect the concepts. The limited mastery of the concept of astronomy usually starts from the student's early knowledge and reasoning abilities. Students follow no lessons with empty knowledge. Each student has brought the initial knowledge before entering the next material so that there is a contradiction between the new material and the initial knowledge of the students. This is relevant to the results of research that learning new concepts is not a purely abstract process but there is a process of thinking between new concepts and early student knowledge [20,21,22].

Mastery student learning concepts and experiences related to the knowledge and experience they already have. In learning something mastery of the concept of matter is more meaningful when associated with the contextual daily life of students. Learning media can be recommended as an analogy of abstract phenomena to be concrete so that students are helped to understand the subject of astronomy they learn. Science practice can help students master the concept of astronomy and practice hands-on student skills.

4. Conclusion
The result of the research stated that the result of test document analysis obtained by the instrument of astronomy subject test is more dominant in the concept comprehension aspect, the test item has not yet measured the application, analysis and creation aspect. Analysis of test results obtained that the ability of the most dominant students in the realm of knowledge and the lowest ability in the realm of application. The results of observation suggest that astronomical learning is applied by lecture, discussion and assignment methods. Lecturers give lectures related to content, discussion students to discuss deeper Astronomy content and assignments to students to make logbooks about celestial phenomena such as stars, moon phases, eclipses and planets. The results of the student questionnaires give a positive response to astronomical learning that provides contextual knowledge in life. Students are very enthusiastic with astronomy learning that is closely related to natural phenomena and everyday life.

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