Quality of learning community and presentations task: investigating student’s discourse of the celestial objects coordinates in astronomy to construct scientific reasoning

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Abstract. The discussion of celestial body coordinates in astronomy requires scientific understanding and reasoning to view the concept of the celestial sphere. Students often have a complicated knowledge of the visualization of the celestial sphere through lectures in class. This initial study was carried out through observing the quality of student presentations in the category as the assignment product given by the lecturer. Small group discussion design to explore prior knowledge of students about the content of celestial body coordinates and review students' understanding. The method of this study is pre-experimental design in the form of one group pretest-posttest design consist of 32 teacher candidates teacher divided into eight small groups. Analysis of the discussion of video recording shows an increase in students' scientific reasoning on aspects of the ability to explain content through presentation tasks and investigating the concept of celestial body coordinates through the learning community. The significant scientific reasoning increases the quality of presentations is proven in the presentations systematic and presentation content. A good quality presentation requires an adequate source of material investigation and prior knowledge based on the scientific conception of celestial body coordinates.

1. Introduction

Reading skills of Indonesian students have an average score of 409 from the range 380-560 to measure understanding capacity, use and reflect a text to achieve the goals of learning achievement, develop knowledge and potential, and social participation [1]. Science skills of Indonesian students have an average score of 406 from the range 380-560 to measure scientific literacy in students aged 15 years in using scientific knowledge to identify questions, obtain new knowledge, explain scientific phenomena, and draw evidence-based conclusions about issues that related to science.

Individual thinking skills to understand phenomena through analysis of the relationship of variations in quantities, variables, or symbols to make decisions is scientific reasoning. Scientific reasoning is the basis for constructing, proving concepts, and understanding concepts related to laboratory scientific processes [2,3]. Scientific reasoning is needed in drawing conclusions through scientific processes such as experimental data, formulating hypotheses, and determining predictions based on accurate measurements [4,5].

The results of interviews with lecturers in the astronomy introduction course stated that to achieve an understanding of material concepts in astronomy introduction, especially in the concept of celestial
body coordinates, requires the ability to understand the content, critical thinking skills, phenomena analysis, comprehensive mathematical abilities and comprehensive abilities of physics. The problem of astronomy introduction courses is the availability of limited astronomy teaching materials, students who have difficulty using references from print and digital media to understand concepts, scientific reasoning difficulties, and problems solving problems. Other basic abilities related to scientific reasoning are examining accurate sources, finding knowledge, arguing, developing ideas, and evaluating [6,7]. This basic ability has not emerged in the learning process of astronomy.

The learning process of astronomy should provide a high level of understanding involving critical, analysis, and reflective thinking skills capable of considering the nature and quality of content or arguments in a learning resource. This learning process is pursued through discussion activities in the learning community and team presentations. Students review videos, astronomy learning media, and teaching materials given by lecturers through the learning community. The results of the discussion in the learning community are presented in class to build student scientific reasoning [8,9]. The results of the observation show the discussion pattern of the learning community and identify the students’ scientific reasoning toward achieving the objectives of the introductory lecture on astronomy.

In the discussion, a learning community was developed to foster analytical thinking and critical students to build scientific reasoning based on presentation assignments. The stages of learning community carried out begin through the lecturer, delivering an introduction to the topic of celestial body coordinates at the beginning of the meeting as many as five lectures. Students prepare the results of discussions, presentations, and exercises. Presentation assignments provide learning methods that direct student scientific reasoning in the form of thinking patterns, examples, and models of student argumentation. This discussion in the learning community is applied to develop student epistemic awareness and exercise the ability to argue in responding to questions. Discussions in learning communities and presentations are expected to train students to respond to authentic questions in discussions by describing explanations based on scientific reasoning, reason, and evidence. This research analyzes the quality of the learning community and the presentation of presentations by investigating the understanding of celestial body coordinates in astronomy lectures to build student scientific reasoning.

2. Method
Students of physics teacher candidates as samples in this study were 32 students (male = 5, female = 27) from two different classes in the odd semester who took astronomy courses, and the study group consisted of 8 small groups. Astronomy provides students with the experience to build scientific reasoning through group learning and team presentations. Group learning and presentation on the topic of celestial coordinates is a lecturer intervention to analysis the quality of scientific reasoning. Interventions group learning and presentations through a series of assignment stages, including searching for literature, studying learning materials and references, exercises, making summaries, and presentations in class. The study group presentation material presents a summary of celestial coordinates that trigger questions, respond to questions, provide arguments, and take notes based on astronomy literacy. The technique of collecting data uses an observation sheet on the quality of student presentations in the class as a product of assignments to studying groups given by lecturers [10,11]. The method of this research is pre-experimental design in the form of one group pretest-posttest design. The results of observations of discussions, presentations, and video recordings on aspects of the ability to explain content, systematic content, and investigation of celestial body coordinate concepts were analysis by quantitative and qualitative approach.

3. Result and Discussion
Involvement in discussions has increased the emergence of authentic questions for the first 5 minutes then declined gradually until the end of the intervention. During the intervention, the teacher submits test questions gradually creating student involvement to actively participate in the learning community [12] and mastering presentation assignments related to an indicator of scientific reasoning [5] such as Table 1 and Table 2.
Table 1. Description of the learning community

| Learning community element | Indicator of scientific reasoning | Description | Percentage |
|----------------------------|----------------------------------|-------------|------------|
| Exercise                   | Conservation of weight           | Resolve the problem set of celestial body coordinates given to students to practice problem solving | 71 |
| Active participation       | Proportional thinking            | Provide responses and questions in the discussion | 82 |
| Authentic question         | Correlation thinking             | Ask questions to find answers | 86 |
| Affective question         | Advanced proportional thinking   | Asking questions related to experience related to material content | 58 |
| Elaborated explanation     | Advanced Probabilistic thinking  | Claim statement in the form of opinions, beliefs, reasons or evidence | 76 |
| Exploratory talk           | Hypothetical thinking, control of variables | Give examples or illustrations to build knowledge together | 77 |

The authentic question gives the highest achievement of 86%, and this shows the student's curiosity is quite good, and the thinking process in connecting several variables and showing scientific possibilities and predictions. Affective question is still quite low 58%, and this shows the ability of students to understand the content of celestial body coordinates based on experience is still minimal and has not led to sophisticated proportional thinking skills.

Table 2. Description of presentation talk

| Presentation task element | Indicator of scientific reasoning | Description | Percentage |
|---------------------------|----------------------------------|-------------|------------|
| Brainstorming group       | Probabilistic thinking, Advanced probabilistic thinking | The ability to devote thoughts based on facts, procedures and material content | 85 |
| Scientific knowledge      | Conservation of weight, conservation of volume | The ability to analysis scientific knowledge based on facts, procedures and material content | 86 |
| Visual aids               | Proportional thinking, Advanced proportional thinking | The ability to use visual aids in the form of software or learning media for celestial coordinates | 88 |
| Test question             | Control of variables             | Give an inauthentic question that demands an analogy answer | 70 |
| High-level thinking       | Hypothetical thinking            | Asking questions that give rise to generalizations or analysis of higher-order thinking | 68 |
| Speculation question      | Correlation thinking             | Ask questions that require students to consider alternative alternatives | 72 |
| Shared knowledge          | Probabilistic thinking, correlation thinking | Ask questions and answers that give rise to reference information that can be considered general knowledge in discussions | 89 |
Shared knowledge gives the highest achievement of 89%, and this shows the ability to ask questions and answers that provide information in discussions. High-level thinking is still quite low at 68%, and this shows the ability of students to ask questions that give rise to generalizations or analysis of high-level thinking. Descriptive statistics for the quality of learning communities and presentation assignments such as Table 3.

Table 3. Descriptive statistics for the quality of learning communities and presentation assignments

| Phase  | Learning community                          | Presentations task                      | n   |
|--------|--------------------------------------------|-----------------------------------------|-----|
| Initial| Active participation, authentic question, affective question | Brainstorming group, scientific knowledge, Speculation question | 32  |
| The Core| Exercise, active participation, elaborated explanation, exploratory talk | Brainstorming group, scientific knowledge, visual aids, high-level thinking | 32  |
| The Final| The authentic question, affective question | Test question shared knowledge | 32  |
| Mean   | 3.9                                        | 3.5                                     |     |
| Standard Deviation | 0.67                                      | 0.55                                    |     |

Scientific reasoning can be provided through learning community facilities and presentations tasks which are divided into 3 phases, namely the initial, the core, and the final phase. Each phase trains several basic learning communities and task presentations. Percentage of the learning community at the initial phase, the core phase, and the final phase, such as Figure 1.

Figure 1. Percentage of the learning community and task presentations for each stage

Students provide reasons and evidence that are the results of assessing high-level thinking to assess cognitive abilities and scientific reasoning. Presentation assignments present student arguments based on claims, reasons, evidence, and arguments [13]. Students get points based on the quality of the results discussion and assignments of student presentations based on claims, reasons, and evidence. In the study group, a review was carried out to make sure all the material had a question and answer interactions in the discussion. Collaborative learning are influence student argumentation skills [14-16]. Lecturer questions are analyzed and given reviews of detailed answers. The training phase in learning is designed to provide feedback on the lecturers’ questions reviewed to ensure that the training is given by the lecturers’ questions [17]. Some additional examples are used to describe the main components or answers to student questions. Students can encode the results of study group
discussions and draw conclusions based on evidence [8]. Learning community as a vehicle for idea disclosure based on inquiry [18], uses simulation as an illustration to bring up ideas [19], knowledge that provides interaction [20], understanding concepts, learning that provides contextual knowledge in life [21, 22], active involvement in science [23] and scientific reasoning on the concept of celestial body coordinates. Presentation assignments present summaries, train students to develop critical and analytical thinking skills.

4. Conclusion

Student needs to develop the knowledge and skills needed to become critical learners from various references. Knowledge and skills can be achieved through the learning process in the classroom through investigation, training, discussion, modeling, and interaction from various levels of education. The method of discussion and presentation has a high effect on meeting the needs of knowledge and skills. The pattern of interaction, discussion, and presentation of material has the same direction as the ability of students to provide increased understanding and scientific reasoning of students. This study provides findings that the learning community method and presentation of assignments through scientific investigation on celestial body coordinate material has good quality and directs students to increase understanding of concepts and scientific reasoning needed by students in this disruption era.

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