Implementing inquiry learning model to improve primary school students’ critical thinking on earth and universe concept

N Azriani1*, N Islami2, N Hermita1, M Nor2, E Syaodih3, H Handayani3, Z Zulirfan4, A Suhandi4, A Malik5, K Mahbubah6 and A Samsudin7
1PGSD Study Program, FKIP, Universitas Riau, Pekanbaru 28293, Indonesia
2Physics Education Study Program of FKIP, Universitas Riau, Pekanbaru 28293, Indonesia
3Primary Education Study Program, Universitas Pendidikan Indonesia, Jl. Setiabudi, Bandung 40154, Indonesia
4Physics Education Departement, Universitas Pendidikan Indonesia, Jl. Dr. Setiabudi No. 229, Bandung 40154, Indonesia
5Physics Education Study Program, UIN Sunan Gunung Djati Bandung, Jl. A.H. Nasution No. 105 Bandung 40614, Indonesia
6Science Study Program of FKIP, Universitas Islam Lamongan, Jl. Veteran No. 53A Lamongan 62214 Indonesia

*neldaazriani15@gmail.com

Abstract. 21st century skills are a very important skill and must be possessed by students, one of them is critical thinking skills. This study aims to improve primary students' critical thinking by implementation inquiry learning model. Instrument test in this study was 10 question and essay format, and it was adapted by Ennis critical thinking framework. Method this study is quasi experiment. This research was conducted by 54 subjects of primary school students in Pekanbaru. The results of this research obtained students' seen from the value of the gain index after implemented inquiry learning model was in medium category. It could be concluded that the inquiry learning model can improve primary students’ critical thinking skills on Earth and universe concept.

1. Introduction
Knowledge-based societies reveal a rapid progress of science and technology and a need for a comprehensive science education that begins from primary students. All students ought to advantage after the science education providing, which involved thoughtful the scientific dimension of phenomena; critical approval of the potentialities and confines of science, and development of critical thinking [1]. The main determination of science education is to help learners develop high-order thinking skills to face challenges in everyday life, through learning activities that encourage the use of higher-order thinking such as critical thinking, reasoning, reflective and science process skills [2]. The skill of the science process is knowledge as part of science skills, experiments and investigations through scientific experiments. Harlen [3] recommended that science education must facilitate all individual toward take an educated fragment in resolutions and suitable activities that disturb their well-being and the benefit
of society and the environment. This suggests a comprehensive considerate of key science concepts in combination with the progress of scientific skills and attitudes important to students’ exists thru and outside their school years so that they can creatively familiarize and activate in a knowledge-driven society.

One of the main subjects contained in the science lesson is Earth and the Universe. Earth and the universe discuss and learn about how the surface of the earth, weather and other things. With the material on the lesson students can implement their knowledge in everyday life. Realizing the importance of the lesson of science especially in the material of the earth and nature need teachers optimally in order to achieve a good learning process. A good learning process will be seen from students' critical thinking skills. Critical thinking skill is a thought that includes the curiosity, the ability to analyze and the ability to evaluate the problem. Critical thinking skills are one of the skills students have to endure and are strongly emphasized in the 21st century. 21st century science education is oriented towards developing strategies and solutions to solve problems in everyday life [4].

Critical thinking is a mode of thinking about what matter, substance or problem, in which the thinker enhances the quality of his thinking by handling skillfully the structures inherent in thought and applying intellectual standards to him [5]. Critical thinking skills are also an understanding and knowledge that is at the cognitive level according to Bloom's taxonomy. The application of teacher strategies in improving students' critical thinking skills can be an opportunity for more skilled teachers [6].

An inquiry-based instruction that dynamically engages students in searching and investigating things (objects, humans or events) systematically, critically, logically, analytically so that they can formulate their findings confidently and increase evidence-based reasons considered fundamental to support students' understanding extraordinary and reason for essential science ideas [7].

Science teachers are encouraged to involve their students in finding answers to questions, experiencing phenomena, sharing ideas, and developing scientific explanations that are embedded in real world problems so that in the learning process, students not only act as recipients of subject matter through verbal teacher explanations, but they the role is to find the core of the subject matter itself [8]. Teachers must be able to guide and reflect on group experiences, as well as facilitate group work. It is to support the work of teachers with students, creating innovative science materials to discuss recommendations for science classrooms. Investigations in science classes are experienced empirically and conceptually, and they can change with the process of developing scientific knowledge [9]. Inquiry learning placing teachers is not the only source of learning, but rather is positioned as a facilitator and student learning motivator.

In fact, the critical thinking ability of learners has not been developed, especially in primary school. This is seen in the design, implementation, and assessment of learning in primary schools has not been aimed at developing the critical thinking skills of learners. Primary school learning is still teacher-centered so that the impact of student activeness. Teachers are a great factor in playing their role as controllers of learning processes. Hermida [10] states that teachers are the key to the success of educational quality because they are the spearhead of educators where they meet students scheduled and programmed.

Teachers must undertake innovations to innovate the skills of critical thinking. Applying the right learning model is one of the innovations that can be achieved by engaging actively in active learning activities to find or implement their own ideas. Inquiry learning helps students gain experience of concepts from nature, skills and scientific abilities and an experiment in the process of raising important questions that focus on problems [11]. Active learning through inquiry has the potential to encourage meaningful learning for varied students by promoting an interesting based interaction with scientific phenomena and stimulating discourse among students about the phenomena [12].

This study aims to improve primary students' critical thinking by implementing of inquiry learning model. First paragraph after a heading is not indented (Bodytext style).

2. Methods
The method used in research is quasi experiment [13]. With the research design is given on Table 1 as follows:

| Pre-test | Treatment | Post-test |
|----------|-----------|-----------|
| O1       | X         | O2        |

Table 1. Quasi experiment design

The sample of this research is the 3rd graders of 54 students consisting of 27 students (14 boys and 13 girls, around 9 years old). The instrument this research is critical thinking skill test which 4 questions essay form. The improvement of students' critical thinking skills is calculated using the gain (g) with the formula given on Figure 1 as following:

$$ s = \sqrt{\frac{\sum_{i=1}^{k} (x_i - \bar{x})^2 f_i}{n-1}} $$

Figure 1. Formula to calculate gain

3. Result and Discussion
The purpose of inquiry learning is to develop the ability to think systematically, logically, and critically, or develop intellectual abilities as part of mental processes [14, 15, 16]. Inquiry learning is a series of learning activities that emphasize the process of thinking critically and analytically to find and find out for themselves the answers to a problem in question. The thinking process itself is usually done through question and answer between the teacher and students. Thus, in learning inquiry learning students are not only required to master the subject matter, but how they can use their potential. Humans who only master the lesson are not necessarily able to develop the ability to think optimally. Instead, students will be able to develop their thinking skills when they can master the subject matter.

Inquiry learning model has implemented in students of 3rd graders primary school. To measuring students’ critical thinking on earth and universe concept, all of students 3rd graders primary school has have been given some question and sample of instrument test can be seen in Figure 2.

Ani is assigned by his teacher to find out the earth is round or flat. Ani was confused. Suddenly, in the morning when Ani woke up, she stood in front of her porch. He saw the weather was bright. But he has not seen the sun. Why does this happen? What is the shape of the earth's surface? What other evidence can show the shape of the earth's surface?

Figure 2. sample of instrument test to measure students’ critical thinking
Based on observations using observation sheets and assessment of students' critical thinking skills. Student's critical thinking skill can be seen in the diagram in Figure 3. 

Figure 3 show that students’ critical thinking increasing 36.85% and N-gain score 57. The inquiry learning model involves students' reasoning so that it can train students' critical thinking skills. Inquiry teaching in science consists of a variety of instructional strategies that teachers use to guide students to understand scientific knowledge and scientific practices engaging with scientifically oriented questions, giving priority to evidence in responding to questions, formulating explanations from evidence, connecting explanations to scientific knowledge and communicating and justifying explanations [17]. Inquiry learning emphasizes the process of discovery and finding. Study material is not given directly. The role of students in this learning is to find and find their own subject matter, while the teacher acts as a facilitator and student guide for learning. Inquiry learning is a series of learning activities that emphasize the process of critical and analytical thinking to find and find answers to a problem in question so students can have various skills and dispositions to analyse, evaluate and assess the beliefs and establish the complexity of real life situations [18].

Classroom research shows how problematic it is to verify students are given prospects to explore their own concepts although at the identical time certifying that students are assumed acceptable funding to guide their thinking [19, 20]. Specifically, educators need help appreciative how students think about science phenomena, how approaches can stimulus student thinking, and how to practise lesson ideas in decided ways for students in their unique framework. Teachers need guided practice in leading student dialogues, teaching thru small group and independent work, and in using assessments as learning occasions. Guiding students in asking science questions, constructing ideas for seeking answers, and construction sense of their involvements as they progress explanations and conclusions is principally difficult for teachers new to inquiry. Clearly, science teachers need on-going support, some of which force be accessible through materials for teachers, as they learn how to guide their students in inquiry science.

4. Conclusion

Based on findings and discussion, it can be concluded that inquiry learning model can improve students’ critical thinking. This research has implemented inquiry learning model and effectively improving students’ critical thinking 36.85% and N-gain score 57. Inquiry learning model is alternative to improve students’ critical thinking skill.
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