Implementation of free inquiry learning model to establish 21st century skills

N Muspiroh\textsuperscript{1}\textsuperscript{*}, M Umami\textsuperscript{1} and D Cahyati\textsuperscript{2}

\textsuperscript{1}Jurusan Tadris Biologi, FITK, IAIN Syekh Nurjati Cirebon, Jl. Perjuangan, Kesambi Cirebon, Jawa Barat, 45132, Indonesia
\textsuperscript{2}Departemen Pendidikan Biologi, Universitas Pendidikan Indonesia, Jl. Dr. Setiabudhi No. 229, Bandung 40154, Indonesia

*noviantimuspiroh.ak@gmail.com

Abstract. Free inquiry learning model through field trip activity on Invertebrate Zoology and Macro algae courses for prospective biology teacher's need to be done, as efforts to establish 21st-century skills to compete in globalization era. The skill in the 21st century includes three domains of competence: cognitive, interpersonal, and intrapersonal. The research purpose to describe cognitive, intrapersonal and interpersonal competencies for a prospective biology teacher. This research uses a quantitative approach with survey method for biology students. Data collection through observation and filling questionnaire. Data were analyzed using descriptive analyse. The results showed that cognitive competence includes cognitive process and strategies, knowledge and creativity with a range of values 80-98, while Likert analysis results on intrapersonal and interpersonal competence showed positive results. The conclusion that free inquiry learning model through field trip activity can establish 21st-century competence needed for a prospective biology teacher.

1. Introduction
Natural Science is one of the sciences studied in college natural science studies the phenomena of nature systematically, based on experimental results and observations. Natural science is science that deals with natural phenomena and material, which is systematic and generally accepted as a collection of observations and experiments [1]. The study of natural science is a way of finding out about nature systematically, so that science is not only a mastery of a collection of knowledge, facts, concepts or principles, but also a good discovery process through investigation, experimentation, observation, and so on. Students’ scientific attitudes in science learning can be developed through discussion, experimentation, observation, simulation, or project activities in the field [2]. Scientific attitude can be defined as, “open mindedness, a desire for accurate knowledge, confidence in procedures for seeking knowledge and the expectation that the solution of the problem will come through the use of verified knowledge” [3].

Science learning on Invertebrate Zoology and Macro algae can be a program for students to study the natural environment. The learning process should focus on engaging immediate experience, such as a field trip for the development of competence to explore and understand nature scientifically. By inviting students to interact directly and understand nature through the process to find something, and to do something, it helps students gain a deeper understanding. Science learning should be conducted
in scientific inquiry to cultivate the ability to think, work, be scientific and communicate them as an important aspect of life skills [4]. Biology as a part of science subjects requires direct experience in learning activities. Appropriate learning model is free inquiry with field trip method.

Some research results show that inquiry and field trips have a positive impact in the learning process. Research states that inquiry can improve the skills of the science process, understand the concept and scientific attitude of students [5]. Meanwhile, research to determine the influence of field trips on students' creative thinking skills and practice on art education, suggest trip to nature and industrial locations can assist students in developing creativity and practice in education [6]. Based on some research results and observation results, the researcher conducted research by applying guided inquiry learning model through field trip activities to establish the 21st century competencies needed for students as Biology teacher candidates. One of the challenges of becoming a teacher today is the need for 21st century skills. They are needed to be further developed through research of cognitive competence (consist of cognitive, knowledge and creativity processes), intrapersonal competence (consist of intellectual openness, work ethic) and interpersonal competence (consist of teamwork, collaboration and leadership) [7].

2. Method
This research uses quantitative approach of survey method. The survey was conducted on the beach of Santolo, Pamengpeuk Garut, West Java. Subject in this research are the student of Syekh Nurjati Institute of Cirebon 3rd semester who took the courses of Invertebrate Zoology and Macroalgae. The study was conducted for 4 weeks. Students are divided into groups by number per group of 6 students, observe of marine biota and collect specimens on Santolo beach. The results of the collection of specimens are brought to the laboratory for the identification process. Identification process by identifying each morphological character and comparing with related reference. The results of identification are written in the form of a report journal and a collection of preserved specimens of marine biota and presented the results. Data collection to measure the 21st century skills of cognitive competence (include cognitive processes, knowledge and creativity) is a journal of preserved reports and collections, while intrapersonal competencies (include intellectual openness, work ethic and self-evaluation) and interpersonal competencies (include teamwork, collaboration and environmental awareness) through questionnaires and analyzed using Likert scale. The results were analyzed descriptive analyzed on all 21st century competencies.

3. Result and discussion
3.1. Cognitive competencies
Table 1 shows the result of the research of 21st century skill formation on cognitive competence shows student of Biology teacher training program has creativity and innovation by presenting the result of field trip in the form of atlas and specimen of marine biota as media, which can facilitate in studying it. In 21st century skill the ability to find and organize information quickly and efficiently a critical skill. The free inquiry model in the learning process can shape and enhance creativity [8]. This ability is required by a prospective teacher in providing creative and innovative teaching. Furthermore, on the knowledge indicator and knowledge process of students are based on the report journal of marine biota research results. In the cognitive process obtained lower results, shown in the ability of critical thinking, analysis and interpretation in the manufacture of journal reports in the form of identification and classification of invertebrates and macro algae does not cover the whole aspect. Nevertheless, the process can support increased cognitive competence (content skill) because prospective teachers must complete data analysis of various invertebrate and macro algae specimens from many sources of information with ICT capabilities. Thus they gain greater insight and information about the scholarship. Furthermore, in their lectures presented the results of their research journals as a learning process for dissemination of information and knowledge. Thus the implementation of free inquiry through field trip can establish cognitive competence in both critical thinking and creative ICT literacy, communication, which is the core of 21st century skills [9]. 21st century skills must be
mastered by a prospective teacher, so that they can have the knowledge and skills that can be integrated in classroom teaching to meet the learning objectives and challenges of the century. Furthermore, they are expected to become agents of change in 21\textsuperscript{st} century knowledge and skills implementation in curriculum and subjects. The implementation of 21\textsuperscript{st} century knowledge and skills in science learning, including digital literacy, inventive thinking, productivity and effective communication [10].

Table 1. The assessment of cognitive competencies in the implementation of free inquiry learning model through field trip activity on Syekh Nurjati Institute of Cirebon students

| Indicator             | Min score | Max score | Mean (N = 109) |
|-----------------------|-----------|-----------|----------------|
| Cognitive process     | 80        | 96        | 90,16 ± 3,53   |
| Knowledge             | 80        | 97        | 93,17 ± 3,05   |
| Creativity            | 90        | 98        | 94,19 ± 13,19  |

3.2. Intrapersonal competencies

Based on the analysis of the data description through Likert analysis showed a positive to implementation of free inquiry learning model can establish the character of intrapersonal. The intrapersonal characters are sequentially from the highest of work ethics, intellectual openness and self-evaluation (Figure 1). Work ethic includes integrity, being able to direct and position oneself according to conditions (self-direction), achievement orientation and professional. A good work ethic to be a conscientiousness character. That’s seen an enthusiastic attitude of students in the process of collection and identification of marine biota. Intellectual openness includes curiosity, intellectual interest, continuous learning and personal, social responsibility well and appreciation for diversity. Intellectual openness showed openness students during or post-learning, an innovative and creative attitude in the manufacture of preserved specimens of marine biota well. Addition, intrapersonal competencies that can be formed through free inquiry learning such as the students are able to self-regulation and self-evaluation. Although the results indicate a neutral attitude of students in self-regulation, because there are still students who do not have emotional stability.

Figure 1. The effect of the implementation of free inquiry learning model to establish intrapersonal skills includes intellectual openness attitude, work ethic and self-evaluation ability at the Syekh Nurjati Institute of Cirebon students.

3.3. Interpersonal competencies

Based on the results of research indicate that Free Inquiry learning model can positively form interpersonal skills for prospective biology teacher's. This interpersonal skills include teamwork, collaboration skills and environmental awareness(Figure 2). Teamwork and collaboration skills in Free
Inquiry learning model are the main factors in the attitude of agreeableness. This is seen during or/and post-learning, the students to be warm to the group’s friends, the division of the tasks of each individual in the group and help each other so teamwork well. Teamwork and collaboration can improve interpersonal skills so that students are expected to succeed in a multi-cultural world that is a challenge of the 21st century.

In addition, during the process and post-learning through the field trip students have a better awareness of the environment so not only capable students identify marine biota, but they are also able to utilize and conserve marine biota well so as to bring up conservation skills to prospective biology teachers. Learning based on inquiry involves learners for the purpose of students how to think, to understand deeper concepts through search and find process [11] so that students have a good conceptual understanding that is able to integrate between material understanding and material interrelationship with the surrounding environment through ideas and abstractions on how to approach problems, reason, complex plan [12].

![Figure 2. The effect of the implementation of free inquiry learning model to establish interpersonal skills includes environmental awareness, communication skill and teamwork and collaboration at the Syekh Nurjati Institute of Cirebon students.](image)

4. Conclusion
Based on the result of the research, it can be concluded that free inquiry learning model through field trip activity can establish 21st century competence namely cognitive, intrapersonal and interpersonal competencies needed for prospective biology teacher’s. The cognitive competence, creativity ability of biology teacher candidates is better than knowledge and cognitive process. Nevertheless, the ability of cognitive processes can help improve students' knowledge skills of prospective teachers by mainly searching for reference resources through ICT skills. In the intrapersonal competence, the work ethic of biology teacher candidates shown through integrity during field trip activities is more prominent than the intellectual openness and self evaluation. Interpersonal competence is better shown in the environmental awareness aspect, compared to the communication and team cooperation aspects. Thus the implementation of free inquiry can form the skills of 21st century biology teacher candidates.

Acknowledgments
I would like to express my gratitude to advisor 1 and 2 who have participated in the writing of this paper until it can be published and useful for many people. I would also like to thank Syekh Nurjati insitute of Cirebon which has given permission to conduct this research.

References
[1] Fowler H W and Fowler F G 1951 The Concise Oxford Dictionary of Current (London: Oxford University Press)
[2] Susanto A 2013 *Teori Belajar dan Pembelajaran di Sekolah Dasar* (Jakarta: Kencana Prenada Media Group)

[3] Nelson H B 1960 *Rethinking science education. Fifty-ninth year book of national society for the study of education* (Chicago: University of Chicago press)

[4] BSNP 2006 *Standar Isi: Standar Kompetensi dan Kompetensi Dasar SMP/MTs* (Jakarta: Penerbit BSNP)

[5] Koksal E A and G Berberoqlu 2012 The Effect of Guided Inquiry Instruction on 6th Grade Turkish Students Achievement, Science Process Skills, and Attitudes Toward Science *International Journal of Science Education*

[6] Mahgoub Y M and A A Alawat 2014 The Impact of Field Trip on students Creative Thinking and Practices in Art Education *Journal of American Sains*

[7] National Research Council 2012 Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century (Washington, D.C: The National Academies Press)

[8] Khanafiyah S 2010 Penerapan Pendekatan Modified Free Inquiry Sebagai Upaya Meningkatkan Kreativitas Mahasiswa Calon Guru dalam Mengembangkan Jenis Eksperimen dan Pemahaman Terhadap Materi Fisika Berkala Fisika 13 (2) p E7-E14

[9] Ananiadou K and M Claro 2009 21st Century Skills and Competences for New Millennium Learners in OECD Countries. *OECD Education Working Papers*, No. 41, OECD Publishing

[10] Turiman P, Jizah O, Adzliana M D and Kamisah O 2012 Fostering the 21st Century Skills through Scientific Literacy and Science Process Skills *Social and Behavioral Sciences* 59: 110 – 116

[11] Arends R I 2012 *Learning to Teach 9th Edition* (New York. Mc Grand Will. Companies.Inc)

[12] Leonor J 2015 Exploration of Conceptual Understanding and Science Process Skills: A Basis for Differentiated Science Inquiry Curriculum Model. *International Journal of Information and Education Technology* 5(4)