

Pre-Service Science Teachers Perception About High Order Thinking Skills (HOTs) in 21st Century

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ABSTRACT

In the 21st century, the pre-service science teachers faced on extremely global competitiveness, globalization, technologically driven by information and rapidly media-saturated that needs appropriate skills to meet these challenges. The aims of this study is to identify pre-service science teacher perception about HOTs in 21st century. This study employed quantitative design using a survey research method involved 120 pre-service science teachers from Tanjungpura University. The results of this study indicated that students are aware of the importance of HOTs and learning that emphasizes the aspects of HOTs to face the challenges of the 21st century. It is indicated by the mean score of pre-service science teacher perception about the important of HOTs to meet the challenges in the 21st century (M = 4.29, SD = 0.61) and the skills of HOT that their will be required to becomes a teacher in the 21st century (M = 4.31; SD = 0.47) in the high level. This is also provides the reasons why we need cultivating a positive awareness of the importance of HOTs in order to fostering the need for teaching that emphasizes the aspects of HOTs during pre-service education.

Keywords: Perception, Pre-service Science Teacher, High Order Thinking Skills (HOTs), 21st Century

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INTRODUCTION

Today, education around the world faced with the challenges of the 21st century that need the reform of the educational system on a wide scale due to the information explosion, globalization, and competition in all fields. This reform is not about the change of the curriculum content but rather the change of pedagogy, ie the change in the act of simple action toward comprehensive action and the change of traditional teaching which emphasizes low order thinking skills (LOTs) to learning that emphasizes the higher order thinking skills (HOTs). In other words, this transition process as the heart of well-conceived educational reforms and restructuring because it is the heart of the changes of the 21st century (Paul, 1995).

In Indonesian, the awareness of the importance of HOTs also becomes a nationwide educational goal. There is can be seen in the Law on the National Education System, Number 20 by the years 2003: "...developing students' potential to become a critically, creatively, and independently citizenship". In the macro terms, this formula implies that the aims of Indonesian Educational System actually is to develop the potential of learners to have HOTs, while in the micro term, this formula implies that the task and role of teachers in schools is to provide a learning environment that allows the development of students potential to acquire knowledge and HOTs as the core of classroom learning.

Unfortunately, the awareness of the importance of building a learning process that emphasizes HOTs in 21st century is often confronted by a traditional paradigm that still focuses on aspects of knowledge and material mastery. As a result, the learning process that occurs will tend to focus on LOTs (Ball & Garton, 2005; Zohar, Deegani & Vaaknin, 2001), learning activities that rely on teachers in the classroom, and learners more as passive recipients of information. Teachers need an understanding of the whole procedure and understanding of the steps in the whole procedure, and have the ability to encourage and consider critical thinking issues, complex reasoning and creative thinking as they develop classroom teaching programs and strategies (Mazarno, & Pickering, 1997; Engle, & Conant, 2002). This condition is further exacerbated by the tendency of students who often difficulties when given HOTs tasks and they seem to have strong resistance to thinking at a lower level. Kowalczyk, Hackworth, & Smith (2012), for example, reported that limited time in the classroom, low student learning motivation, lack of appropriate learning materials, and student resistance to critical thinking methods were the main reason why the teaching process of thinking was not taught in the classroom.

A number of studies also suggest that the emergence of teacher perceptions related to the difficulty to teaching HOTs in their classroom may be derived from previous educational processes during pre-service education. The lower portion of HOTs during pre-service education is possible due to the assumption that thinking skills are very difficult to teach (Mazarno, & Pickering, 1997; Halpern, 2003). It is not surprising that the selection of conventional learning forms that emphasize memory, memorization and low-level thinking tasks is often regarded as the most rational reason to be used in pre-service education.

In response for this problematic, one of the main agendas that can be done is early encourage the positive awareness of pre-service science teachers on the importance of HOTS in 21st century. For this reason, this study aims to identify pre-service science teacher perception about HOTS in 21st century. More broadly, this research is expected to contribute to understanding the lecture process in accordance with the curriculum in pre-service education that emphasizes the thinking skills in 21st century.

LITERATURE REVIEW

1. What is HOTS?

In general, it is difficult to give a precise definition of higher and lower order thinking. The concept of HOTS basically derived from the Taxonomy of Educational Objectives, Handbook I: Cognitive Domain (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956) and is popularly known as Bloom's Taxonomy. Bloom's (1956) taxonomy of educational objectives was one of the early frameworks that developed to classify mental levels of thinking from LOT to HOT processes. Remembering and understanding can classify into LOTs, whereas the application, analysis, synthesis, and evaluation can classify into HOTS (Zohar, 2004; Teare, 2005).

Although many theoreticians and researchers have different definitions about HOTS, but all of them agree that HOTS means the ability to go beyond the information given, to inculcate a critical attitude, and to solve problems (McLaughlin & Luca, 2000). HOTS are complex thinking processes in outlining matter, drawing conclusions, building representations, analyzing, and building relationships by involving the most basic mental activities (Resnick, 1987), to deciding what to believe; what to do; creating a new idea, a new object, or an artistic expression; making a prediction; and solving a nonroutine problem (Lewis & Smith, 1991). The other expert, Anderson and Krathwohl (2001) also developing a new model of framework thinking and learning outcomes based on Bloom's Taxonomy and then classification six cognitive dimensions processes: (1) remembering; (2) understanding; (3) applying; (4) analyzing; (5) evaluating; and (6) creating. In this framework, a series of knowledge dimensions such as factual, conceptual, procedural, and metacognitive knowledge added to complement cognitive dimensions processes.

2. Why Student Need HOTS in 21st Century?

In the 21st century, the student in many levels of education faced on extremely global competitiveness and globalization. Partnership for 21st Century Skills (2008) describes as follows: "In an economy driven by innovation and knowledge, in marketplaces engaged in intense competition and constant renewal, in a world of tremendous opportunities and risks, in a society facing complex business, political, scientific, technological, health and environmental challenges, and in diverse workplaces and communities that hinge on collaborative relationships and social networking - the ingenuity, agility and skills of the people are crucial to competitiveness". Even, a columnist of The New York Times, Thomas Friedman (2007) argues that in the 21st century makes the world so close and requires everyone to compete using the skills that they possess. He describes

in detail the evolution of the job market and national Economies that have resulted from ten “flattening forces”. These forces require a new set of skills from individuals that wish to flourish or survive in this economy and addressed in order to prepare a new generation for a “future citizenship”.

Not only that, students in the 21st century also will be faced on technologically driven by information and rapidly media-saturated. Since the emergence of technology optic cables and web browser, the explosion of information can be metaphor like "information super fast train", where all the information is delivered digitally (Halpern, 2003), and peoples can easily quite literally at them fingertips via Internet with only a few minutes of "search time" on the computer and a few clicks of a mouse (Lau, 2011).

Data submitted by IBM (2014) estimation the world currently producing about 2.5 quintillion gigabyte data in the form of the file, print, and digital. It is an incredible of information available that's make what we learn today might easily become obsolete tomorrow (Lau, 2011). This is also making a reason why we need to provide all students' achieve the learning outcomes that required be a good thinker. If they cannot think intelligently and clearly about the myriad of information and issues that confront us, they will be on confusion and uncertainty. For this reasons, the student must be able to selected, interpreted, digested, evaluated, and applied all of they needed information in relevant, credible, and valid (Halpern, 2003).

RESEARCH METHOD

This study employed quantitative design using a survey research method to identify pre-service science teacher perception about HOTs in 21st century. The study involved 120 pre-service science teachers from Tanjungpura University, Indonesia using randomized sampling.

The instruments used for this study is a questionnaire. A total of 20 items of questions used in this study to identify pre-service science teacher perception about HOTs in 21st century, range from strongly disagree to strongly agree. The instruments in this study were developed with the help of four (4) education experts to meet the criterion of face validity before using in the wide scales. The criterion of face validity in this study based on expert examination is 0.86 or eligible to be used.

Data in this study were analyzed using descriptive statistics such as mean and standard deviation using SPSS version 16. First, the data were obtained doing scoring and then being converted on the five scales. Next, the data being tested using descriptive statistics and interpreted using criteria in the table 1.

Table 1. Interpretation of the mean scores

Mean Score	Interpretation
1.00 - 2.49	Low
2.50 – 3.49	Medium
3.50 – 5.00	High

(adopted from Wiersma, 2000)..

FINDINGS AND DISCUSSION

A major dynamic impacting the teaching of HOTS in 21st century to preservice teachers appears to be that these perceptions are filtered through their already-held beliefs (Joram & Gabriele, 1998; Webb, 2005). Stuart and Thurlow (2000) discovered that preservice teachers would not change their unstated perceptions or beliefs until they saw the difference in teaching and students for themselves. For the reasons, this study aims to identify pre-service science teacher perception about HOTS in 21st century. Based on the research data collection, the data in table 2 revealed that the mean score of pre-service science teacher perception about the important of HOTS to meet the challenges in the 21st century ($M = 4.29$, $SD = 0.61$) and the skills of HOTS that their will be required to becomes a teacher in the 21st century ($M = 4.31$; $SD = 0.47$) in the high level. Overall, the mean score of pre-service science teacher perception about HOTS in 21st century on the high level. ($M = 4.30$; $SD = 0.55$). According Hasim, Abdullah, Arifin, & Noh (2015), the teachers or preservice teacher see that teaching HOTS has future value and this will logically increase their level of commitment and skills that their need in implementing HOTS.

Table 2. Descriptive statistic analysis of pre-service science teacher perception related with HOTS in 21st century

Aspects	Variables	Mean	Standard Deviation	Interpretation
The important of HOTS for pre-service science teacher to meet the challenges in the 21st century	1. The demand of graduates that have knowledgable and workforce skills in the 21 st century.	4.57	0.61	High
	2. The highly competition in all field	4.38	0.32	High
	3. The rapid flow of information and disinformation	3.76	0.85	High
	4. The convergence of knowledge	4.48	0.73	High
	5. The social-cultural dynamics due to globalization	4.27	0.52	High
	Mean Total	4.29	0.61	High
The skills in HOTS that will be required to become a teacher in the 21st century	1. Critical thinking	4.12	0.45	High
	2. Creative thinking and innovation	4.50	0.53	High
	3. Problem solving	3.89	0.50	High
	4. Complex communication	4.20	0.48	High
	5. Collaboration with others	4.84	0.39	High
	Mean Total	4.31	0.47	High
	Total average	4.30	0.55	High

Furthermore, the data in table 2 also showed that pre-service science teachers have the awareness of the importance of HOTS in the 21st century, as evidenced

by their high perception about this. Pre-service science teachers view that a number of challenges such as the rapid flow of information and disinformation, social-cultural dynamics due to globalization, the convergence of knowledge, and the highly competition in all fields required the fresh graduates that have knowledgeable and workforce skills in the future will increase significantly. In addition, the high perceptions of pre-service science teachers that related in the challenges of 21st century also seem to be consistent with the high demand for teaching that emphasized to HOTS (critical-creative thinking and problem solving), and a numbers of 21st century education domains (complex communication and collaboration with others). Chia & Goh (2016) stated that teachers play a critical role to cultivate various competencies for students in order to succeed in the new century. Teacher have to embeded these educational goals into the curricula they teach, and to do their job well, teachers need to be aware of their own perceptions and beliefs, feel that they are supported to carry out their plans and goals, and have the motivation to develop new pedagogies to improve their practice (e.g., Liu & Tan, 2015; Chia & Goh, 2016). This provides the reasons why we need cultivating a positive awareness of the importance of HOTS in order to fostering the need for teaching that emphasizes the aspects of HOTS during pre-service education.

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To become a “future teacher” that has deal with different facets of challenges in complex environments, pre-service science teachers need 21st-century skills and competencies, such as: HOTS, complex communication, and collaboration with other. The need for the importance of building this skills and competencies not only comes from teachers or administrators in university. These needs can also come from pre-service science teachers as subjects who will faced in the 21st century. The results of this study indicated that students are aware of the importance of HOTS and learning that emphasizes the aspects of HOTS to face the challenges of the 21st century. Consequently, pre-service science teachers should be assisted to acquire HOTS; either through the conventional teaching and learning environment or a self- instructional, individualized manual (Heong, Yunos, Othman, Hassan, Kiong, & Mohammad, 2012).

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