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Engaging Nature of Science to Preservice Teachers through Inquiry-based Classroom

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Abstract: Inquiry-based classroom is widely distributed in the school science based on its useful and effective instruction. Science teachers are key elements allowing students to have scientific inquiry. If teachers understand and imply inquiry-based learning into science classroom, students will learn science as scientific inquiry and understand nature of science. This study aims to explore how nature of science is engaged through inquiry-based classroom in teacher preparation program. Data are collected by qualitative methods; classroom observation, videotape recording, photography, and interview are employed during April-May 2013. Participants are preservice science teachers, Guangxi Normal University, China. The findings showed that inquiry-based classroom is suitable for preservice science teachers. They perceived nature of science at high level and let them to have positive attitude towards science. That is, it helps them to understand nature of science and reach the goal of science education. Then, scientific inquiry and nature of science will be employed to science classroom.

Key words: inquiry-based classroom, inquiry, nature of science, preservice teacher, science teaching

INTRODUCTION

Science is a major subject that taught in the academic institutions. Students need to learn and understand about concept in science and nature of science. The process of teaching and learning should be aware the culture of the society in which students live in which relevant to social thinking and practices (Tasar, 2003). It needs proper teaching and learning process in which provide students to have core concepts, theories and models, the processes gain new knowledge, and make them as a social enterprise operates. Science in the classroom is not only knowledge that teachers transmitted through instructional practices, but also it could integrate nature of science in which teacher as a key element to raise it in the classroom.

Nature of science as part of science education and goal that make students understand about science. If classroom allows students learn about facts, concepts, laws, principles, and theories without how it generates and relation between science with society. It means that science is just dead knowledge that students learn through rote learning or history of science (Griffiths and Barman, 1995). It could engage students to understand what science is and what role it plays by classroom practices that leads students to scientific literacy as well (Matthews, 1994; National Research Council, 1996; Abd-El-Khalick et.al., 1998; McComas, 2000; Miller, 2004; Nuangchalerm, 2009a; Nuangchalerm, 2009b; Nuangchalerm, 2010; Osborne. 2011). Its results will serve not only science itself, but also community of science and society will be shaped science as it be.

Science teachers should understand nature of science and how science should play in the classroom practices for society decision (Driver and et.al., 2000). Teachers' belief about the nature of science is strongly correlated with perception and understanding in science. That those should be implement nature of science should be started in pre-service teachers because if they misunderstand about nature of science, they will engage students to science that it could not be (Borko and Putnam, 1995; Nuangchalerm, 2009b). Teacher preparation program have to seek ways of nature of science stand and show in the current of science teaching. With science education consideration, teacher preparation program can emphasize them too much nature of science through inquiry-based classroom that permits students to understand in and about science.

The inquiry-based classroom will help students to solve problem and make them comfortable with classroom. Teacher preparation program should embed nature of science and teaching strategies in which inquiry-based classroom can be done as possible. It connects between teachers' beliefs and classroom practices, teachers' epistemology is an important mediating influence on how students used to learn and build their scientific concepts (Maor and Taylor, 1995). Teachers' and students' views of the nature of science and inquiry-based learning should be implemented because they can make mental model to solve problem and seek the answer by fully competency (Hodson, 1993; Duschl and Gitomer, 1997). Student involves classroom management, rather than on practices in which teachers meld theory and practice (Blumenfeld, *et al*., 1994; Krajcik, *et al*., 1994).

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That is, inquiry-based classroom acts important role for engaging students to have habit of mind in science and also scientific mind. Pre-service teachers are key element to stimulate their students having nature of science, if they less inquiry-based instruction it can lead classroom miss the goal of science education. This study concentrated on how pre-service science teachers learn to incorporate nature of science into their classroom through inquiry-based instruction. The study can help us to understand inquiry-based instruction in the Chinese context in which applying for other countries as well as educational contexts allowed.

Methodology:

The study conducted with preservice science teachers of Guangxi Normal University between April and May 2013. The study employed qualitative method to gather data; classroom observation, videotape recording, and interviewing about nature of science and inquiry-based classroom. The author attend science classroom as one student, some activities in which students did, and how they behaved were recorded. Some interesting phenomena, interview method employed as it possible. All of data were collected and analyzed by descriptive explanation. Also, questionnaire about students' perception nature of science was asked, participants have to response and express. The level of perception about nature of science is to be considered with Likert's five-point rating scale. Each respondent is asked to rate each item on some response scale. They could rate each item on a 1-to-5 response scale where; 1=strongly disagree, 2= disagree, 3=undecided, 4=agree, and 5=strongly agree. Data were analyzed by mean and standard deviation. The researcher analyzed collected data by using a computer program, checked the completeness of the data, and then obtained data from responses to the questionnaire. Data were recorded; statistic values were calculated and interpreted. Data were analyzed by qualitative explanation.

Results:

Students have learned nature of science by teacher never told them what it is. Classroom activities engage students to meet the philosophy and nature of science in terms of scientific worldview. They have beliefs of what science are during the activities, think, and do about science through scientific inquiry. Science process skills are incorporated in every time that I observed. Preservice teachers learned to talk and inquire knowledge by safe space learning because they can feel free to share, talk, do, think, and create based on cooperative learning and they make a judgment by means of argumentation between public awareness.

The findings of this study revealed that preservice teachers perceived nature of science almost at high level. They perceived that science cannot be separated from our live and society at highest level, but the medium level of perception occurred when science is a subject in which taught in school and scientist is a specialist who live in our society. The level of perception about nature of science can be shown in Table 1.

Table 1: Level of perception about nature of science.

Item	M	SD	Level of perception
Science as a body of knowledge	3.53	1.04	High
Science is an empirical study about nature	4.07	0.94	High
Science is a subject in which taught in school	2.89	1.25	Medium
Science is always need experiment	3.80	0.93	High
Observation is the heart of science	3.70	0.94	High
Science and local knowledge cannot be separated	3.98	0.84	High
Science and art are not separated	3.71	0.97	High
Scientist employs scientific method for build knowledge	4.15	0.67	High
Scientist employs science process skills to seek new knowledge	4.04	0.79	High
Scientist is a member of community	3.91	0.68	High
Scientist is a specialist who live in our society	3.40	1.01	Medium
Scientist is creator new technology to society	3.72	0.72	High
Science is a judgment of social and science ways	3.60	0.89	High
Creative and logical thinking made science progress	4.15	0.70	High
Science made technology, Technology made science	4.16	0.82	High
Scientific knowledge subject to be change	3.96	0.90	High
Science cannot be separated from our live and society	4.67	0.74	Highest

Preservice teachers perceived nature of science almost at high level that instructional strategies influencing to their beliefs and values of what science should be. Even though some items they perceived in the medium

level such as science is a subject in which taught in school. They perceived that science is not just only subject that we teach or study in the academic institutions, but science is relevant to daily life and scientific knowledge should be transmitted to our children by instructional process. The additional data can be supported by explanation as they listed below.

"I think science is a great subject in our life, it is not just appearance in the school"

Attitude towards science can be judged that need to prove them and engage science into classroom. They feel beyond that science is not just only subject that appeared in the school, but also distinguished knowledge in which found in everyday life. Science influenced our beliefs, knowledge, understanding, and way of doing in and out school hours.

"As we know science is a basic law and rational reflection about our nature and society"

"Science is in our life as long as we are good at observing and doing something which we think"

As the above opinion in which expressed by preservice teachers during time of inquiry-based classroom. The perceived nature of science in positive feeling, that makes them to have a good memory and belief about science teaching as it should be inquired.

"…knowledge is a necessity of solving the problem, education is more a teacher here teach students, learning the skills of learning new things, so in the face of the known and unknown problems in front can have very good response"

The additional data in which supported by observation indicated that they perceived science as not only subject, but science is process for constructing knowledge. Scientific knowledge leads to technology that creative thinking employed on how to solve and innovate things by science. They are happy to learn and do with others. Inquiry-based science allowed students to make a cooperative learning, they can share, discuss, talk, and express their ideas about innovation. They have to create something that works and can be explained by scientific principle. Teacher plays his role to be facilitator, students play their role to be constructor and creator that inquiry-based learning engages them to nature of science. They familiar with science process skills every hour that school science practice should incorporated into classroom. The process of science is emerged when they use hands-on and mind-on activities within group.

Discussion:

Students regarded to nature of science when inquiry-based learning run the program of study. It is not difficult to say that process of science integrated during the classroom activities, students think, talk, discuss, act, practice, conclude and etc. that scientist employed for seeking new knowledge. Inquiry-based classroom in China provided example of best practice in which school science should not be abandoned: questioning method let students aware of thinking and seeking new innovation to solve the problem or find some new knowledge (Griffiths and Barman, 1995; Abd-El-Khalick, et.al., 1998; Nuangchalerm, 2012). Teacher seems to students as learning catalyst during science classroom activities. Preservice science teachers expressed their perception as well as they assimilated nature of science through inquiry-based learning in which professor let them know and understand before enter to school science. The level of perception showed that having high level of average score, also they provided some evidences of perception about nature of science through dialogues and interviewing supporting in this study.

Inquiry-based classroom is directly to students for personal wisdom or constructivist approach. The process of inquiry permits students to share their wisdom and concepts by explainable science through small group discussion. If nothing occurred, the knowledge transmission between oneself to others will not be success and reach the goal of science learning (Duschl and Gitomer, 1997). Teachers can stimulate their students by various level of questioning depends on learning styles and readiness. They have to convince with their teaching's belief and classroom success (Nuangchalerm and Prachagool, 2010). The intrinsic drive by believing and also inquiring mind will let them understand nature of science. That is, they learn how to incorporate nature of science into classroom that those inquiry-based instruction accepted by teaching and learning process.

The results of this study give us example of good practice that educators can use for shaping science education and promoting nature of science into classroom. Preservice science teachers should be engaged nature of science through inquiry-based instruction, it will help them to understand good science teaching and cultivate their students to meet goal of science education. However, it needs time to incorporate nature of science as well

as other skills for good science teachers should be embedded. They have to learn more and practice teaching skills through inquiry-based instruction in continuously.

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