

Preferred and Actual Opinions toward Inquiry-based Instruction of Primary
Science Teachers in the Northeast of Thailand

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Abstract

Inquiry-based instruction is widely used in science classrooms. It helps students and teachers employed student-centered approach as well as the advancements of academic development. This study explored preferred and actual opinions of 545 primary science teachers toward inquiry-based instruction. They were asked preferred and actual opinions through five components of inquiry-based instruction during workshop on active learning from 5 provinces. Data were collected through teachers' inquiry-based instruction questionnaires. Data were analyzed by mean, standard deviation, and percentage, also Pearson correlation was used for seeking its correlational significance. The findings showed that teachers had preferred and actual opinions of teachers toward inquiry-based instruction at high level. Also, phases of instruction, preferred and actual opinions are positively correlated. The findings need to be more discussed how teachers implement inquiry-based learning to their students in the classroom contexts.

Keywords: Inquiry, Teacher Perception, Instruction, Correlation, 5Es

INTRODUCTION

The new education through the lens of 21st century learning is now focusing on how to produce quality of citizen. The quality of 21st century citizens seems to theoretical and practical ways in which all sectors participate in curriculum. Also, teaching and learning should response nature of learners and its change in the context of learning accreditation. We cannot say no to concerns education at all, but we can invest our education to be productive by providing a suitable methods and good practice to instruction. The world of competitiveness influences to change and adaption in diverse aspects. Education is now ready to have academic competition in the arena of evaluation by many methods and criteria i.e. PISA, TIMSS, and other education rankings.

Most successful of education cannot be deny teachers as critical factor, key element, and change agent in the classroom practice. National Educational Act B.E. 2542 (1999) was launched for creating guideline to improve quality of education in Thailand, student-centered approach was promoted to all education level. School curriculum is reformed and pedagogy need to be changed of transformed, students are constructivist, autonomous learners, and self-knowledge creators.

But, the result of competitiveness seems to be less, PISA pointed out that Thailand need to seek alternative ways to make productive and competence learners to face with new era of social changes.

The investigation of inquiry-based learning is widely studied and is growing in importance in today's school science (Qodar *et.al.*, 2018). Inquiry-based learning will be occurred that emerge and stimulate by learning environments, learning design, classroom management by professional teachers. Increasingly, inquiry-based instruction can help students to meet necessary skills in the 21st century learning. Nationally, an increase of education reform is now pushing necessary skills more than student-centered education to all level. Because the world is rapidly changed, both policy and program of education need to answer the 21st century learners. They have to face with complex situations, solve the problem with creatively, make preciously decisions based on reasoning, and arguing with diverse information. The inquiry-based learning is tools of education bridging them to science and education for tomorrow.

Students have to construct their knowledge and familiar with new learning environments. Necessary skills such as 3R-reading, writing, arithmetic,

and 8C-concent, competence, collaboration, communication, critical thinking, creativity, computing and ICT, change and adaptation are need to implement in our children. Home and school can help our children to meet the requirements of necessary skills. Parents should be participated in the process of education, that is, make education to hit the goals of education for all, and all for education. The Teachers can incubate some attribute due to the limited of time in school and other responsibilities. Skills make students valued in their life and work for the future as it is a vital tool to promote in students differently.

Inquiry-based instruction has been long recommended that one of the best pedagogical approaches for school through inquiry methods (DeBoer, 1991). This study aims to investigate preferred and actual opinions of teachers about inquiry-based instruction in the northeast of Thailand. The information will be discussed for implementation as well as education reform. Teachers are key agent to introduce and promote inquiry-based learning to all students. If teachers had, students learned, quality of education should be promoted and response to new era of learning in the 21st century learning. Teachers help students understand content and necessary skills to learning things that surrounding them.

Inquiry-based learning is not new in education, but it is a currently used in education development. It is nature of learning in science as well as science is learning to discover in natural phenomena. Inquiry-based learning help students get new concepts in science, engage students to have nature of science, and also make positively in attitudes toward science (Nuangchalerm, 2014; Nuangchalerm *et.al.*, 2016). In addition, inquiry-based learning makes constructive classroom and productive students (Nuangchalerm, 2013). It is not only helps students to understand real science, but also it will prepare students to face with 21st century environments .

The inquiry as tool of scientists think and do, it has been used in terms of teaching and learning process of science and mathematics. Helping students understand the nature of science (Lederman *et.al.*, 2002; Abd-El-Khalick *et.al.*, 2004), which is the nature of science are linked in relation to epistemology. Creating knowledge in new era, acquisition method for knowledge construction is called for inquiry-based learning. The basis of information and decision making that is reasonable and the benefits that will arise from the decision to develop a society (National Research Council, 1996; 2000; Cakir, 2008). Due to science is a way of knowledge

construction, it make students think and do like scientists (DeBoer, 1991).

Students will take participation to understand in the context of the discovery of new knowledge (Rutherford, 1964), students get to know and understand how the work of scientists to research systematically seeking answers from questions (Sund & Trowbridge, 1973). Students should learn through direct experience of nature, students should continue pursuing the knowledge of self which will help see the process of the science and pressure from students in science content decreased.

Teaching science, inquiry-based learning is a way to access the knowledge of the truth of the scientists for the study the world around (Bybee, 2004). Science needs presentation of scientific findings to public by explaining, consist with the empirical evidence convincing. In addition, inquiry-based learning also covers activities that make students improve the knowledge and understanding of scientific concepts, as scientists study natural phenomena (Anderson, 2002). It also make students to have belief the knowledge that occurs in an individual and held their applause, action, information, and integrating knowledge by virtue of the social interactions that lead to the sharing of knowledge from

one person to another, one with scientific language and culture (Carin & Bass, 1997; Harlen, 2000).

Teaching science through inquiry is the teaching process and way to development of students ' perspectives, understand the scientific concept (Schwab, 1966). Scientific concepts should be adjusted when there is new information or evidence that the explicit. Science should be teaching in the ways of modern science. The instructors should provide opportunities for people to learn from the in- and out-laboratory. Self-exploration from a variety of sources, and apply the knowledge acquired from shared discussions can fulfill them to learn science as well (Martin-Hansen, 2002). It helps students to create a motive in learning by integrating between thought and action (minds-on and hands-on activities) and to stimulate ideas advanced by using question (Minstrell, 2000).

Science is not only subject matter, but also process of learning and acquire knowledge to innovate new thing to our modern society. We cannot reject science by inquiry-based learning because it is a nature of teaching and learning through science culture. Teaching science through inquiry-based learning promote understanding of the nature of science (Lederman *et.al.*, 2002). This is the process of bringing

people to the features of those who know in the age of globalization. Learn to seek knowledge with the research question, answer and use your judgment to decide. Encouraging learners to learn throughout life long learning and making science in meanings.

Teaching science is not only presenting the conclusions of scientists when they are discovered, new knowledge is only known as the "rhetoric of conclusions," these things will keep people do not see the process of science, just see the results arising from scientific work for this reason, therefore, science educators have developed scientific teaching model quest for learning and pushing through the scientific physical classroom to prepare youth to be ready to learn and adapt to a world of change, which is a method that can develop students to access knowledge step-by-step.

Typically, when scientists discover new knowledge will be presented and published through social science concepts as well. Instructors and students like a learning society which is to exchange knowledge, learn and passed from generation to generation (Pottenger, 2007; Seraphin & Baumgartner, 2010). Students are therefore expected to have a similar behavior scientists, such as questions, data collection, data analysis,

communication and presentation of public knowledge. It also requires honesty, responsibility and openness, because teaching quest for learning highlight the nature of science, the importance of the scientific process (What scientists do) and in the context of scientific discoveries (What scientists know). The teaching of science should use a quest for learning which is the approach that will help to enhance understanding of the concept of science and the scientific process, as a result, individual achievement, and motivation to learn (Patrick *et.al.*, 2009). It helps students discover new knowledge and skills and develop their intellectual skills necessary to find the answer (Bruner, 1996).

Teaching science, therefore, promotes the development of the learners in the knowledge. Understanding of natural phenomena and adjustment ideas of the students to understand that science is a part of the social and scientific productivity, it's causing the subsequent social impact as well. It allows students to accept and recognize the importance of science as a tool of human beings to access knowledge and truth. Both are also promoted as a feature of scientists (Sund & Trowbridge, 1973). They have opportunity to develop scientific and necessary skills, learn to learn their own

full potential, based on the nature of science and understanding, which is an important target of study for science (Nuangchalerm, 2010).

The instructor to modify beliefs and values about the nature of science, learning, teaching, change, adjust. Understanding the role of students and teachers during the teaching with the nature of learning by arranging learning atmosphere, contributing to cognitive restructuring, and engaging them to the science lessons (Blumenfeld *et.al.*, 1994). Teachers express their understanding that make a good teaching opportunity for the students with action rather than to describe the theory (Krajcik *et.al.*, 1994). Therefore, this quest for learning as a part of teaching science that develops emotional, social, intellectual, and scientific processes. Students developed their feature as scientists pursuing knowledge by understanding nature of science.

Students learn to communicate science and be able to communicate effectively between local and universal knowledge (Saefullah *et.al.*, 2017). Students are given the opportunity to develop the skills required by their feelings and understanding until the cause of scientific attitudes and have good attitudes towards science. The instructional techniques that help people

learn to relate to questions based on personal experience. This teaching helps enhance the functioning of the brain. Learners understand the real thing not simply to memorize only. The knowledge gained from the experience of the original links into a new experience with a durable understanding. Students learn from hands-on to develop knowledge, thinking from the collaborative process. Students use the tools in a variety of learning to promote classroom democracy.

Teacher preparation time required to teach more than the normal teaching. This requires more time may affect the study of other subjects. Students get to work adding more quality work decreased. Teaching and learning has increased costs. When an activity to study outside the classroom or are experimental. When encountering situations and problems that your instructor assigned. The learner may cause anxiety. If the situation is not created where the instructor makes a suspicious or of interest may result in the deterioration of learners in the lesson. This teaching may not be suitable for large classrooms because it takes a lot of equipment and other resources.

Teaching also provides the opportunity to learn and exchange

academic. The interaction between students and the environments are needed to improve for engaging them to inquiring behaviors (Anderson *et.al.*, 1996). The instructor will need to have the confidence that this teaching is students. Promoting the process of thinking through sensory training when they get put into practice will absorb the attributes of curiosity. Who would like to see? Have fun researching an answer. Therefore, to achieve effective teaching, the instructor should alter the role as facilitators in the learning by the media and the preparation of teaching materials and teachers must get acquainted with teaching, knowledge questions (Barrow, 2006). Promoting the necessary process skills, including developing a scientific point of view, to learners which will help students to understand the world around you are also able to modify the idea is more science. Be able to communicate easily with the science and the environment.

The teaching through inquiry can develop better problem-solving thought processes. Students are those who find the answers with a lively self. In which the instructor must take into consideration the guidelines of learning to fit contents. The context of the classroom and the availability of learning by different method of knowledge construction, it helps

students in both direct and indirect factors without a basis in knowledge construction (Nuangchalerm, 2013). The pedagogical practice in which teachers and students have interaction between inquiry-based learning and pedagogical practices leads students to think and do like scientists. Also, the integration of teaching and contents can meet the goals of science education.

METHOD

The study employed surveying method to explore primary science teachers who participated in the workshop on active learning. Faculty of Education, Mahasarakham University, 5 Educational Services Areas in the northeast of Thailand, and Aksorn Education Company collaborated in the program of teacher development. So, teachers are freely registered in the workshop through online registration. Then, qualifications and amount of registers are defined by Aksorn Education company. Five provinces- Buriram, Nakhonpanom, Nakhonratchasima, Ubonratchathani, and Udonthani are selected. One hundred and eighty teachers in each province are limited through online registration, but the quantity of participant tends to be changed by chance of workshop day. Primary science teachers in each province are selected by chance to ask and response

to questionnaire about preferred and actual opinions on inquiry-based instruction. They have to rate their opinions by themselves and sent to researchers after workshop finished. Final workshop, 545 respondents returned questionnaires. Questionnaires for asking teachers' preferred and actual opinions about inquiry-based instruction are developed. The theoretical background for constructing questionnaires are employed Pedaste *et.al.*, (2015), and Nuangchalerm (2017). Research instrument is validated by 3 experts in science teaching, questionnaires are checked the completeness, and measures the congruency. Questionnaires toward inquiry-based instruction of teachers consisted of 5 components with 32 items by 5-point Likert scale.

Participants have to rate their opinions when workshop finished. Then, the questionnaires are returned to researcher. Data are checked and proved the completeness and filled in the computer. Mean, standard deviation, and correlation are used for statistical testing between preferred and actual opinions. This study employed correlational analysis and qualitative method to explain inquiry-based implementation.

The level of opinion was considered with Likert's five-point rating scale. Each respondent was asked

to rate each item on some response scale. They could rate each item on a 1-5 response scale where; 1 = lowest, 2 = low, 3 = medium, 4 = high and 5 = highest. Researcher checked the completeness of the data and then obtained data from responses to the questionnaire. Data were recorded; statistic values were calculated and interpreted by using the criteria by mean and its interpretation (4.51-5.00 Highest; 3.51-4.50 High; 2.51-3.50 Medium; 1.51-2.50 Low; 1.00-1.50 Lowest)

The opinions were calculated and discussed in quantitative explanation. To meet the purpose of the study, data were described in terms of preferred and actual opinions about inquiry-based instruction to reflect of what teachers express their opinions and understanding in inquiry-based instruction.

RESULTS AND DISCUSSION

The results showed that teachers in the northeastern region of Thailand had preferred and actual opinions about inquiry-based instruction are those at high level. But, the preferred opinion was slightly higher than those an actual opinion and it can be seen at Table 1. All of phase instructional activities were at high level at all. Then the study investigated correlation between phases of instruction, preferred opinion, and actual opinion. The findings showed that

phases of instruction had the positive relationship with preferred opinion at .05 level of statistical significance and it can be seen at Table 2. While as phases of instruction had the positive relationship with actual opinion at .01 level of statistical significance. In addition, preferred and actual opinions had the positive relationship with actual opinion at .01 level of statistical significance.

The phases of instruction in both preferred and actual opinions are positively correlated. It showed that teachers had inquiry-based instruction as well as nature of teaching in science.

Teachers had instructional experiences in different contexts. National curriculum that regulated teachers employing core curriculum,

curriculum design of how and what teachers should invite lesson to their students. The science teaching in Thailand, are mostly used inquiry-based learning in schooling. It allows teachers and students had interaction and involving with student-centered approach as well as National Education Act B.E. 2542. Teachers can study and analyze whether the teaching approach which fits the context of classroom science self, the inquiry-based instruction is seemly significance to school science (Schwab, 1965). Setting inquiry-based instruction can be simply and suitable to classroom, Thai teachers familiar with 5Es which consisted of engage, explore, explain, elaborate, and evaluate.

Table 1. Preferred and Actual Opinions

Phase of instruction	Preferred		Actual	
	Mean score	Level of opinion	Mean score	Level of opinion
Engagement	4.24	High	3.92	High
Exploration	4.30	High	3.98	High
Explanation	4.25	High	3.88	High
Elaboration	4.30	High	3.94	High
Evaluation	4.30	High	3.94	High
	4.28	High	3.94	High

Table 2. Correlation Among Phases of Instruction, Preferred Opinion, and Actual Opinion About Inquiry-based Instruction

	Phases of instruction	Preferred opinion	Actual opinion
Phases of instruction	-	.378*	.984**
Preferred opinion	.378*	-	.487**
Actual opinion	.984**	.487**	-

* statistically differences at .05 level of statistics

** statistically differences at .01 level of statistics

The 5Es instructional activities are widely used in Thailand due to it provided students to set hypothesis, make questions, explore and describe the phenomena. It allows students to present their experiences through observation and scientific explanation. Students perform a planned to solve the problem together. Teacher is an agent facilitates learning and they make students have meaningful learning. Students perform the analysis manually in order to obtain accurate and complete knowledge. In addition, key factors that leads students to have scientific concepts through personal beliefs and assumptions about the nature of science (Roehrig & Luft, 2004), meet the requirement of the aim of education (Lotter *et.al.*, 2007), effective teaching (Crawford, 2007), ability and motivation of the learner (Wallace and Kang, 2004). It also manipulate the culture of learning to be culture of thinking, develop thought processes that lead to the search for answers (Wang *et.al.*, 2010; Goldsmith & Seago, 2011).

To seek knowledge through inquiry, emphasize the fact finding process manually. Questioning techniques that stimulate students to think and generate of what they want to know. Issues leading to a hypothesis to research seeking answers on the basis of knowledge and experience by taking

into consideration the quality of the questions asked. To get good quality questions teachers must think the questions in advance. The question must be able to motivate learners to experience the original link to the new experience. The types of questions that are both open and closed end (Roth, 1996). The question should not be too difficult, and the closest to the original experience of learners. The questions they need to answer should be a sentence or a phrase it.

The phases of inquiry-based instruction, teachers favor to employ 5Es by inviting science knowledge, inquiry focus, freely learned, develop scientific thinking processes, critical thinking to get answers by using various techniques, process scientific question, therefore, is a technique that helps learners develop a process of scientists. The 5Es can be defined into *Engagement*, teachers suggested lesson or interested issues. Issues may come from students or instructors are those in the classroom. The teaching activities consist of questioning issues. Teaching activities should be based on the experience of the original participants have learned already. *Exploration*, teachers should not tell students that they will need to learn and what must not describe a concept much. Students must have a role in the shared

responsibility for what the surveys. Collected and/or save data. The survey outcome will generate a description based on the meaning and understanding of them. *Explanation*, mental facilities to ensure an enjoyable learning for our students to think about the orientation lessons, it make cooperation between the students and the teachers. *Elaboration*, students organize thoughts and hands-on experiences through discovery. Making the link between the original experience with a new experience in what students learned already. The concept that is created must be associated with a different idea or other related experience. Students applying what they have learned by extending the ideas from an example or more of experience in survey spatial arrangement can find details. *Evaluation*, is cognitive testing according to standards of learning assessments should be continuous, which is not the end of the lesson.

Preferred and actual opinions about inquiry-based instruction hit the goal of science teaching, they perceived at high level. They implemented 5Es inquiry into science classroom as well as each phases of instruction is no gap. The level of opinions in both preferred and actual opinions indicated that teachers satisfied with their teaching expectation, but it is not reach the highest level of preferences. In addition, correlation

between preferred and actual opinions about inquiry-based instruction is explored in positively reported. The 5Es inquiry seems to be important to teachers due to it is concurrently used in schools. It is widely distributed in science classroom and others based on curriculum implementation and pedagogical strategies. The results of this study confirmed that teachers in the northeast of Thailand familiar with 5Es inquiry-based instruction. But they need to have continuously improved instruction with understanding in nature of teaching and learning.

Teacher development can be guided by the extensive body of research into how effective change occurs in educational settings. Bell & Gilbert (2005) indicated that science teacher development model includes three components: (a) personal development in which the teacher must be aware there is a need for professional development and acknowledge the desire to acquire new ideas or strategies, (b) social development in which the teachers have opportunities to discuss ideas with other teachers, and to collectively renegotiate what it means to teach science and be a teacher of science, and (c) professional development in which the teachers are supported in implementing the new ideas and strategies in their classroom practice, drawing on the changes they

make personally, and socially. These three components are viewed as essential to building on teachers' commitment to enact change within their own classrooms and professional communities. Identifying teachers committed to personal development can be useful in selecting participants while social development and professional development aspects of the model can be used in designing teacher development programs.

A successful teacher development, calls for change in habits of teachers and their pedagogical strategies. Most of studies, points that views, along with practice, feedback, follow-up, and maintenance of the new skill or idea, allowing the teacher to reflect on their pedagogical implementation (Nuangchalerm *et.al.*, 2016). Many teachers can change their mindset and pedagogical practices by teach having a variety of experienced instruction. However, inquiry-based instruction, served as models for their own teaching; teachers tend to teach as they were taught.

Students involved in the scientific question, gather evidence that will help develop and evaluate the explanation into question about science, create descriptions from eyewitnesses that can lead to answers science questions, assess learners by creating an alternative

explanation, which is caused by the reflection of the idea, and make presentation and communicate what they have learned. The instructor must know that the quest for learning related to the learner's cognitive abilities should be developed. Understanding the processes in which scientists use to do research that help develop knowledge about science, and also the creation of the scientific concept (Bybee, 2000).

CONCLUSION

Teachers in the northeastern region of Thailand had preferred and actual opinions about inquiry-based instruction at high level. All of phase instructional activities were at high level at all. 5E inquiry-based instruction is widely used and familiar with Thai teachers for teaching science and mathematics as well as nature of classroom inquiry. The correlation between phases of instruction, preferred opinion, and actual opinion had the positive relation. It means that teachers employed inquiry-based instruction to their classroom based on preferring and implementing as much as they can do.

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