CHAPTER II

LITERATURE REVIEW

The discussion of literature review is divided into three sections. The first section discusses inquiry-based learning. The second section discusses students' inquiry skills. The last section discusses the connection between inquiry-based learning and students inquiry skills.

2.1 Inquiry-based Learning

2.1.1 Definition of Inquiry

Many experts have defined and discussed the term and nature of the inquiry. The definitions and explanations given are supporting and complementing each other. The National Research Council (NRC) released the National Science Education Standard (NSES) in 1996. In regard to the inquiry standards, the NRC (1996, p. 23) states,

> "Inquiry is a multifaceted activity that involves making observation; posing questions; examining books and other sources of information to see what is already known in light of experimental evidence; using tools to gather, analyze, and interpret data; proposing answer, explanations, and predictions; and communicating the results" (NRC, 1996, p. 23, as cited in Llewellyn, 2014, pp. 5–6)

Leslie W. Trowbridge and Rodger W. Bybee (1990, p. 209) describe that inquiry is the process of defining and investigating problems, formulating hypotheses, designing experiments, gathering data, and drawing conclusions about problems. Another definition comes from Kuhlthau, Maniotes, and Caspari (2007,

p. 4) who define inquiry as a process that can inspire students to learn and create unique ways of sharing what they have learned; and it emphasizes students to conduct their own research and construct new understanding. From that definition, it can be concluded that inquiry is a process of thinking in which individuals can construct their own knowledge and apply it in their life.

2.1.2 Definition of inquiry-based learning

Inquiry-based learning becomes the leading pedagogical approach of the Primary Years Programme (PYP) in IB Schools (IBO, 2007, p. 29). The aims of IB is to develop inquiring, knowledgeable, and caring young people (IBO, 2007, p. 1). As inquiry becomes one of IB curriculum's aim and the main pedagogical approach, it means that inquiry is the most important thing to do by all teachers in IB Schools, including in ABC Kindergarten School.

Inquiry-based learning is based on constructivism learning theory. Bransford et al (2000) as cited by Eggen and Kauchack (2007, p. 235) state that, "Constructivism learning theory can be described as a view of learning suggesting that learners create their own knowledge of the topics they study rather than having that knowledge transmitted to them by some or other source (e. g., another person or something they read)." As inquiry-based learning rooted in constructivism learning theory, the term inquiry-based learning generally refers to student-centered ways of teaching in which students raise questions, explore situations, and develop their own ways toward solutions (Maaβ & Artigue, 2013, p. 780).

The word inquiry-based learning literally means as a learning that based on inquiry. The definition of inquiry-based learning come from Alberta Learning

(2004, p. 1) that defines inquiry-based learning as "A process where students are involved in their learning, formulate questions, investigate widely and then build new understandings, meanings and knowledge." Gulo (2002) as cited in Trianto (2007, p. 135), defines the meaning of inquiry-based learning, he states that inquiry-based learning is a teaching and learning process that optimally involves students' skills to seek and investigate a new knowledge systematical, critical, logical, analytical, so that students can formulate their own findings.

Then De Jong et al, as cited in Santrock (2008, p. 429) state that inquiry learning (is also called discovery learning) is a learning in which students construct their own understanding and teachers facilitate the learning by providing students stimulating activities that activate their natural curiosity.

Based on those definitions above, the researcher concluded that inquiry-based learning is a process that involves students to construct their own understanding through some activities that help them to understand the new knowledge. The activities could be through defining and investigating problem; making observation; posing question; formulating hypotheses; gathering data or information; designing experiment; interpreting data; drawing conclusion about problem; so students can construct their new knowledge and share what they have learned to other people.

2.1.3 Characteristics of Inquiry-based Learning

Inquiry-based learning is based on constructivism learning theory. Bruning et al (2004) as cited in Schunk (2008, p. 235) briefly state that, "Constructivism is a physiological and philosophical perspective contending that individuals form or

construct much of what they learn and understand". First of all, this part will explain about the characteristic of constructivism learning theory as interpret by Bruning et al (2004) and R. Mayer (1996), as cited in Eggen and Kauchack 's book title *Educational Phycology*. Based on Bruning et al (2004) and R. Mayer (1996), the four major characteristics of constructivism are:

1. learners construct knowledge that make sense to them,
2. new learning depends on current understanding,
3. social interaction facilitates learning,
4. the most meaningful learning occurs within real-world tasks.

(Bruning et al, 2004; R. Mayer, 1996, as cited by Eggen & Kauchak, 2007, p. 238)

Based on the characteristics of constructivism above, International Baccalaureate Organization (IBO) describes that characteristics of inquiry-based learning are when students can:

1. exploring, wondering, and questioning;
2. experimenting and playing with possibilities;
3. making connection between previous learning and current learning;
4. making predictions and acting purposefully to see what happens;
5. collecting data and reporting findings;
6. clarifying existing ideas and reappraising perceptions of events;
7. deepening understanding through the application of a concept;
8. making and testing theories;
9. researching and seeking information;
10. taking and defending position;

11. solving problems in a variety of ways.

(IBO, 2007, p. 29)

Characteristics of inquiry-based learning also come from NSES (National Science Education Standard). National Research Council (2000, p. 27) express the five features characterizing inquiry-based learning, which are:

1. students create their own question;
2. students give priority to evidence in responding to questions;
3. students formulate explanations based on evidence;
4. students formulate explanations to scientific knowledge;
5. students communicate and justify explanations.

(NRC, 2000, p. 27, as cited in Maaβ & Artigue, 2013, p. 781).

Another characteristic of inquiry-based learning describe by Bass, Contant, and Carin (2009, pp. 6–9), that characteristics of inquiry-based learning are:

a. students work hard at expressing their experience through language;
b. students involve in group work and support one another learning;
c. students work in continuing assessment prepared by teacher;
d. students able to clarify, elaborate, or justify their investigation procedures and findings.

2.1.4 Inquiry-based learning in ABC School

International Baccalaureate (IB) is an international organization that offers high quality programmes of international education to a worldwide community of schools. IB provides three programmes, the Primary Years Programme (PYP) for students age 3-11 (grades K-5), the Middle Years Programme (MYP) for students

age 12-16 (grades 6-10), and the International Baccalaureate Diploma (IB Diploma) for students age 17-18 (grades 11-12).

The IB aims to develop inquiring, knowledgeable and caring young people who help to create a better and more peaceful world through intercultural understanding and respect (IBO, 2007, p. 2). Because of IB's aim is to develop inquiring students, inquiry becomes a leading pedagogical approach in IB school (IBO, 2007, p. 29).

As a leading pedagogical approach, Arends expresses that the overall goal of inquiry teaching has been, and continues to be, helping students learn how to ask questions, seek answer or solutions to satisfy their curiosity, and build their own theories and idea about the world (Arends, 1994, p. 368). From this statement, can be seen that the center of this approach is students, and teachers' role are to be a facilitators who guides students to achieve the goal of this approach.

The example of inquiry as teaching approach comes from Richard Suchman (1962) as cited in (Arends, 1994, p. 368). According to Suchman, in inquiry teaching, teacher presents students with puzzling situations or discrepant events which spark curiosity and motivate inquiry (Suchman (1962), as cited by Arends, 1994, p. 368). For example:

> "The teacher holds up a pulse glass. The pulse glass consists of two small globes connected by a glass tube. It is partially filled with a red liquid. When the teacher holds one hand over the red bulb, the red liquid will begin to bubble and move to the other side. If the teacher holds one hand over the left bulb, the red liquid will continue to bubble but move to the other side. The teacher asks students: Why does the red liquid move?

(Suchman (1962), as cited by Arends, 1994, p. 368)

In this example, as students inquire and seek an answer to the question, the teacher facilitates and encourages them to ask for data about the pulse glass and the moving liquid, to generate a prediction that help explain the red liquid's movement, and to think of ways they could test their prediction. From this example, it can be seen how teacher works as a facilitator in inquiry-based learning.

For being good facilitators, Swan (2006) as cited by Maaβ and Artigue (2013) states that as a teaching approach, inquiry teaching refers to teaching practice which allows students to do inquiry and thus refers teachers' side of inquiry learning. It means that teachers, as good facilitators, have to master the inquiry first before conducting inquiry learning in their lesson. So teachers will know the best way to do inquiry-based learning in every lesson based on the need of the students. It is in line with what Harro Van Brummelen states in his book title *Walking with God in the Classroom* that as facilitator, teacher's main role is to facilitate learning; they pose problems and encourage students to set personal goals, and also to choose their own activities (Van Brummelen, 2009, pp. 35–36).

Type of inquiry-based learning in IB School

As a leading pedagogical approach, International Baccalaureate Organization (2009) states that there are recognized many different forms of inquiry. They are based on students' genuine curiosity and on their wanting and needing to know more about the world (p. 30).

Tafoya, et al. (1980) as cited by Mark Walker (Walker, 2007, p. 18) in his book titled *Teaching Inquiry-Based Science*, divided inquiry learning into four types, he states that inquiry-based learning can be either:

a. Open inquiry

In open inquiry, the lesson is wholly inquiry based. In this inquiry, students have opportunity to deriving questions, designing and carrying out investigations as well as communicating their results.

b. Guided inquiry

In guided inquiry, the teacher is in charge of the first step by deciding on the topic and finding students' prior knowledge about the topic; the students is taking control of all the other phase (by still guided by the teacher). In guided inquiry, questions and procedures are still provided by teacher. Students, however generate an explanation supported by the evidence they have collected.

c. Structured inquiry

In structured inquiry, the teacher has a greater degree of control by supporting and directing students during the process of the inquiry. In this inquiry type, the learning goal is to introduce students to the experience of conducting investigations or practicing a specific inquiry skill, such as collecting and analyzing data.

d. Confirmation exercise inquiry

In the confirmation exercise inquiry, the teacher has the absolute control over every process of inquiry, making all decision and the students execute. In this type of inquiry, students are provided the question and procedure as well as results, which are known in advance.

Type of inquiry-based learning conducted in ABC Kindergarten School is guided inquiry. In this school, the teachers has important roles in conducting guided inquiry. Teachers conducted inquiry process to lead students in inquiry learning. In conducting inquiry process, there are some instructional models of inquiry (which will be explained in sub chapter 2.1.5 that explained about inquiry instructional model). Through this inquiry process, teachers provide a set process to help students to do inquiry and develop their inquiry skills.

2.1.5 Inquiry-based learning Instructional Model

The definition of the instructional model written in the book title *Educational Psychology,* by Eggen and Kauchack. They state that "Instructional model is prescriptive approaches to teaching designed to help students acquire a deep understanding of specific forms of knowledge." (Eggen & Kauchak, 2007, p. 423). From this definition, the researcher concludes that inquiry instructional model is a set of teaching process to help students acquire a deep understanding of how to do inquiry-based learning. Branch and Oberg (2004, p. 8) strongly state that inquiry instructional model guides students in using analytical thinking that includes all phases of the inquiry-based learning process. According to Preston, Harvie, and Wallace (2015), these instructional models for inquiry are designed to support classroom teachers in the construction of progression of learning activities that assist in the development of inquiry skills.

There are some inquiry instructional models which developed by some experts. From many instructional models of inquiry developed, in conducted research about how teacher implement inquiry-based learning in Kindergarten level of ABC

School, the researcher decided to combine two inquiry instructional models as basic for making the indicators of this focus research. The first is inquiry instructional model by Kath Murdoch, which guide IB school in implementing inquiry-based learning, the second one is the 5E instructional model by Bybee. The researcher chose the 5E instructional model because this instructional model are commonly used in science education and homeroom teachers also usually did this instructional model during teaching and learning process.

2.5.1.1. Inquiry instructional model by Kath Murdoch

A journal by Gordon (Gordon, 2012) describes six phases of learning through inquiry based on Kath Murdoch's inquiry instructional model. Those six phases of inquiry are tuning in, preparing to find out, sorting out, going further, making connections, and taking actions.

1. Tuning in

In this phase, teachers tune in what the students' knew and this is where students activated their prior knowledge. This is the time to connect students' existing schemas about the topic to the new information they encounter. There are some activities can conduct by the teacher in this phase; (a) engaging and gathering prior knowledge; (b) writing or telling from students' experience; (c) posing questions for determining students' prior knowledge; (d) explaining teaching goals and expectations.

2. Finding out

In this phase, students formulate questions and wonder about their topics. Teachers guide students to asking questions to start extending the background knowledge they already have. Teacher leads students to build on what they already

know. In this phase, emphasis on gathering data first hand is a very important thing to do. Some activities for this phase are; (a) brainstorming; (b) creating and conducting an experiment; (c) going to the library to locate books on the topic (for gathering data sources); (d) using literature and picture story books to extend students' experience of the topic; (e) viewing videos/film, photos, paintings, and other visual text as resource.

3. Sorting out

In this phase, students will be synthesizing their learning and beginning to make the connection between their prior knowledge and their new understanding. Teachers help students to keep reviewing questions and initial thinking. Some activities on sorting out phase are; (a) deciding on questions that are worthy of further inquiry; (b) teaching sources that can help students in connecting their prior knowledge with new knowledge; (c) some challenging questions for students to think about.

4. Going further

In this phase, students look to deepen what they learning. Students have a wider knowledge base generating during the sorting out activities. This is a phase that gives an opportunity for students to pursue questions or issues/interest of their own or in a small group. Some activities of this phase are; (a) conducting book and online research; (b) reading literature and non-fiction with the view to supporting a viewpoint; (c) project that connect with the new topic; (d) jigsaw-expert groups; (e) working in real life problems, issues, associated with the topic.

5. Making connection

In this phase, students reflect on what they've learned in the previous phases and reach conclusions. Some examples of reflecting phase are; (a) writing a report; (b) preparing a presentation or debate; (c) publishing a story in print or through a performance; (d) discussing what they have learned with others.

6. Taking action

In this phase, teachers help students to apply students' new knowledge. That application may mean new inquiries, in which case, they inquiry instructional model starts again. Some activities in this phase are; (a) provide exhibitions of learning to school and community; (b) social or environmental action projects; (c) personal goal setting and action plan; (d) reviewing and responding to questions asked during the inquiry process.

2.5.1.2. The 5E Instructional model

Bybee (2009) state that the 5E instructional model is already used since in 1980 by many teachers in science education. Bybee (2009) also states that the E5 inquiry framework has five phases or domains of inquiry; engage, explore, explain, elaborate, and evaluate. Each phase has a specific function and contributes to the teachers' coherent instruction and the students' formulating a better understanding of knowledge, attitude, and skills.

Bybee (2009, p.p 5-8) in his journal title The BSCS 5E *Instructional Model and 21st Century Skills* explained all the phase of the 5E instructional model, they are:

1. Engagement

In this phase, the teacher assesses the learners' prior knowledge and helps them become engaged in a new knowledge through the use of short activities that promote curiosity and elicit prior knowledge. The activity should make connections between the past and the present learning experiences, expose prior knowledge, and organize students' thinking toward the learning outcome of current activities.

Things that teacher can do in this phase:

a. asking questions, defining a problem, and acting out a problematic situation to engage the students and focus them on the teaching and learning activity;
b. present a situation and identify the instructional task and learning outcome;
c. sets the rules and procedures for the activity;
d. all the activities in this phase need to be sort and simple.

Successful engagement results in students being puzzled by, and actively motivated in the learning activity.

2. Exploration

Exploration experiences provide students with a common base of activities within which current understanding, processes, and skills are identified and conceptual change is facilitated. Learners may complete some activities that help them use prior knowledge to generate new knowledge, explore questions and possibilities.

The teacher's role in the exploration phase is that of facilitator or coach. The teacher initiates the activity and allows students time and opportunity to investigate object, materials, and situations based on each student's own ideas of the topic.

3. Explanation

The explanation phase focuses students' attention on a particular aspect of their engagement and exploration experiences. This phase also provides opportunities to the students to demonstrate their conceptual understanding, process skills, or behaviors. This phase also provides opportunities for teachers to directly introduce a concept, process, or skill. Teachers have a variety of techniques and strategies at their disposal. Learners explain their understanding of the new knowledge by their own word. An explanation from the teacher may guide them toward a deeper understanding, which is a critical part of this phase.

4. Elaboration

In this phase, teachers challenge and extend students' conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills. Students apply their understanding of the new knowledge by conducting additional activities.

Note the use of interaction within students group as a part of the elaboration process. Group discussion situations provide opportunities for students to express their understanding of the subject and receive feedback from others who are very close to their own level of understanding.

5. Evaluation

The evaluation phase encourages students to assess their understanding and abilities and provides opportunities for teachers to evaluate students' progress toward achieving the educational objectives.

2.1.6 Indicator of how to implement inquiry-based learning

From the theory of inquiry instructional model by Kath Murdoch and the 5E instructional model above, the researcher arranged some indicators that indicate how a good inquiry-based learning is implemented in kindergarten level. The researcher arranged indicators by combining Kath Murdoch's inquiry instructional model and the 5E instructional model of inquiry because:

a. Kath Murdoch's instructional model is used by IB School as a guidance for teacher in conducting inquiry-based learning in every classroom.
b. The 5E instructional model of inquiry is more commonly used by many science teachers in the world since the 1980s (Bybee, 2009, p. 4). Other than that, based on observation in kindergarten level of ABC School, homeroom teachers usually use this instructional model of inquiry during teaching and learning process.

Based on these two reasons, the researcher decided to make this two instructional models of inquiry as for the basic to arranged six good indicators of how teachers implement inquiry-based learning in their classroom. Those six indicators of how teacher implementing inquiry-based learning in the classroom are:

1. Teacher finds out students' prior knowledge and helps students become engaged in new knowledge.
2. Teachers guide students to ask questions to extend their background knowledge. Teacher also leads students to building on what they already know.

3. Teacher explains the new knowledge and gives opportunities for students to connect it to their previous knowledge or current learning experience.
4. Teacher helps students begin to apply previously introduced knowledge and experiences to new knowledge.
5. Teacher encourages students to reflect on what they have learned in the previous stages and reach conclusions to see how much learning and understanding has taken place.
6. Teacher encourages students to further apply their new understanding from what they have just learned.

Those indicators used by the teachers as steps to implement inquiry-based learning in Kindergarten level. From this indicators, the researcher observed the steps of how homeroom teachers implemented inquiry-based learning. The researcher did anecdotal observation and interviewed homeroom teachers to see how the implementation of inquiry-based learning in Kindergarten level of ABC School.

2.2 Christian perspective of inquiry-based learning

From the beginning of human existence in the Garden of Eden, God gave a human a ratio to think, and free will to express what they think. When God placed human in Garden of Eden, God also placed animals surround them. At that time God gave them a freedom to name the animal one by one. Then human used their ratio to find the name of each animal in the Garden of Eden, and human could name the animals one by one. That story tells, that from the beginning human can develop their natural thinking when God facilitated them with all thing that could stimulate

their thinking. God used human thinking to process their own knowledge, with the intension to develop their knowledge.

The story of the wonderful of God's mercy above showed that from the beginning God trained human to use their ratio, so human could think the wonderful things using their ratio. That story also showed that human can develop their own knowledge using their ratio. However, God has desired that human can use their ratio to glorify His name and to find all of the wonderful knowledge that can help people to know God more. God really wants each person can use their ratio to do good things in His righteous path. The explanation above showed that the idea of inquiry-based learning was done by God in the beginning of the creation story. As inquiry-based learning expected students to create their own understanding, God also expected human to use their own understanding to do good things in their life.

Because of sin, it is really possible for human to use their ratio to do something that unglorified God's name. Because of this reality, this world needs teachers who can guide and facilitate every person in using their ratio in the righteous path. Teachers who can guide each person to develop their own knowledge to create something that can glorify God's name, that are teachers who facilitate students in inquiry-based learning teaching and learning process. Based on this, the researcher intended to do a research that aims to describe how teachers implement inquiry-based learning in the Kindergarten level. The researcher also wants to know how teachers implement inquiry-based learning in the God's righteous path.

2.3 Previous Relevant Studies

There are some previous studies conducted by another researcher that relevant with this research. The first study is "A GUIDED INQUIRY TEACHING APPROACH IN A PRIMARY SCHOOL", a thesis conducted by Gunawati Tjioe, Magister Pendidikan, Universitas Pelita Harapan, 2008 (Tjioe, 2008). The research method used in this thesis was qualitative research. The aim of this research is to describe how the guided inquiry teaching approach is used in a primary school and how it helps students in their learning and critical thinking skill. This research used as a relevant study because this research discussed guided inquiry in International Baccalaureate (IB) School and in the primary level. Because this research has a similar topic with the research conducted by the researcher, so the researcher used this research as a relevant study to support in analyzing the implementation of guided inquiry in IB primary school.

This research found that teachers in IB school were prepared through a variety of training, the unit was planned in a way that motivated students' inquiry, the implementation of the teaching approach followed the six stages of the Inquiry Cycle within the Guided Inquiry approach, and many of the abilities stated in the Critical Thinking standards had been developed well in the students, whereas some were still developing. In all, the study seemed to suggest that Guided Inquiry teaching approach had helped students in developing their critical thinking.

Besides on that research, the researcher also used other research as a relevant study that is a journal article written in 2016, titled "The effectiveness of Inquiry Learning Method to Enhance Students' Learning Outcomes: A Theoretical and Empirical Review". Written by Vera Septi Andrini, Doctoral Candidate of Learning

Technologies, Universitas Negeri Malang, East Java. Indonesia (Andrini, 2016). The aim of this study was to describe how inquiry learning model can increase students' learning outcomes. The researcher used this study as a relevant study because this study provided the information of how inquiry learning can increasing students' learning outcome, that could help the researcher in analyzing data about how inquiry-based learning can develop students' inquiry skills.

The finding of this study is inquiry learning model provides the opportunity for students to construct their own knowledge, using concepts that have been held to solve the problems encountered in other words, and students have the opportunity to link new information with existing cognitive structure resulting in meaningful learning. Then the teacher's job only as facilitator and mediator, which helps students to learn and use the skills of their process to gain more knowledge.

The last study used by the researcher as a relevant study is a thesis titled "THE EFFECT OF WORK MOTIVATION, CLASSROOM MANAGEMENT AND CRITICAL THINKING SKILLS TOWARDS TEACHERS' COMPETENCE IN INQUIRY-BASED LEARNING AT IB-MYP SCHOOL". This thesis was written by Mely Kartono, Educational Technology Program, Faculty of Education, Universitas Pelita Harapan in 2016 (Kartono, 2016). The research method used in this research was quantitative research using path analysis, which aims to measure the effect of work motivation, classroom management, and critical thinking skills towards teachers' competence in inquiry-based learning.

There are some differences between this research with the research conducted by the researcher. This research used a quantitative method, while research conducted by the researcher used a qualitative method. Then this research

conducted in IB-MYP, while the research conducted by the researcher conducted in IB-PYP. The research used this research as a relevant study because, from this research the researcher could learn the factors that affect the implementation of inquiry-based learning by teachers. The findings of this research showed that teachers need to possess critical thinking skills to enable to plan, organize and support students during task orientation. Work motivation and critical thinking skills have an opposite effect towards teachers' competence in inquiry-based learning due to inappropriate approaches used by teachers in inquiry-based learning and the disabilities of teachers to teach critical thinking skills during the transition of implementing a new curriculum. The remaining variables are important to be possessed by teachers to achieve competence in inquiry-based learning as they affect each other.