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The Development of Students' Academic Skills Through Guided Inquiry Model in Science Learning at Elementary School

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Abstract: One of the most important life skills that must be taught to students is an academic skill. Academic skill is basically to develop the general thinking skills that is called scientific thinking ability. Academic skill in science learning is very important to be taught because science is obtained from the process of discovery and scientific study. The purpose of this study is to describe a guided inquiry learning model that trains students' academic skills in learning science. This study uses library research with a qualitative descriptive approach. The result of this study shows that the implementation of guided inquiry learning allows students to find ideas. It gets from their experience in learning based on constructivism learning theory, student activities, and understanding concepts by themselves, so that science learning is more meaningful. This affects students' academic skills because, through the discovery process, students are actively involved in asking questions and looking for answers. Students are trained to formulate problems, make hypotheses, determine experimental variables, make experimental designs, analyze experimental data, and make conclusions. Based on the explanation, it can be concluded that the guided inquiry learning model in science learning can be used to train students' academic skills in elementary school.

Keywords: *academic skills, science learning, guided inquiry learning model*

INTRODUCTION

The regulation of minister of education and culture (Peraturan Mendikbud, 2014) number 103 of 2014 mentioning that education is a conscious effort and planned to realize the learning atmosphere and learning process so that students can actively develop their potential. Every student has a very important self-potential to be developed in achieving national education goals. Learning must be designed with certain methods, models, and strategies to develop students' self-potential which are adapted with the potential that will be developed. Teachers must facilitate students to develop their potential.

The methods, models, and strategies of learning must be designed to facilitate every student so that they become independent students then can realize the learning community. Students are the next generation of the nation that their quality will determine the quality of the nation in the future. It impacts that the other qualities must be developed by the curriculum and must be realized in the learning process include students' creativity, students' independence, student's cooperation, students' solidarity, students' leadership, students' empathy, students' tolerance, and students' life skills (including academic skills) that can establish nations' character (Menteri Pendidikan Dan Kebudayaan RI, 2013).

The principles of learning needed activities to be used to achieve the quality that has been designed in curriculum document include; (1) student-centered, (2) developing student creativity, (3) creating fun and challenging conditions, (4) values, ethics, aesthetics, logic, and kinesthetic, and (5) providing diverse learning experiences through the application of various

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learning strategies and methods as fun learning, contextual learning, effective learning, efficient learning, and meaningful learning (Menteri Pendidikan dan Kebudayaan RI, 2013). Life skill is form of learning that connect it with students' real life, so that the learning becomes contextual and meaningful (Anwar, 2004). One of the important life skills which be trained to students is academic skill. Academic skill is basically to develop the general thinking skill that is called scientific thinking ability. Academic skill in science learning is very important to be trained because science is obtained from the process of discovery and scientific study.

The guided inquiry learning model is one of learning models that emphasize students to actively looking for, process, construct, and use knowledge. According to Kardi (Kardi, 2013) in guided inquiry learning model, teacher is only as facilitator of students to learn and is not provider information to them. The guided inquiry learning facilitates students to build knowledge and helps them to develop conceptual understanding (Pandey1, G. K. Nanda, and Ranjan, 2011). It can be interpreted that students must find their own information relating to the problem that must be solved. Students practice to identify problems, formulate hypotheses for an event, design and carry out research to prove an idea or curiosity. Based on that, the guided inquiry learning model is one of the models that can be used to develop students' academic skills.

METHODS

The research method in this research uses library research with a qualitative descriptive approach. This research is started by collecting data, presenting data, and drawing conclusions based on the analysis of various relevant sources including journals, books, and other suitable sources.

RESULTS AND DISCUSSION

Academic Skills

Academic skills are also often called scientific thinking skills which are development of general thinking skills and are part of life skills. Academic skills include the ability to identify variables and describe their relationship to certain phenomenon, formulate hypotheses, design, and research to prove an idea or curiosity. Scientific, critical, objective, and transparent attitudes are required to develop these skills. The competencies needed by students in practicing scientific thinking skills (***academic skills***) are presented in table 1 below.

Table 1. Competences and Indicators of Scientific Thinking Skills (Academic Skills)

Competences	**Indicators**
Formulating problem	1. The created formulation of the problem based on the given phenomenon 2. The created formulation of the problem interprets the experiment that will be conducted 3. The created formulation of the problem is briefly and clearly
Formulating hypotheses	1. The created statement is simple and based on conversion 2. Hypotheses can be used in designing experiments 3. Hypotheses can use as basic to do experiments
Determining	1. Variable is created according to hypotheses. 2. Variable is created briefly and clearly

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Competences	Indicators
variable	3. Variable can use as basic to do experiments
Making experiment design	1. The created design of the experiment is to test the hypothesis 2. The created design of thse experiment can identify the response variable 3. The created design of the experiment is clear and in order.
Presenting the results of observation in tabular form	1. The created table includes the appropriate data 2. The data of variable manipulation and variable response are clearly stated 3. The information in the table is organized precisely
Analyzing data	1. The analysis is made according to the observational data 2. The created analysis of the data is one's thinking result. 3. The analysis is made briefly and clearly
Making conclusion	1. The conclusion is based on observational / experimental data 2. The created conclusions can answer research questions 3. Using short and clear sentences

Source: (Glencoe, 2007)

The Integration of Academic Skills in Learning

The success of learning model development of academic skills is determined by program/design arranged by the school and teacher's creativity in formulating the learning methods. The steps taken in compiling the learning program are;

1) Identifying competency standards and basic competencies
2) Identifying study material/learning material
3) Developing indicators
4) Developing learning activities with academic skills
5) Determining the used materials or tools or sources
6) Developing assessment tools that are appropriate with indicators of academic skills

The steps that can be taken in describing integrated academic skills in learning include:

1) Identifying indicators of academic skills that are developed in real life as outlined in the form of learning activities.
2) Identifying knowledge, skills, attitudes, and values that support academic skills.
3) Classifying subjects in topics or themes that are appropriate to academic skills.
4) Determining the learning methods.
5) Designing the form and type of assessment.

The Guided Inquiry Learning Model

1. The Characteristic of guided inquiry learning model

The inquiry is a learning model in which students find and use various sources of information and ideas to increase their understanding of a particular problem, topic, and problem. Students are required to give answers from a certain problem that is more meaningful than just simple and correct answers. The inquiry learning model requires students to investigate, explore, ask, and learn. The guided inquiry is a learning way to fulfill many curriculum requirements through involvement, motivating, and challenging

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learning according to 21st-century goals in schools. It guides students to think and learn through inquiry (Madden, 2011)

The guided inquiry learning facilitates students to build knowledge and helps them to develop conceptual understanding (Pandey1, G. K. Nanda, and Ranjan, 2011). The guided inquiry is characterized by identified problem and teacher‘s questions as a research procedure and students are given performance task that clear and simple to inquiry activities (Wenning, 2011). Kardi (Kardi, 2013) states that inquiry is implemented in five stages: 1) identifying a question or problem, 2) formulating hypotheses, 3) collecting data, 4) testing hypotheses, 5) formulating generalizations. So that the application of guided inquiry-based learning can not only improve students' ability to understand the material but can also improve the ability of scientific process and work skills (Ambarsari, W. Santosa, 2012). The characteristics of guided inquiry are

a) Students are conditioned to carry out investigative activities to gain knowledge.
b) Students learn actively and are reflected in learning experiences.
c) Students learn based on what they know.
d) Students develop a series of thinking in the learning process through guidance.
e) Student development occurs gradually.
f) Students have different ways of learning.
g) Students learn through social interaction with others.

(Ashiq H. A., Muhammad, A., and Azra, 2011)

Based on the description, the guided inquiry is a variety of activities that train students to ask questions, make observations, make hypotheses, test hypotheses, prove hypotheses, use tools, analyze data, propose answers, predict answers, explain and present the results. Inquiry identifies assumptions, uses critical and logical thinking skills, considers several explanations, and obtains information by conducting investigations. So it can be concluded that the guided inquiry learning is a model that focuses on the thinking process which builds experiences through students’ involvement actively in learning. Students learn by building their own understanding based on their experiences and what they already know through teacher-guided inquiry activities.

2. The Advantages and Disadvantages of Guided Inquiry Model Learning

The guided inquiry model offers integrated inquiry that is planned and guided by librarians and teachers, enabling students to gain a better understanding of the subject's curriculum content and concept information. Inquiry develops skills and abilities students which are needed for work and daily life in the 21st century (Gerald, 2011).

Piaget states that optimal education requires challenging experiences for students so that the process of assimilation and accommodation can produce intellectual (Arends, 2012). Assimilation is the students’ process in getting information from outside which merges with the knowledge and behavior that they have. Accommodation includes the process of changing (adapting) old schemes to process information and new objects in their environment (Ormrod, 2008). Accommodation occurs when students adjust their schemes that suit with their new information and experience (Ormrod, 2008). According to Gestalt psychologists, the lack of cognitive balance has a motivational role that keeps people active until balance is reached (Hergenhahn, B.R. dan Olson, 2009). According to Piaget, all scheme developments are common to all humans, so the implication for education is that something cannot be taught to someone if no readiness refers to its maturity (Suyono dan Hariyanto, 2011).

This is confirmed by the results of research from Maliyah, et al. (Maliyah, 2012) concluded that the guided inquiry learning in chapter temperature and heat uses experimental method, discussion method, and demonstrations method which affects on learning

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achievement, mathematical representation ability, and verbal representation ability. The guided inquiry model challenges students and make them frustrated if they do not find ideas (Belland, B. R. Walker, A. Olsen, W.and Leary, 2012). The syntax used in the learning model can be seen in Table 2. Branch & Oberg (Branch, J. and Oberg, 2004) suggest six phases in the guided inquiry model.

Tabel 2. The Syntax of Guided Inquiry Learning

Phase	Description
The first phase: Planning	The teacher presents problems related to daily life. Determining procedures to solve problem with do experiment by students.
The second phase: Retrieving (getting information)	Students looking for and collect data about problem that is raised by the teacher from various sources
The third phase: Processing (processing information)	Students assess and prove their hypotheses by conducting experiments and analyzing their observation results on experiments.
The fourth phase: Creating (making conclusion)	Students make conclusions from their observation results, making reports on their experimental activities
The fifth phase: Sharing (communicating information)	Students present their observation results. The teacher guides the discussion and then provides reinforcement and corrects the things that are not right.
The sixth phase: Evaluating	The teacher gives appreciation to each group who has given their presentations then gives individual assignments about the material that has been learned.

The purpose of applying guided inquiry learning is that students are free to create and develop the concepts which they learn. They are given opportunity to solve the given problems in group learning, they are in a class that is taught to interact socially with their peers to exchange information and ideas between groups. The guided inquiry model can be used for students who have not learned experience with learning that uses inquiry approach. Guided inquiry is suitable to be applied in learning that discusses the principles and concepts that are fundamental in a particular science.

3. The Implementation of Guided Inquiry Learning Model

The guided inquiry model is defined as one of the inquiry learning models that presentation of problems, questions, and contents or supporting materials determined by the teacher. Problems and questions from teacher that encourage students to investigate and find solutions (Acevedo, N. A. Van Dooren, W. Clarebout, G.Elen, J. and Verschaffel, 2010). In this study the researchers analyze the guided inquiry learning model in science learning to practice students' academic skills.

The learning model refers to a particular approach in learning that covers the goals, stages, environment, and management systems (Arends, 2012). The guided inquiry learning model is classified based on the learning objectives, the stage of guided inquiry, the environment in which students are learning, and the management of learning.

a) The goal

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The guided inquiry learning aims to provide opportunities for students to learn how to find facts, concepts, and principles through direct experience, and trains them in investigating problems or questions.

b) The Stages

Based on the several learning steps that have been written by several experts, the guided inquiry learning steps used by researchers are based on Branch & Oberg (Branch, J. and Oberg, 2004). The guided inquiry learning model uses questions and analogies as guidance during experimental and inquiry activities to train students' academic skills. Analogies and questions will guide students who are not experts to practice the competencies that are expected (Zydney, 2010)

The researchers assume that students are not familiar with investigation activities that involve science and psychomotor process skills such as formulating problems, formulating hypotheses, determining experimental variables, making experimental designs, presenting experimental results in tables or graphs, analyzing, and making conclusions. This study has three main implications based on the theory of social constructivism that is developed by Vygotsky, namely: 1) through working in groups, students do social interaction so that they are aware of their basic mental functions and use them for growth; (2) the teacher gives assignments in the zone of proximal development that are tasks within the reach of students' knowledge; (3) Providing learning with scaffolding, that is learning with guidance (Arends, 2012). According to Vygotsky, language and mind will become increasingly independent in child development (Ormrod, 2008). Vygotsky states that children develop more systematic rational concepts that are the result of dialogue with mentors or skilled teachers (Fu, Y. Han C. T.and Hui, 2013).

c) The Learning Environment

Students as active learning discover and implement inquiry processes. The teacher's role guides students in the experimental activities. Jerome Bruner provides theoretical support in learning, which is a discovery model that emphasizes the inductive reasoning and inquiry process. Bruner suggested that students should learn through active participation in learning, so that they gain experience, and conduct experiments that stimulate them to find their own concepts and principles (Slavin, 2011). The theory developed by Bruner received support from Suchman (1962) who developed an approach that is called inquiry training. When teacher uses the guided inquiry approach, teacher must design confusing situations to motivate students' curiosity and students' inquiry (Arends, 2012).

d) The Management

The management of inquiry learning is the same as the management of cooperative learning in which students are grouped into groups to be given the task of doing practical work and working well in their groups, the teacher guided the process that carried by students.

Science Learning

Science is scientific knowledge obtained through scientific methods and has proven its truth. Science discusses nature and its contents (Mitarlis, 2009). Science is not only mastery of knowledge collection in the form of facts, concepts, or principles, but also is a process of discovery and related to how to find out about nature systematically. Science in Elementary Schools is integrated with other material thematically and integratedly which is very instrumental to help students understand natural phenomena.

The science learning process emphasizes concepts discovery learning to learn and understand the natural surroundings scientifically, so it is hoped that it can be used by students as a means to learn about themselves and natural surroundings, then apply it in their daily

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lives. Science education is designed to help students gain a deeper understanding of the natural surroundings (Trianto, 2011).

Referring to the understanding of science, it can be concluded that the essence of science includes four main elements, namely:

1) Attitude: curiosity about objects, natural phenomena, living things, and causal relationships that cause new problems that can be solved through correct procedures; Science is open-ended.
2) Process: problem-solving procedures through scientific methods; scientific methods include organization of hypotheses, the design of experiments, evaluation, measurement, and drawing conclusions.
3) Products: in the form of facts, principles, theories, and laws.
4) Application: application of scientific methods and concepts of science in everyday life.

These elements are characteristic of science that cannot be separated from one another which are expected to appear in the learning process. This can make students to understand natural phenomena through problem-solving activities, scientific methods, and imitate the way scientists work in discovering new facts and experiencing the learning process as a whole (Mitarlis, 2009). Science related to students' way to find out about nature systematically, so that science is not only mastering a collection of knowledge in the form of facts, concepts, or principles, but also a process of discovery that enables students to practice and develop their academic skills.

The Relevance of Inquiry learning and Academic Skill

Learning outcomes are things that must be improved in each learning process including the students' academic skills. To improve students' academic skills, there are 3 ways its application in schools, namely 1) charged to the existing subjects, 2) separated subjects, 3) integrated into subjects (BSNP, 2006).

The Development of academic skills education is based on government regulations (PP) No. 19 of 2005 article 13 and KTSP guidelines issued by BSNP, that at the level of primary and secondary education or equivalent can be included life skills education. Science learning must trains students so that they able to do scientific inquiry to develop thinking ability, acting scientifically and communicating. Whereas Science itself is closely related to facts, concepts, principles, and discovery process which are one of the processes of increasing academic skills.

The inquiry learning approach is the right thing to improve students' academic skills. This is because the inquiry learning model gives students opportunity to discover their ideas from the faced experiences, emphasize students to active, and be able to understand their concepts so that science learning has meaning, which is based on the theory of constructivism learning. The inquiry learning model influences students' academic skills because through inquiry activities, students are actively involved in asking questions and searching for answers. This is supported by Chhadva, et al (2013) in his journal *Effectiveness of Life Skills Education on Adolescents* explains that life skills learning can help students deal effectively with life's challenges.

The inquiry process is based on students' academic skills consisting of four levels, namely level 0 (confirmation/verification), that is a formulation of problems, procedures, and solutions from the teacher. Level 1 (structured inquiry), that is a formulation of problems and procedures from the teacher, while the solutions from students. level 2 (guided inquiry) that is the formulation of problems from the teacher, while procedures and solutions from student.

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Level 3 (open inquiry) is the formulation of problems, procedures, and solutions from students.

The application of academic skills integrated to this subject requires the development of an academic learning model of academic skills that its success is very determined by the arranged program which is created by school and teacher's creativity in formulating its learning method. The development of an academic learning model of academic skills that are suitable for science namely contextual learning. It is the learning that presents the real world in the classroom and encourages students to make connections between their knowledge with its application in real life. Furthermore, students obtain knowledge and skill from a limited context little by little. They also can construct knowledge and skill by themselves to solve problems in their life.

The inquiry learning model is based on the theory of constructivism that is grounded in social learning, the closest development zone, cognitive apprenticeship, and scaffolding. It is expected to be able to improve academic skills and understanding the concepts of science. The assessment in the context of inquiry is needed to measure three students' progress in achieving three main learning outcomes of inquiry-based science learning namely conceptual understanding in the field of science, the ability to conduct scientific inquiry, and understanding of inquiry. Through inquiry learning is expected to improve life skills (life skills) which include personal skills, academic skills, social skills, and vocational skills.

There are several levels of inquiry learning model. It based on the learning characteristics in the student activity sheet which are inquiry 1 (structured inquiry) and inquiry 2 (guided inquiry). Inquiry 1 includes topics, questions, materials, procedures or experimental designs derived from the teacher, analysis of the results is facilitated by the teacher, and conclusions come from students. While inquiry 2 includes topics and questions derived from the teacher, practical material, procedure or experimental design facilitated by the teacher, analysis of the results and conclusions derived from students. .

The inquiry approach can form and develop students' self-concept. It also can avoid students from ways of learning by memorization. Moreover, it can give students time to assimilate and accommodate information (Wirtha, I.M dan Rapi, 2008)

The Relevance of Science, Inquiry Learning, and Academic Skills

Science is essentially a learning approach that allows students both individually and in groups to actively seek, explore, and discover concepts and principles holistically and authentically (Depdiknas, 2003). Science education is expected to be a vehicle for students to learn about themselves, the environment, and the prospects for further development in applying it in everyday life. The learning process emphasizes on learning the discovery of concepts to learn and understand the natural environment scientifically (Trianto, 2011).

The inquiry learning model requires students to investigate, explore, ask, and learn. Guided inquiry is a way of learning to fulfill many curriculum requirements through involvement, motivating, and challenging learning according to 21st-century goals in schools to guide students thinking and learning through inquiry (Madden, 2011). The guided inquiry learning allows students to build knowledge and help students to develop conceptual understanding (Pandey1, G. K. Nanda, and Ranjan, 2011). The guided inquiry is characterized by problems that are identified and some questions by the teacher as research procedures. Students are provided with clear and concise performance goals for inquiry activities (Wenning, 2011).

The guided inquiry learning has several characteristics that are:

1) Students are conditioned to do investigation activities to get knowledge.

2) Students learn actively and reflected on the experience in learning
3) Students learn based on what they know.
4) Students develop a series of thinking in the learning process through guidance.
5) Students development occurs gradually
6) Students have different ways of learning
7) Students study through social interaction with others.

(Ashiq H. A., Muhammad, A., and Azra, 2011)

Based on an explanation above, the inquiry is many kinds of activities involved in observation, questioning, test the hypothesis and prove it with experiment, use tools, analyze and interpret data, propose an answer, use logical and critical thinking skills, and consider to several explanations. The inquiry is a process to get information with do an investigation. Moreover, Science learning is possible to be taught with inquiry learning because it has the same characteristics that are in investigation activities to get knowledge.

In line with that, the guided inquiry model offers integrated inquiry that is planned and guided by librarians and teachers. That makes it possible for students to gain a better understanding of the subject matter of curriculum content and the concept of information. Moreover, it can develop the skills and abilities that are needed to work and everyday life in the 21st-century (Gerald, 2011).

In summary, the guided inquiry model has several advantages, as follows:

1) Increase student motivation.
2) Give students the opportunity to think carefully about ideas, problems, and questions.
3) Provide opportunities for students to fully participate which will increase their curiosity, both inside and outside the in classroom.
4) Encourage students to have a spirit of initiative.
5) Encourages patience, cooperation, unity, and decision making among students.
6) Improve students' understanding of the process, concepts, and relationships.
7) Provide the right to education and knowledge that enables them to explore the social environment.

(Berg, C. A. R.Bergendahl, V. C. B.and Lundberg, 2003).

Academic success applied to this subject matter is very determined by the program compiled by the school and the teacher’s creativity in formulating learning methods. The development of academic skills suitable for sains is contextual learning. The learning is designed as if presenting the real world in the class and stimulating students to connect the knowledge learned in the class with daily life in society. Students train to gain knowledge and skills little by little from limited context. Moreover, they train to build their knowledge by themselves to solve the problem in daily and social life.

The indicators of academic skills that are of concern in this study are formulating problems, making hypotheses, determining experimental variables, making experiments, analyzing experimental data, and making conclusions. Kardi (Kardi, 2013) states that inquiry is implemented in five steps: 1) approving a question or problem, 2) formulating a hypothesis, 3) collecting data, 4) examining a hypothesis, 5) formulating a generalization. It causes that the application of guided inquiry learning can not only improve student's ability in understanding material but also can improve science process skill and scientific work (Ambarsari, W. Santosa, 2012). The findings in this study are also in accordance with the findings of the study of Astuti & Setiawan (Astuti Y. dan Setiawan, 2013) which discusses that physics learning using a guided inquiry model on the topic of heat can improve science process skills (academic skills, pens). Chhadva, et al (2013) in their journal also explained that life skills learning can help students who support life's challenges effectively.

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The successful achievement of these academic skills aspects is supported by learning tools and assessment instruments that will be used. To complete their learning tasks in observation and experiment, students are trained to formulate problems, formulate hypotheses, determine research variables, enter data in tables, analyze research results and make conclusions. Bruner suggested that students should learn through active participation in learning, so that they gain experience, and conduct experiments that stimulate them to find their concepts and principles independently (Slavin, 2011) Khulthau (Kuhlthau, 2010) states the guided inquiry requires students to develop work steps in solving problems that have been given by the teacher through the Student Worksheet.

CONCLUSION

Based on the explanation, it can be concluded that the guided inquiry learning model in science learning can be used to train student's academic skills. The learning using the guided inquiry learning model gives students opportunities to find ideas from experiences that be faced which is based on the theory of constructivism learning, stressing students to be active, and be able to understand concepts by themselves so that learning science is more meaningful. This has an effect on students' academic skills because students are actively involved in asking questions and finding the answer. Students are trained to formulate problems, make hypotheses, determine experimental variables, make experimental designs, analyze experimental data, and make conclusions.

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