TEACHERS' READINESS TO IMPLEMENT INQUIRY FOR SCIENCE INSTRUCTION IN ELEMENTARY SCHOOL

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Abstract

This study aims to know teachers' readiness in implementing inquiry for science instructions in elementary school. This study implemented dominant less dominant design or mixed method. The data was collected using purposive sampling technique. There were 90 elementary school teachers from three regional offices, namely Pangkalpinang, Serang, and Denpasar as respondents for this study. The instruments used for this study was a questionnaire as the main data collection, in addition to an interview and an observation form. 27 teachers from three regional offices were observed using the form for Teacher Performance Assessment Instrument (TPAI). This instrument consists of two parts, TPAI-1 for assessing the lesson plans and TPAI-2 for assessing the performance of teachers in actuating the instruction. An in-depth interview was conducted for 27 elementary school teachers after the observation. On the one hand, the result shows that only a few teachers can be categorized ready for implementing inquiry for science instruction. This was concluded from the appraisal of teachers' preparation and their activities during the instruction process. On the other hand, a large number of teachers can be categorized not ready to implement inquiry for science instruction. Lack of knowledge and information regarding the importance of inquiry in science instruction can be mentioned as one of the obstacles in implementing inquiry for science instruction. From this study, it is recommended that inquiry for science instruction needs science equipment. However, the most important thing is an inquiry for science instruction needs teachers to change their mindset that science instructions for elementary school must be taught by inquiry.

Key words: *teacher's readiness, inquiry, and hands-on activities*

1. Introduction

Many problems are faced by elementary school teachers in the teaching of science education, among other things: (1) the number of primary school students in a class tends to be large, especially for elementary schools in big cities such as Bandung, (2) the curriculum is too crowded, oriented on science disciplne and only suitable for elementary students with above average and superior abilities. Curriculum changes that often occur apparently have not yet managed to significantly streamline the curriculum; (3) the influence of parents can cause a bad influence for students; and (4) the equipment and the allocation of funds still need to be reorganized, (Hinduan *et al*., 2003).

The development of science is occuring at a rapid pace, so it is impossible for teachers to teach all the facts, concepts, and principles to students. If a teacher is willing to teach all subject matter, then the only path that can be taken is to cram all the facts, concepts, and principles into the lesson. If the teacher is pressed for time, then all the facts, concepts, and principles will be taught by traditional lecture. As a result, students

will have a lot of knowledge but are not trained to discover knowledge, including in this research the knowledge of natural science.

Psychologists generally agree that it is easier for children of elementary school to understand complicated concepts and abstract concepts if the teaching of these concepts are accompanied by concrete examples. Learning will become more meaningful when students build the concepts and principles by doing practical activities (hands-on activities). Similarly, in science instruction, the development of teaching in elementary school science today is experiencing a shift from teacher-centered learning towards student-centered learning.

Nationally, science learning outcomes have not shown encouraging results despite students earning a high score in national evaluation in some schools. This opinion is based on the achievement of learning outcomes by passing standard of national final exam, and score in national evaluation being applied nationally in recent years. Even Jalil (2003) says that the quality of education is not only low, but also shows symptoms of decreasing from year to year.

Some reason are considered to greatly affect low achievement of students taking science subjects, among others, the subject matter is too dense and taught unattractively, the ability of teachers to master and deliver the material, as well as supporting facilities and infrastructure in the learning process. There is no one root cause of all this is, but a lot of the main accusations are addressed to teachers because it is they who are spearheading in the classroom and meeting with students programmatically (Wardani, 1999).

The school and classroom are analogous to an aircraft and its black box respectively. If an airplane crashes, the black box is highly sought after because that's where the recorded information is which can help find out why the plane crashed. Such is also the case with education. If the quality of education suffers, then the classroom should be targeted for assessment and improvement. The classroom records most information related to the interaction between teachers and students (Jalil, 2003). The question that arises now is 'what happens in the classroom?'

In the context of learning in the classroom, improving the quality of learning has already begun on the learning objectives, student characteristics, the material to be taught, and learning resources available. However, in reality, there are still many less-qualified, inefficient and less attractive learning process occured in the classrooms. Thus making elementary school students learning outcomes not maximal. Such conditions are found in some primary schools, located in both urban areas and remote areas. Professional teachers should have a deep understanding of the field of study and an awareness of the difficulty of the material to be taught to students. If the teachers are not prepared to teach the subject areas, there is a tendency for teachers to teach as they were taught. If they were taught through lectures, then they will teach through lectures, although the method is less effective (McDermot, 2000). In this research, teachers skilled in teaching science should be prepared since they learned how to teach effectively on the teachers' undergraduate program by giving examples and exercises on how to teach science effectively for elementary school students.

In the context of learning in the classroom, improving the quality of learning has begun from making the design of learning based on the goals, characteristics of students, materials to be taught, and available learning resources. However, in reality, there are still many less-qualified, inefficient and less attractive learning process, even boring impression that the learning achievement is not optimal. This condition is found in several elementary schools, both in urban areas and in remote areas.

Education issues occur in almost every country, differing only in grade and type of problem. The best way to learn science is by doing practical science lab activities as learning science is about doing science. Science teachers in England and Wales feel guilty when their students do not conduct practical activities during the lesson (Woolnough, 1994: 25). The old adage "I hear and I forget, I see and I remember, I do and I understand" is most apt in this situation. Similarly, teachers in Japan feel ashamed if they are not able to improve their teaching. Japanese culture is partly based on the concept of "Kaizen" (continuous quality improvement) and is an obligation for teachers.

Becoming a teacher is a lengthy process. Abell and Bryant (1997: 153) say that the steps to become are a teacher are: (1) begin as teacher training students when they observe teachers teaching; (2) through education at a pre-service teachers; and (3) continue through their career as a teacher. Thus, the quality of teachers of which is determined by the education at a pre-service teachers. When the quality of primary school teachers is low, then there may be some that are not quite in their pr evious education especially at a pre-services level.

2. Methodology

This study uses a dominant less dominant design or mixed method with reference to the book Research Design, Qualitative and Quantitative Approaches (Creswell , 1994). Quantitative studies were done to see the teacher's ability to design and implement inquiry in the process of learning science in elementary school. A qualitative study was conducted to determine the factors supporting elementary school teachers and constraints faced by experienced elementary teachers who implement inquiry based learning in elementary schools.

The population in this study was elementary school teachers (preferably a) teachers who graduated from S1 Primary Teacher Education Program FKIP - UT, b) teachers who are also students of S1 Primary Teacher Education Program, or c) teachers who graduated from another S1 Primary Teacher Education Program in Indonesia). Samples were taken using purposive sampling from 90 elementary teachers from three (3) regional offices of UT. From a number of samples, 9 teachers from each UT regional offices assessed their readiness to implement the plan for the lesson plan and lesson plan in the process of learning science in the classroom. In addition, 9 teachers from each UT regional office were interviewed in depth to determine their readiness to carry out the inquiry in the process of learning science, the factors that support implementation of learning inquiry and the factors that hinder implementation of learning inquiry in elementary school, and to know the efforts that they have done in order to carry out the inquiry learning in elementary schools.

This research was conducted in three (3) UT regional offices, in Pangkalpinang, Serang, and Denpasar between March and December 2013. The selected UPBJJ elementary teachers from the three regional offices were assumed to have characteristics similar to primary teachers of other regional offices.

The instruments used to collect information about the readiness of teachers to teach science in elementary schools were: (1) questionnaire; (2) guidelines for assessing the ability of teachers to prepare lesson plans in the form of guidelines TPAI-1; (3) guidelines for assessing the ability of teachers to perform learning by using TPAI-2; and (4) Guidelines Interviews.

The data collected in the study includes: (1) data on the factors that supportreadiness of teachers teach science in elementary school, and (2) data on the constraints experienced by teachers in implementing the learning science by inquiry in elementary school captured through a questionnaire. Similarly, the data on the efforts of

the teachers in order to carry out the inquiry in learning science in elementary school was captured by questionnaire. The data was then followed up by in-depth interviews. The data on the ability of teachers to plan lesson plans was captured using the instrument TPAI-1. Data on teachers' ability to implement the lesson plans in the learning process in the classroom was captured using the instrument TPAI-2. Meanwhile, data on students' mastery of concepts with the topics covered in the process of learning science in the classroom was captured using a test instrument developed by the teacher.

Besides comparing the quantitative aspects, this research also included qualitative aspects such as events observed during the learning process. Interviews were also conducted with teachers and students. Questions in the interview covered aspects of the attitudes of teachers and students if they feel "science is fun" during the learning process.

Data analysis techniques for each data result were carried out as follows. Data about the readiness of teachers to implement learning by inquiry in elementary school was obtained by distributing questionnaires and conducting interviews with several teachers. The data was analyzed by content analysis and it was determined that the ideas, issues and concepts are the same (Patton, 1987), or the first organized into a password-specific password (Bogdan & Biklen, 1982). The final results of the analysis of this content is the opinion of the teachers pertaining to factors that support the readiness of teachers to carry out inquiry learning in elementary school setting.

3. Research Findings and Discussion

The number and distribution of respondents in this study was slightly different to originally planned. It can be seen from: (1) the number and distribution of respondents who completed questionnaires, (2) the number and distribution of those respondents interviewed, (3) the number and distribution of elementary schools visited, and (4) the number and distribution of elementary school teachers who were observed, which is presented below.

Respondents who completed questionnaires amounted to 92 people, spread over three UT regional offices with slightly varying proportions, as shown in Table 1. The number of respondents in each region were 39 (42.39%) in Denpasar, 27 (29.35%) in Pangkalpinang, and 26 (28.26%) in Serang.

Table 1. Number and percentage of respondents in each UT regional office

Number	UT Regional Office	Number of Respondents	Percentage
1	Pangkalpinang	27	29.35
2	Serang	26	28.26
3	Denpasar	39	42.39
Total		92	100

In terms of gender, 76 respondents (83.00%) who completed questionnaires were women while 16 people (17.00%) who completed questionnaires were male. Meanwhile, the number of elementary school teacher respondents who were observed in the classroom were 22 females (81.48%) and 5 males (18.52%).

From an education perspective, 62 teachers (67%), had completed S1 Primary Teacher Education Program), 18 teachers (20%) had completed high school, 7 teachers (%) had attained diploma 3 or vocational high school, with the remaining 5 teachers (5%) possessing a diploma 2.

The number of respondents who were observed by researcher using TPAI - 1 and TPAI - 2 totalled 27 people, all of whom are grade III, IV, V, and VI elementary school teachers. The number of respondents who were interviewed in depth, equalled the number of teachers who were observed teaching. The number and distribution of respondents who were observed teaching is shown in Table 2.

Table 2. Number of Respondents observed in the classroom and interviewed after instruction

Number	UT's Regional Office	Number of Respondents	Percentage
1	Pangkalpinang	9	33.33
2	Serang	9	33.33
3	Denpasar	9	33.33
Total		27	100

There were some indicators used in this study to determine the readiness of elementary school teachers to carry out the inquiry learning in elementary school. In general, before the learning process take place, teacher needs to prepare lesson plans. in this study is referred to as the learning improvement plan. The next step is the implementation of teaching and learning activities based on lesson plans that have been prepared. With reference to the Handbook Strengthening Ability Professional (PKP) Primary Teacher Education Program S1-UT Program with course code PDGK4501 / 4 credits mentioned, there are six (6) components that are used to assess the ability of teachers to plan instructional improvement. The same manual mentions seven (7) components that are used to assess the ability of teachers to implement instructional improvement, Tim FKIP-UT (2013). Each component studied has one or more sub-components. This research incorporates both of the above mentioned component.

The six components used to measure the ability of teachers to plan instructional improvements are: (1) determining the material improvement of learning and set goals/indicators of improvement of learning; (2) developing and organizing materials, media (teaching aids), and learning resources; (3) planning scenario of learning improvement activity; (4) designing learning classroom management improvements; (5) planning procedures, types, and prepare learning assessment tool repair; and (6) the document display instructional improvement plans.

In terms of teaching preparation, the data were collected by assesing the document of lesson plan by using format of TPAI-1. The result show that for the component 1 of the lesson plan, most of elementary school teachers use learning appropriate repair materials with the curriculum and the problem rectified. The largest part of which is as many as 12 respondents (44.44%) earned a score of 4 of the highest score 5, which means they have to make a statement indicator / special purpose clear, logical, and is a derived from general purpose / problem. A total of 11 respondents (40.74%) earned a score of 3 of the highest score 5, which means indicator/ formulation of specific objectives clear and is a derived from general purpose/ problem identification result. A total of four respondents (14.81%) earned a score of 4 of the highest score 5, which means that the results of identification, or indicator/ formulation of specific objectives clear, logical, complete, and is a derived from general purpose / problem identification result.

The component 2, develop and organize material, media (teaching aids), and learning resources specifically for subcomponents develop and organize learning

materials, most of which as many as 15 respondents (55.56%) received score 3 means that only two descriptors appear in the lesson plan. A total of 11 respondents (40.74%) received grade 4 out of a scale of 5, which means only three descriptors appear in the lesson plan. Only one respondent (3.70%) earned a score of 5 of the highest score 5, which means that all descriptors appear in the lesson plan. The fourth descriptor of the component 2, includes: (a) the range of material (breadth and depth) that correspond to the problem addressed; (b) the systematic material; (c) compliance with the abilities and needs of students; and (d) recency (in accordance with the latest developments in the field).

For subcomponent 2.2, as a part of the component 2, determine and develop teaching aids. Most respondents (22 people or 81.48%) earned a score of 3 of the highest score 5, which means that in the lesson plan more than one type of media did not appear to comply with the objectives. A total of 4 respondents (14.81%) earned a score of 2 of the highest score 5, which mean that the lesson only used one type of media but did not comply with the objectives. One respondent earned a score of 5 of the highest score 5, which means that in the lesson more than one type of media was used which complied with the objectives. In this case, learning tools or media is everything that is used in the improvement of learning, making it easier for students to learn (for i.e. drawings, models, original objects, maps, and charts), but do not include the blackboard, erasers, chalk and other basic classroom facilities.

Furthermore, for the subcomponent (2.3) as a part of the component 2, selecting learning resources, which may include textbooks, supplementary books, human resources, museums, environmental, laboratory, and so on, most respondents (15 people or 55.56%) earned a score of 3 of the highest score 5, which means that only two of the four descriptors appeared, while 12 respondents (44.44%) earned a score of 4 of the highest score 5 that mean that only 3 of 4 descriptors appeared. The four descriptors were: (a) the suitability of learning resources with the objective / indicator; (b) suitability of learning resources to the development of students; (c) the suitability of learning resources with the material taught; and (d) the suitability of learning resources to the environment students.

Component (3) is planned scenario for instructional improvement activities. The majority of respondents (15 people or 55.56%) received grade 3 out of a scale of 5, which means that 3 to 4 of the eight descriptors appeared, while 12 respondents (44,44%) obtained grade 4 out of a scale of 5, which means 5 to 6 descriptors appeared. In this case, the instructional improvement activities can be listening to the teacher's explanations, observations, group learning, experimenting, reading, and so on. The eight descriptors used for planning scenario improvement activities of learning were: (a) in accordance with the specific purpose/ indicator, (b) in accordance with the material to be taught, (c) in accordance with the development of the child, (d) in accordance with the time provided, (e) corresponding to the means available and or the environment, (f) varies in scenario for instructional improvement activities , (g) allow for the impact of accompaniment, and (h) allowing the involvement of students.

Subcomponent 3.4 determined ways to motivate students or teachers attempting to make students learn actively. Most respondents (15 people or 55.56%) received grade 3 out of a scale of 5, which means that 2 out of 4 descriptors appeared, while 12 respondents (44.44%) gained grade 4 out of 5, which means that 3 out of 4 descriptors appeared in the lesson plan. In this regard, the efforts of teachers to make students active learning were: (a) preparation of material (including apperception) for students, (b) preparation of media, (c) specifies the type of interesting activities, and (d) engages the students in activities.

Subcomponent 3.5 is being prepared for questions. Most respondents (15 people or 55.56%) scored 3 out of a scale of 5 in the lesson plan. In addition to the question of memory, comprehension questions were also prepared. The number of 12 respondents (44.44%) gained a score 4 out of 5 grading scale, which means that in addition there are questions to measure aspects of memory and comprehension. In this case, the questions asked for analysis or synthesis or evaluation are simply not visible in the lesson plan.

Subcomponent 4.1 determines the arrangement of space and learning facilities. Most respondents (16 people or 59.26%) received score 3 out of a scale of 5, which means that 3 of the 4 descriptors appeared in the lesson plan while 11 respondents (40.74%) gained score 4 of 5, which means that 3 of the 4 descriptors appeared in the lesson plan. The 4 descriptors used in the guidebook were: (a) the arrangement of space and learning facilities in accordance with the level of development of students, (b) the arrangement of space and learning facilities in accordance with the type of activity, (c) the arrangement of space and learning facilities in accordance with the time, and (d) the arrangement of space and facilities in accordance with the learning environment.

Subcomponent 4.2 determined ways of organizing students so that students can participate in the improvement of learning. Most respondents (12 people or 44.44%) received score 4 out of a scale of 5, which means descriptors a, b, and c appeared in the lesson plan. A total of 11 people (40.74%) received grade 3 of a scale of 5, which means descriptors a and b appeared in the lesson plan. Three respondents (14.81%) gained score 2 out of the scale of 5, which means that only one descriptor appeared in the lesson plan. In this case, the purpose is the activity of organizing student teachers in defining the grouping, member task, organizing workflow and ways of working, so that students can participate actively in the improvement of learning process in the classroom. Organizing students descriptors were: (a) setting up and organizing students (individuals, groups, classical), (b) the assignment, (c) workflow and ways of working, and (d) the opportunity for students to discuss the results of the task.

Component 5 covered planning procedures, types of instructional assessment, and preparing instructional improvement assessment tool that includes subcomponent 5.1, which was to determine the procedure and types of assessment. Most respondents (12 people or 44.44%) earned a score of 4 of the highest score 5, means listed procedures and types of assessment, one of instructional assessment in accordance with the purpose / indicator. A total of 11 respondents (40.74%) earned a score of 3 of the highest score 5, which means ratings listed procedures and types of assessment were in accordance with the objective/ indicator. While 4 respondents (14.81%) earned a score of 2 of the highest score 5, which means listed of procedures and types of assessment but were not in accordance with the purpose/indicator.

Subcomponent (5.2) covered making assessment tools and an answer key. Most respondents (15 people or 55.56%) received score 2 out of a scale of 5, which means that each question/questions measured an indicator/ objective. A total of 6 respondents (22.22%) received score 3 out of a scale of 5, which means that each question/questions to measure the indicators/objectives and language and/or format for each question were in accordance with the rules. Furthermore, 5 respondents (14.81%) gained a score of 4 out of 5, which means the grading scale assessment tools and answer keys were in accordance with the arrangement of preparation of items. Only one respondent (3.70%) included questions that met the requirements and were accompanied by key/signs for the correct answer.

Meanwhile, the seven components that are used to assess the ability of teachers to implement instructional improvement are: (1) ability to manage the space and teaching facilities; (2) implement instructional improvement activities; (3) manage classroom

interaction; (4) be open and flexible as well as helping students develop positive attitudes toward learning; (5) demonstrate a special ability in improving learning, especially for science subjects; (6) conduct the assessment process and the learning outcomes; and (7) the general impression of the implementation of learning.

For component (1) manage the space and learning facilities, the majority of respondents (18 people or 66.67%) received score 3 out of a scale of 5, which means that 2 of 4 descriptors appeared at the time of learning based lesson plans they developed. A total of 9 respondents (33.33%) gained score 4 of 5 grading scale, which means that 3 of 4 descriptors appeared at the time of learning. The four descriptors used were: (a) in accordance with the needs of spatial learning, (b) the necessary facilities are available, (c) the necessary learning resources are available, and (d) the facilities and learning resources are easily exploited.

For subcomponent (2.2), the majority of respondents (19 people or 70.37%) gained score 3 out of scale of 4, which means 2 of 4 descriptors appeared during science instruction in the classroom. A total of 8 respondents (29.63%) gained score 4 of 5 grading scale, which means that 3 of 4 descriptor appeared. The four descriptors used were: (a) in accordance with the purpose of learning and teaching materials, (b) in accordance with the development and learning needs of students, (c) learning is well coordinated, and (d) learning is in accordance with the situation and the environment.

While for subcomponent (2.3) most of respondent that is 19 respondent (70,3%) earned a score of 3 of the highest score 5, that mean that some students are involved in using learning tool (media) that match with purpose, student, situation, and environment. A total of 8 respondents (29.63%) earned a score of 4 of the highest score 5, that mean that all students were categorized to use learning aids.

For subcomponents (2.5) carrying out individual, group, and classical learning improvements, the vast majority of respondents as many as 15 people (55.56%) earned a score of 4 of the highest score 5, that mean that three descriptor appear. Some respondents earned a score of 3 of the highest score 5, that mean that two of the five descriptors appear at the time of implementation of the lesson. The five descriptors include: (1) the implementation of classical activities, groups or individuals in accordance with the objectives / materials / needs of students; (2) the implementation of classical, group or individual activities in accordance with time and learning facilities; (3) changes from individual to group activities, class to group activities, or otherwise take place smoothly; (4) the role of the teacher accordance with the type of activity (classical, group, or individual) that is being managed; and (5) in every activity (classical, group, or individual) students are optimally involved.

In the process of learning, for the subcomponent (3.2), it can be seen that most of the respondents (19 people or 70.37%) earned a score of 4 of the highest score 5, which means that teachers implemented activities to explore the response or question students during the learning process and gave feedback to students. Meanwhile, eight (8) respondents (29.63%) earned a score of 4 of the highest score 5, which means teachers asked another students to respond to his/her questions or accommodate students' responses and questions for further activities.

For subcomponent (3.4) - trigger and maintain the involvement of students - the majority of respondents (19 people or 70.37%) received score 3 out of a scale of 5 which means that 2 of the 4 descriptors appeared in the learning process. A total of 8 respondents (29.63%) gained score 4 of scale 5 which means that 3 of the 4 descriptors appeared during the learning process. The four descriptors used were: (a) help students to recall the experience or the knowledge that has been gained, (b) encourage students

who are passively participating, (c) asking open-ended that can elicit student reactions and (d) respond positively to students who are actively participating.

For subcomponents (3.4) triggering and maintaining student involvement, the majority of respondents ie 19 people (70.37%) received an assessment of 3 from the rating scale 5 meaning two of the four descriptors appeared in the learning process. A total of 8 respondents (29.63%) received a rating of 4 from a rating of 5 meaning that three of the four descriptors appeared during the learning process. The four descriptors used include: (a) helping students recall the experience or knowledge they have acquired, (b) encouraging passive students to participate, (c) asking open-ended questions that can elicit student reactions, and (d) Respond positively to students who participate.

For subcomponent (4.2) - showed enthusiasm in teaching - most respondents (15 people or 55.56%) received score 3 out of a scale of 5 which means that 2 of the 4 descriptors appeared in the learning process. 2 respondents (7.41%) received scored 3 out of a scale of 5 which means that 3 of the 4 descriptors appeared in the learning process. A total of 10 respondents (37.04%) gained score 5 of 5, which means that all descriptors appeared in the learning process. The four descriptors used were: (a) eye contact and facial expressions, (b) tone of voice when delivering an important topic, (c) how to approach students and pay attention to things that are being worked on, and (d) the movement and gestures when delivering an important topic.

For subcomponent (5.1) - guiding students to prove the concept of science through direct experience of the object being studied - the majority of respondents (18 people or 66.67%) received score 2 out of a scale of 5 which means that learning took place by lecture followed by demonstration without involving many students to actively ask questions. A total of 4 respondents (14.81%) received score 3 out of a scale of 5 which means that 2 of the 4 descriptors appeared in the learning process, which means that learning took place by lecture followed by demonstration by students. 5 respondents (18.52%) gained score 5 of 5 grading scale, which means that learning took place with verification activities by the students in groups or individually, and then the students made decisions with the guidance of teachers.

For subcomponent (5.2) - increasing student engagement through learning experiences with a variety of activities - most respondents (17 people or 62.96%) received score 2 out of a scale of 5 which means 2 of 4 descriptors appeared. A total of 4 respondents (14.81%) received score 3 out of a scale of 5 which means that 3 of the 4 descriptors appeared. 6 respondents (22.22%) gained score 5 of 5 grading scale which means that all descriptors appeared in the learning process. The 4 descriptors were: (a) student activity doing experiment/observation by individuals/groups, (b) students conduct discussions in small groups, (c) student informs the result of the experiments to their friends/class clearly, and (d) all students/class concluded the concept of science based on the comparison of the results of experimental group/individual students.

For subcomponent (5.4) - skilled in performing science experiments as well as the right to choose science tools - most respondents (22 people or 81.48%) received score 3 out of a scale of 5 which means that the teacher was skilled in using the tools of the experiment. 5 people (18.52%) used science equipment in accordance with the level of development and safety of students.

For subcomponent (5.5) - apply the concept of science in everyday life - most respondents (14 people or 51.85%) gained score 4 of 5 which means that one or two students gave examples of the application of the concept of science in daily life. 7 people (29.53%) received score 3 out of scale of 5, which means the teacher encouraged students to give examples of applying the concept of science in everyday life. 6 respondents

(29.53%) gained score 5 of 5 which means that more than 2 students gave examples of the application of the concept of science in everyday life.

Assessment in inquiry-based science learning is very important. For subcomponent (6.1) conducting an assessment during the learning process - the majority of respondents (19 people or 70.37%) received score 3 out of a scale of 5 which means the teacher did assessment by assessing student mastery learning by asking questions and giving assignments to students. A total of 6 respondents (22.22%) gained a score of 4 of 5 grading scale, which means the teachers did assessment by assessing the performance of the students. 2 respondents (7.41%) gained a score of 5 of 5, which means besides teachers doing assessment performance of students during instruction, teachers also assess the students through the signals shown by the students, that indicated students understand the science concept being taught.For subcomponent (6.2) - carry out an assessment at the end of the instruction - the majority of respondents (20 people or 74.07%) gained score 4 out of scale of 5 which means that teachers conducted assessment at the end of instruction in accordance with the purpose of the science instruction. A total of 7 respondents (25.93%) gained score 5 out of a scale of 5 which means the teachers conducted assessment at the end of science instruction in accordance with the purpose of the science instruction. Nevertheless, the item test have not been able to measure the student's ability to carry out the inquiry during science instruction.

For subcomponent (7.1) - the effectiveness of the learning process - the majority of respondents (17 people or 62.96%) received a score of 3 out of a scale of 5. Some respondents (4 people or 14.81%) received score 4 out of a scale of 5. The remaining 6 respondents (22.22%) gained a score of 5 out of 5 grading scale, which means that all descriptors appeared in the science instruction process. The four descriptors were: (a) learning smoothly; (b) the classroom atmosphere was controlled in accordance with the plan; (c) the classroom atmosphere was controlled through adjustment; and (d) leads to the formation of the impact of accompaniment (for example, there is an opportunity for students to be able to work together, responsible, tolerant).

In general, based on the observation of teachers during the instruction process, the vast majority of primary school teachers carried out the process of learning science based lesson plans that had been prepared. Most of them used the lesson plan that had been developed in the previous year and revised as necessary to the process of teaching and learning at the time of observation. A general trend was that teachers tended to only change the month and year in the lesson plan, to the extent that one of the principals in elementary schools visited said that "Teachers are now likely to follow the play *Arja Galuh,*" meaning that teachers tend to want convenience only and do not bother to prepare the lesson plan. (Arja Galuh is a traditional Balinese art form).

Various efforts have been made by teachers to be able to carry out inquiry learning in the classroom that include the selection of the most appropriate method of inquiry that can be implemented in elementary schools, media selection, and appropriate learning aids so that the learning process can run as expected. Efforts to continue to encourage and motivate students to be active in the learning process is also being conducted by designing learning activities in the form of working groups with the number of students in the group varying between 5 and 10 people per group, tailored to the topics studied and the availability of learning aids.

In general, teachers tend to use demonstration methods in science learning and are combined with group discussion activities using students worksheets. A small percentage of teachers who were observed at the time of teaching did not seem ready to teach science with inquiry. Science is taught by lecture method only. The visual aids that teachers should not use are seen and not used during the learning process. Nevertheless,

some teachers seem ready to carry out inquiry learning (discovery) in science. This can be seen when they teach science at one of public elementary school in Tanjung Pandan Belitung. The teacher has been able to engage students actively in the learning process. Science equipments in that elementary school look quite complete. After being traced, the results of the interviews obtained information that some teachers in elementary school is the core teachers who have received intensive training from the SEQIP Program. But unfortunately the program has been discontinued. However, things that need to be replicated by the teacher is still the spirit to teach the science with inquiry using various media that exist including the use of LCD, the use of props, and assisted with the use of students worksheets.

The readiness of of teachers to teach science by inquiry in elementary school can also be seen in elementary schools of Dharma Karya UT located in Pondok Cabe, South Tangerang, Banten. The teachers observed during instruction in the classroom look ready to teach science by using inquiry. In terms of facilities supporting the learning process, Dharma Karya UT elementary school can be categorized as quite advanced in that area. Most classes were observed to be taught bilingually in Indonesian and English. One class is guided by two teachers. In the process of learning, teachers are accustomed to using the LCD and use a variety of learning resources which are relevant to the topic or subtopic taught in elementary school.

When connected to Wenning theory (2011) which states there are five (5) levels of inquiry learning, interactive demonstration process (interactive demonstration) is the most frequently encountered by teachers despite not being fully implemented. Meanwhile, four (4) levels of inquiry (discovery learning, inquiry lesson, laboratory inquiry, hypothetical inquiry) can be categorized as appearing less frequently during the science instruction process in elementary school.

The limitations of science equipment in elementary school are expressed by most teachers as an obstacle to implementing inquiry in science learning. In addition, the limited time available, and lack of knowledge and insight about the inquiry are also obstacles in implementing inquiry in science teaching. From interviews with several teachers, teachers rarely use science equipment, so the science subjects are taught by lecture. Most of those interviewed said they did not use science equipment in teaching science subject due to the equipment not being available in the school. However, from the observation of the implementation of science instruction, there seems to be some teachers who have been able to involve students in the learning process by utilizing a variety of learning resources including utilizing local environment for relevant topics. Relevan with this finding, (Harlen & Qualter, 2008; Cobern & Loving, 2002; Pell & Jarvis, 2003) in Slavin, *et al*., (2012) mentioned that science education is particularly problematic in elementary schools. Numerous surveys have found that elementary teachers are often unsure of themselves in science, with little confidence in their science knowledge or pedagogy. Since the appearance of the National Science Education Standards (National Research Council, 1996, 2000, 2012) and the recent National Research Council (2012) frameworks, there has been general agreement in the U.S. about what students should learn in science, and a consensus that science should be taught using inquiry-oriented methods that emphasize conceptual understanding rather than just facts.

Trowbridge and Bybee in the NRC (1996) say there are three levels of inquiry, which are: (1) discovery learning, where teachers identify the problem and the process, but students are allowed to identify several alternative outcomes; (2) guided inquiry, where the teacher poses a question and students are asked to determine the process and troubleshooting; and (3) open inquiry, where the teacher only provides a context to solve

the problem and then the students identify and solve or resolve problems in their own way.

Acording to Beyer (1979), there are three aspects of inquiry, which are knowledge, psychomotor, and affective (Beyer, 1979), but based on observation knowledge is still the most dominant aspect of inquiry. Meanwhile, psychomotor and affective aspects appear to have not been maximally instilled by the teacher to the elementary students. The process of science instruction is dominated by lecture, which likely inhibits the development of skills that should be controlled by the student. It is believed that skills development in students can be developed through laboratory activities (hands-on activities) but are rarely focused on by the teacher.

Similarly, aspects of the development of attitudes, such as honesty, responsibility, cooperation, and mutual respect that should appear in the proceedings in science teaching, were not clearly visible from observation. However, based on some classroom observation, psychomotor aspects and aspects of the development of attitude began to emerge, although not optimally.

Item tests were developed by teachers that simply ask about aspects of knowledge, especially knowledge of the facts but can also become an obstacle to the implementation of inquiry learning. In addition, the types of problems in the item test that developed less supportive science instruction by inquiry in the classroom. For example, the question of what is meant by photosynthesis? When does photosynthesis occur? Questions like these will only ask about the aspect of knowledge of facts alone. The questions asked in daily tests, midterms, final exams, or national exams do not just ask about aspects of knowledge to uncover the facts or concepts, but also ask about things with regard to why and how, for example, why does photosynthesis occur during the day? What is the process of photosynthesis? In other words, the question put to the students should also include questions that require students to answer the questions that demand higher capabilities for example matters of analysis, synthesis, and evaluation in accordance with the level of the development of elementary school age children.

4. Conclusion and Suggestions

There are some factors that support the readiness of teachers to implement learning by inquiry in SD. Generally, teachers have prepare a lesson plan before they implement the learning process in the classroom, either developing a new lesson plan, using an existing lesson, or adapting an existing lesson plan. The availability of teaching aids and learning resources are also said to be an important factor to support teachers in preparing the process of science teaching by inquiry in elementary school. In addition, the learning environment and good support from principals and teachers in schools, contribute substantially to the implementation of the process of science teaching in elementary school. However, it was observed that not all schools have adequate science equipment that can be used by teachers to support science teaching and learning in the classroom.

Some of the constraints experienced by teachers in planning lessons with the inquiry in elementary school include, among other things: choosing teaching methods to be used, choosing props or teaching aids, organizing classes, determining the type of assessment that is appropriate to the material being taught, guiding students to perform experiments, and asking questions that are relevant to the topic being taught. In addition, a small proportion of teachers said they had suffered difficulties in concluding the lesson, and in considering some of the foreign terms in the material being taught.

The efforts that have been made by elementary teachers to be able to carry out learning by inquiry in primary schools include, among others: the selection of the most

appropriate method in order to carry out inquiry in elementary school, media selection and science equipment are appropriate so that the learning process can run as expected. Efforts to continue to encourage and motivate students to be active in the learning process is also being conducted by designing learning activities in the form of groups with varying numbers of students adjusted to the topic being studied and the availability of learning aids. When science equipment is not available at the school, most teachers ask students to bring simple learning aids from home or from the surrounding environment. In addition, some teachers buy their own learning aids or borrow them from nearby schools. Some teachers take the students out of the classroom in order to stimulate the learning process and adapt materials to the topics taught.

Based on the results of the assessment of lesson plan and the results of the assessment of teaching observation, it appears that a small percentage of teachers conduct inquiry learning in elementary school. Moreover, the major part of elementary school teachers are not ready to implement learning by inquiry, largely because of the limitation of science equipment to support the implementation of science teaching by inquiry in elementary school. In addition, limited insight and understanding of the importance of science teaching by inquiry in elementary school is a barrier to science teaching.

Questions posed by elementary school teachers to their students mostly ask for knowledge aspects, especially knowledge of the facts which can become an obstacle to the implementation of inquiry learning. However, questions are asked in the daily tests, midterms, final exams, or national exams that do not just ask for aspects of knowledge to uncover the facts or concepts, but also ask about things pertaining to questioning of why and how. In other words, the questions put to the students in class should also include questions that require students to answer the questions that demand a higher level of capability, for example the problems of analysis and synthesis and should be adapted to the level of development of elementary school age children.

From the observation of teachers during the instructional process in the classroom, the three aspects of inquiry, namely knowledge, psychomotor, and affective are supposed to appear, but in fact is still dominated by the cultivation of knowledge aspect while psychomotor and affective aspects appear to have not been maximally instilled by the teacher to the elementary students. The process of learning science is dominated by lecture method, inhibiting the development of skills that should be controlled by the student. Aspects of skill development in students can be done through various laboratory activities (hands-on activities) despite using only simple tools and materials found in the school environment or raised privately by teachers and students. Similarly, aspects of the development of attitudes, such as honesty, responsibility, cooperation, and mutual respect that should appear in the proceedings in learning science, were not visibly seen from observation. However, in some elementary schools observed, psychomotor aspects and aspects of development were somewhat visible, although not optimally.

As a follow up to the results of this study, the following are suggested: (1) implementation of learning science by inquiry in elementary school needs to be supported by adequate science equipment, although more important is the need for change in the mindset of elementary school teachers regarding learning by inquiry; (2) innovation in science teaching, should be done in the form of teachers training such as training for teachers by SEQIP need to continue to be implemented for the good innovations can be passed, so that learning science by inquiry in elementary school can be realized; and (3) questions tested at the school level, or national examination should also include inquiry based questions, so that teachers understand the importance of introducing primary school children to learning science by inquiry. Dimensions

development aspects of knowledge, skills, and attitudes that are introduced through the science learning should at least be understood by the teachers so that they feel morally obliged to introduce the approach to students through a variety of topics or subtopics IPA taught in elementary school.

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