BASIC SCIENCE FOR PRESCHOOLERS IN ENGLISH

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Abstract. *The study aimed to investigate the program implementation of Scientific English for preschoolers on children of two pre-schools. For this purpose, 43 children were purposively selected. This program was developed by a team of English teachers in collaboration with preschool teachers. The teachers were trained on how to teach science through inquiry approach using their first language and foreign language (English). The learning intervention was developed based on theories that assume that children construct knowledge through inquiry process. Data were collected from some classroom observations. Interviews were also conducted to collect data on how the teachers prepared the lesson and taught their students. After the class intervention, students' post-test scores showed significant increases. The increase in their score average of vocabulary gain suggests that the program was effective in increasing English vocabulary and science knowledge. Furthermore, the classroom observation during intervention showed that the program significantly improved student-teacher interaction in science learning. The conclusion from data analysis suggests that the students were more active in using English and involving in their science activities during the implementation period than their previous classroom learning.*

Key words: science, inquiry, preschool, English, and language

1. Introduction

Early education must provide educational support to develop children's basic cognitive and affective skills through experience and positive stimulant so that they can gain maximum development (Bennett, 2003). At the preschool age, children need to strengthen their perceptive and cognitive skills as well as science skill through questioning, testing and searching answers (Brunton & Thornton, 2010:15). Similarly, Mirzaie, Hamidi, and Anaraki (2009:83) hold that children are usually curious about their environment and this curiosity helps develop cognitive and scientific skills. This scientific and cognitive development will enable them to reach their subsequent maximum academic achievement.

Preschools play an important role in developing early cognitive and affective skills. (Bibi & Ali, 2012: 153). The study conducted by Bibi dan Ali (2012:157) concluded that the primary school students who were enrolled in preschools had better academic performance than those who were not. Their preschool exploration and experience will determine scientific concept formation which can be used to start their subsequent basic education.

There are two reasons for the implementation of this community service program. First, pilot surveys conducted in four preschools in Ilir Barat District, Palembang indicated that the preschools were increasingly under pressure to introduce children to basic academic skills such as reading, writing and mathematics. Consequently, the children were taught instructional materials ahead of their current cognitive maturity like formal classroom learning with the teachers as the centre of instructional activities. The skills teachers need to develop at the age of preschool should not be the same as the cognitive

skills developed in elementary and junior high school. What they need to develop is inquiry skills such as asking questions, searching the answers to questions, constructing meanings and sharing their experience and experiments. To solve this problem, the writers believe that the preschools must adopt research based learning designs and new learning materials.

Second, English and science are considered to be crucial competencies in modern era. Consequently, many schools are developing new learning designs and new learning materials for English and science at preschool. The growing necessity to master English has motivated many people to implement early foreign language learning for young learners in preschoolers. Such implementations are still discussed not only in terms of age constraints but also in terms of the quality and quantity of the education provided.

In light of the aforementioned reasons, the writers carried out a community service program. The purpose of this paper is to report on the program and how the program attempted to meet the needs of preschool teachers who need to adopt science education in refining their teaching practices. We examined what the teachers did during the intervention on the science knowledge and vocabulary development of preschool children. We also explored whether there are any significant differences between the average test scores of scientific English given before the intervention and those given after the intervention. However, the aim was not to teach the children to master science using English but to make children aware of science and simultaneously develop basic English vocabulary.

1.1 Scientific English Class

Science is a way of learning about natural world that surrounds us knowing not only about what we learn but also the process of learning it (Wenham, 1995:2). Science and English should be introduced to preschooler since it can facilitate subsequent science and social science learning. Johnston (2005:7) holds that science learning provides children with many opportunities to do many kinds of exploration and experience that will determine scientific concept formation to start their subsequent education. Similarly, Bibi and Ali (2012: 153) reinforced the importance of preschool activities in developing early cognitive and affective skills. Early learning has long-term psychological consequences.

Appropriate bilingual science classes should be developed by considering children's potential linguistic and cognitive competencies as well as their age-related limits. A scientific English class in this community service program refers to simple science instructions in dual languages, enabling the students to develop questions and search the answers as well as develop English vocabulary. Many traditional classes teach young children English and science focusing on rote learning such naming objects, reciting or memorizing that do not promote children's understanding and knowledge. Alternatively, the process quality of early childhood learning should provide developmentally appropriate activities, rich and motivating learning materials and simulating environment. Christ and Wang (2012:75-77) point out that various preschooler-internal factors such as age and interests as well as well as preschooler-external factors, for example teaching approaches and materials should be considered in determining the number and the selection of words that young children should learn. Regarding their age, Christ and Wang suggest that teachers teach between 3-5 new words in each learning session after carefully adjusting the students' needs.

To introduce science and English, teachers can start teaching by providing basic scientific concepts and vocabulary learning about the natural world, involving children's prior knowledge and experience (Hirsch, 2006). Bilinguals' knowledge of scientific

concept and vocabulary is presumed to benefit later science learning and subsequent reading comprehension (Hirsch, 2006).

1.2 Inquiry Learning

This community service program employed inquiry learning approach because many studies have shown that inquiry based science learning helped children learn science through the natural learning process to develop science process skills and enhance science attitudes (Staver & Small,1990). A study of preschool children's science learning conducted by Samarapungavan, Mantzicopoulos and Patrick (2008) suggested that the inquiry learning approach into the life cycle of the butterfly monarch supported children's engagement in the practices of scientific learning. They reported that the preschoolers were able to performed scientific investigations to refine their knowledge. The study found the children were able to generate questions, observe, predict and report their exploration.

Inquiry learning in this program means a natural learning approach focusing on student involvement in science activities and exercises. Inquiry benefits early learning in several ways. Firstly, it motivates children to learn science concept and learn about the process of science knowledge construction (Olson & Louks-Horsley, 2000). Secondly, the approach can facilitate a variety of learning opportunities to explore science. It is also suitable for language learning because children normally learn a language through natural communication (Goodman 1986). Thirdly, inquiry approach is suitable for developing independent science learning because it challenges children to devise their own procedure to answer the question or solve the problem (Bennett, 2003:34).

At the beginning of inquiry learning, the teacher needs to explore what children have learned and connect their current learning to previous knowledge. Teachers can challenge students' prior knowledge or beliefs by providing a problem or probing question for investigation as well as the necessary materials for observation. Observing, questioning, testing and searching the answer are key activities of inquiry learning in preschools (Cuevas, Lee, Hart & Deaktor, 2005). Observation in the science learning process needs to be prioritized because it is the main skill in the preschool education. (Harlen and Qualter, 2009, Johnston, 2011).

1.3 Methodology

The program involved fourty three preschool children aged 4-*5,5* years and six teachers from two different schools. The preschools were chosen based a purposive and convenience sample so they did not represent random sample. The six teachers were divided into two teams according to the school in which they were teaching in two different schools. Only one teacher had fewer than three years of teaching experience, and five teachers had four or more years of teaching experience. The preschools were selected for the community service program as they adopted integrated science and English in their curriculum.

Three modes of data collection were conducted to ensure that the data collected would be sufficient and valid. Firstly, this study used semi structured observation of the classroom activities with the use of predetermined observation form and video recordings to identify the qualitative improvements of the children science activities and examined which science skills and words of English the children acquired. Data from previous cycle were used to improve subsequent cycles. Secondly, the writers also used interviews to collect data from two of the six teachers using semi structured forms of interview after the three cycles. The predetermined questions of the interview focused on the teachers' perception of the intervention. Finally, a pretest and a posttest were performed before and

after the scientific English learning intervention to examine the preschool children´s learning achievement. The same test was repeated with an interval of three month period between the two tests (Table 1).

Table 1. Pre test and post test design

Pretest	Intervention	Posttest
Scientific English Test	3 cycles of Scientific English Instructions	Scientific English Test

The test consists of pictures that depict a wide range of kitchen utensils, fruits, vegetables and observation checklists, adopting vocabulary test package developed by Truro Central School, School Committee Policy (n.d). The children were asked to name a number of objects and activities shown on a picture test book. They could use verbal or nonverbal responses.

The intervention was carried out over a twelve-week period. Prior to program intervention, the writers discussed with the teachers and the principal how we would implement bilingual science classes and refine their previous teaching approaches. We provided the teachers with a one-day workshop by incorporating inquiry approach to the science learning, their previous teaching experiences and knowledge. The 12 topics (1. Senses, 4. Caring for your sense organs, 3. Color, 4. Taste, 5. Smell, 6. Size, 7. Sound, 8. Kitchen utensils, 9. Fruits and vegetables, 10. Matter, 11. Bubble, and 12. Dough) were organized and distributed into three learning cycles for class interventions. The intervention of each topical learning unit was observed and followed by a reflection to assess how the intervention was carried out.

The first cycle was used to collect baseline data that was collected from observations of the classroom teachers' interactions with the children during the first and the second weeks. The subsequent cycles were used for the intervention.

The first learning cycle is divided into two topical learning sessions namely human senses and caring for human senses. In the first session, the students were given a lesson of human senses. The purpose of this lesson is to teach children about the human senses and vocabulary associated with bodies and senses. The children were facilitated to observe and discuss their observations then asked to report their observations.

The team prepared two kinds of observation forms to record somewhat different activities of teacher and children activities. The first observation form was used in the interventions to collect data about variation in classroom processes, including classroom instructional materials and students' behavior and activities over three cycles. On the other hand, the second observation was used to collect indicators of the instructional activities done by teachers by combining judgements about the teachers' planning and teaching implementation activities as well as children's involvement in the learning process.

The two observation forms include instruction for observers, the qualitative coding levels, the descriptors, and the observation items. There are four levels of performance for each learning activity in the rubric of the first observation form which set standards for the student achievement in the criterion. The performance levels range from 0 to 3, with a "0" describing the actions, and/or outcomes of students who is "unrecognized" and a "1", "2" and "3" describing a performance "poor", "satisfactory" and "excellent" consecutively. The observer also judged children's participation level across a range of science topics and English children used in the classroom settings.

The writers recorded the interview and made verbatim transcription followed by light editing so the transcription still captured every word said on the recording.The interviews asked how they implement inquiry science learning and how the implementation benefits young children's bilingual science learning. The interviews

helped the writers to see a true reflection of the teachers' actual work and their perceptions about the program.

The result of pretest and posttest was compared with the results of the observations and the interviews to see data corroboration and discrepancies. The data triangulation process was carried out to insure that the data collected would be a factual reflection of the real activities and the behaviours of the participants involved in the intervention.

2. Results and Discussion

The following discussion focuses on the observation in one of the classes. In one instance, the writers observed all children settled down soon after short excitement and engagement for learning of human senses. The majority of talks during the learning sessions were eliciting targeted vocabulary words on human senses, asking for spellings or pronouncing the words. The second topic was discussing some ways of taking care of human senses. There seemed to be some excessive explanations, translations of some words and instructions. These inadequate practices of too much explanations in bahasa Indonesia could inhibit "valuable input in the L2" (Ellis , 1984:133, Pontier, 2014:95).

From the first cycle, it was concluded that a problem had arisen regarding the amount of teacher's talks during the first cycle. It could affect the children's focus and understanding so it was decided that the teacher would minimize her talks and use more pictures and other learning aids to make learning more meaningful.

To accomplish the second cycle, the teachers implemented the inquiry approach in their classes from the third to the seventh weeks of the intervention. Prior to the intervention, the teachers attended one day workshop on inquiry based learning. The writers and the teachers in this study developed instruction to promote student active learning. In the second cycle, the children received an inquiry based learning instructional approach in English implemented by the teachers observed by the writers. The inquiry learning activities focused on providing opportunities to learn the properties of matter, and the behavior of materials (e.g., change in liquids and solids through melting), fruits and vegetables, size, shape and colors. The teachers introduced appropriate vocabulary in basic science learning through the use of inquiry approach by repeatedly using specific science vocabulary and providing enough time to elicit more children's talks.

The children interacted with the learning materials fairly naturally and excited with the materials quickly. However, the students paid less attention to teacher's talks while experimenting. This time there were only few questions and responds from the children regarding their science learning. From the classroom observation alone, it seems difficult to tell either their curiosity toward science materials in the experiment or the teacher's abundant talk affected their attention.

The data in the second cycle revealed that the children's involvements in the inquiry activities were more elicited and occured in a more formal way with formulaic phrases or expressions than those of in the first cycle. From classroom observations in the third cycle, it was found that there were significant differences in terms of teachers' and children' behaviour over the first, the second and the third cycles of intervention. Children's independent learning activities tended to improve starting from the second cycle due to the provision of a wide range of resources and time for explorations. Inquiry activities were unrecognized in the first and second cycles, where children usually did not have opportunities to develop their own explorations. The most exciting science learning in the third cycle observed by the observer was children's experimenting with an egg which was sucked by an empty bottle.

After finishing the three cycles, two of the six teachers were interviewed individually about their feelings towards their teaching. The teachers seemed to agree that an inquiry approach helped them facilitate science and language learning. Hana, for example, admitted that she preferred teaching using kitchen uttentials because she had been familiar with the tools so she found them easier to use. She claimed that the teaching aids helped her explain complex and abstract ideas and helped children observe science process.

The two teachers also reported that the intervention program made them aware of the need to provide teaching aids for students to interact and to develop the children's inquiry skills to learn science. They said that the intervention has benefited the children in terms of science learning motivation.

Extract 1. Nadya*: My passive students who were previously very passive in the classroom became very active in their science practices. They like to observe and participate.*

She figured out how kitchen utensils and materials can advantage young children, allowing them to be involved in observing, questioning, testing, and searching the answer.

In the following excerpt, Nadya highlighted that using the kitchen tools and materials increased young children's involvement in science and English learning.

Excerpt 2. Nadya: *The pictures and other teaching aids really help us elicit responds in our teching.*

The teacher found experiment with dough useful because it offered challenges for the children to manipulate materials and tools as well as interact with teachers and peers in English In Excerpt 3, Hana, observed how experiment with dough using flour, vegetable oil and food colorings enabled children to make their own choices about the size, shape, and color of objects, which would not be as easy to do with other materials. By testing different mixture of the dough, reducing or adding the quantity of materials, these learning activities stimulated scientific thinking.

Excerpt 3: Hana: *The most exiting lesson for the student was dough experiment. They were amazed and busy with their dough.*

To investigate if there was a mean difference between children's vocabulary scores of each of pretest and test (Table 2), mean comparison was calculated. Raw scores of the two tests were converted to means and standard deviation.

Table 2. Paired Samples Statistics of the results pre-test and post-test for Scientific English Test

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	pre-test	51.3220	41	17.42954	2.72204
	post-test	68.2439	41	15.92950	2.48777

The children's total pretest score in scientific English was low (M = 51.3220, SD = 17.42954) The resulting data from the posttest after the intervention shows that the majority of children gave more correct answers so their total posttest scores increased significantly (M=68.2439, SD=15.92950). A t-test was run to check the mean difference of the two tests was significant and the t-test showed that the average scores of the tests differed significantly, t = -5.146, p <.05 (Table3). However, the data should be served as an assessment only and should be viewed with a degree of caution as not all of the students displayed improvements. The data is also incomplete because one child was absent for the pretest and another for post test, so. Another drawback is that the test lacked validity because the same test was used in pretest and post test; the pretest could interfer the posttest.

Table 3. Paired Samples Test Statistical test of differences in the pretest and post-test results

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	VAR00001 VAR00002	-16.92195	21.05746	3.28862	-23.56851	-10.27540	-5.146	40	.000

3. Conclusion

The intervention introduced pre-school teachers to a bilingual science class with child-centered educational tools and equipment. The data analysis seems to suggest that learning intervention using inquiry approach helped children to become active in science and language learning. However, in term of program intensity and duration, this learning provides limited exposure to English and the children cannot be expected to achieve high mastery in science and English.

Although the result of the study cannot be generalized it offers an important pedagogical implication. This study suggests that developmentally appropriate inquiry activities should be designed to facilitate active verbal and nonverbal interaction, and support children's concept and language development in the context of science. To design instructional materials and activities for the inquiry learning, teachers must be creative in creating or providing science teaching aids for students to use. In this respect it does seem that our kindergarten hands-on materials such as food, kitchen utentials and materials proved to be appropriate learning materials for preschool science. Since inquiry learning using hands-on materials has been proved to be both challenging and friendly for teachers, it should become a substantial content of preschool curriculum.

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