



## Science Process Skills in Kindergarten Projects

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### Abstract

*In Thailand, early-childhood education has emphasized more on promoting science learning since 2010 by a national project called Little Scientists House, Thailand. The schools are eligible to apply for the certificate if they implement 20 science activities and one inquiry project with their kindergarten students in that academic year, and the certificate is awarded for the following two years. There are about 3,000 schools apply for the certificate each year. One main aim for supporting kindergarten students doing inquiry projects is to promote children's science process skills. This study aims to explore what science process skills were developed in the kindergarten inquiry projects since the science process skills are a vital outcome in science education at all levels. The samples in the study were 67 science project reports from three provinces of Thailand that applied for a Little Scientists' House certificate in the year 2016. Content analysis technique was used to analyze data. The frequency of each skill was counted and graded at low, medium, and high levels, with the percentage of frequency occurring between 0 -32, 33 – 67, 68 -100, respectively. The results showed that the skills of observing, measuring, using numbers, communicating, identifying and controlling variables, and interpreting data and making conclusions were found at a high level. Specifically, observing had occurred in all inquiry projects. Classifying, using space/time relationships, and experimenting were at a medium level. Inferring, predicting, formulating hypotheses, and defining variables operationally were at a low level. Interestingly, there was no skill of predicting developed in any inquiry project work. In conclusion, inquiry project could support children in developing their science process skills, so that promoting inquiry projects at the kindergarten level would enhance children's science process skills. However, we found some misconceptions and error in the use of science process skills which need to be correct. Thus, a professional development program is need for kindergarten teachers and educators to develop effective inquiry projects.*

### 1. Introduction

Children between the ages of three and ten have an inherent interest in exploring and understanding their world [1]. They already have considerable skills in inquiry based thinking and knowledge of science, mathematics, and technology [1]. Research findings reveal that they are already capable of key aspects of inquiry behavior such as; can make assumptions, test their assumption, and draw initial conclusions from their findings [1]. However, their development should be supported by a facilitator of learning. As the idea of the zone of proximal development, based on Lev Vygotsky (1978), suggests that a child can access the next level of development with the support of a more knowledgeable people [2].

In Thailand, early-childhood education has emphasized more on promoting science learning since 2010 by a national project called Little Scientists' House, Thailand. The project was derived from the "Haus der kleinen Forscher" Foundation, Germany. There are now about 20,000 primary schools involved in the project, and more than 5,000 schools have a Little Scientists' House certificate. The schools are eligible to apply for the certificate if they implement 20 science activities and one inquiry project with their kindergarten students in that academic year, and the certificate is awarded for the following two years. There are about 3,000 schools that apply for the certificate each year. One main aim for supporting kindergarten students doing inquiry projects is to promote children's science process skills. The science process skills are a vital outcome in science education at all levels. These skills play a crucial role in acquiring knowledge of natural phenomena and understanding the way scientists work [3]. The science process skills generally focused in Thai science education are comprised of 13 skills [4], which are according to American Association for the Advancement of Science (AAAS) [5]. These skills are observing, classifying, measuring, using numbers, using space/time relationship, inferring, predicting, communicating, identifying and controlling variables,

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formulating hypotheses, defining variables operationally, experimenting, and interpreting data and making conclusions. Therefore, this study aimed to explore what science process skills had developed in the kindergarten inquiry projects.

## 2. Methodology

This research used content analysis technique to analyze documentary data from project reports developed by the teachers. The reports describe how kindergarten students do their inquiry project based on their curiosity.

### 2.1 Samples

The samples in the study were 67 science project reports from three provinces of Thailand that applied for a Little Scientists' House certificate in the year 2016 as shown in the Table 1.

Table 1 General information of data

Province in Thailand	Number	Percent
Nan	45	67
Nakhon Nayok	9	13
Srakaew	13	19
Total	67	100

### 2.2 Data collection

During March to April 2016, the science project reports from three provinces were collected

### 2.3 Data analysis

The content in the science project reports were read and coded as 1 and 0, if it follows and not follows the definition of each science process skill as defined in Table 2, respectively. Then, the frequency of each skill was counted and converted to percentage. Then, it was ranged at low level, medium level, and high level, if the percentage of frequency was between 0 -32, 33 – 67, 68 -100, respectively.

Table 2 Definition of each skill

Skills	Definition
Observing	Using any one or combination of the five senses to gather information about an object or event.
Classifying	Grouping or ordering objects or events into categories based on properties or criteria.
Measuring	Using both standard and nonstandard measures or estimates to describe the dimensions of an object or event.
Using Numbers	Counting number of an object and applying numbers by their mathematical relationships or finding average value.
Using Space/Time Relationships	A process to describe allocation, direction, shape and size of an object and its changes in a period of time.
Communicating	Using words or graphic symbols to describe an action, object or event.
Inferring	Making an "educated guess" about an object or event based on previously gathered data or information. It is an interpretation of what is observed.
Predicting	Stating the outcome of a future event what may happen or what is going to happen based on a pattern of evidence, principle, rule or theory.
Identifying and Controlling Variables	Being able to identify variables that can affect an experimental outcome, keeping most constant while manipulating only the independent variable.
Formulating Hypotheses	Stating the expected outcome of an experiment based on prior knowledge that offers an explanation to an event. The statement can be tested or find out the answer.



Table 2 Definition of each skill (Continued)

Skills	Definition
Defining Variables Operationally	Stating how to observe and measure a variable in an experiment
Experimenting	process of conducting an experiment/inquiry to find the answer from formulated hypotheses. It is composed of 3 activities as follow: 1) designing a fair experiment/inquiry 2) conducting the experiment/inquiry 3) record the results of the experiment/inquiry
Interpreting Data and Making Conclusion	interpretation or describing the experimental data and making conclusions from the data.

### 3. Results

The data of frequency and percentage of science process skills developed in the kindergarten are shown in Table 3. The bar graph (Figure 1) was constructed to show the percentage of frequency of science process skills developed in the kindergarten, including classification of the levels.

Table 3 Frequency and percentage of science process skills developed in kindergarten

Skills	Frequency	Percent	Skills	Frequency	Percent
1. Observing	67	100	9. Identifying and Controlling Variables	56	84
2. Classifying	33	49	10. Formulating Hypotheses	13	19
3. Measuring	56	84	11. Defining Variables Operationally	7	10
4. Using Numbers	59	88	12. Experimenting	22	33
5. Using Space/Time Relationships	30	45	13. Interpreting Data and Making Conclusion	55	82
6. Communicating	47	70			
7. Inferring	7	10			
8. Predicting	0	0			

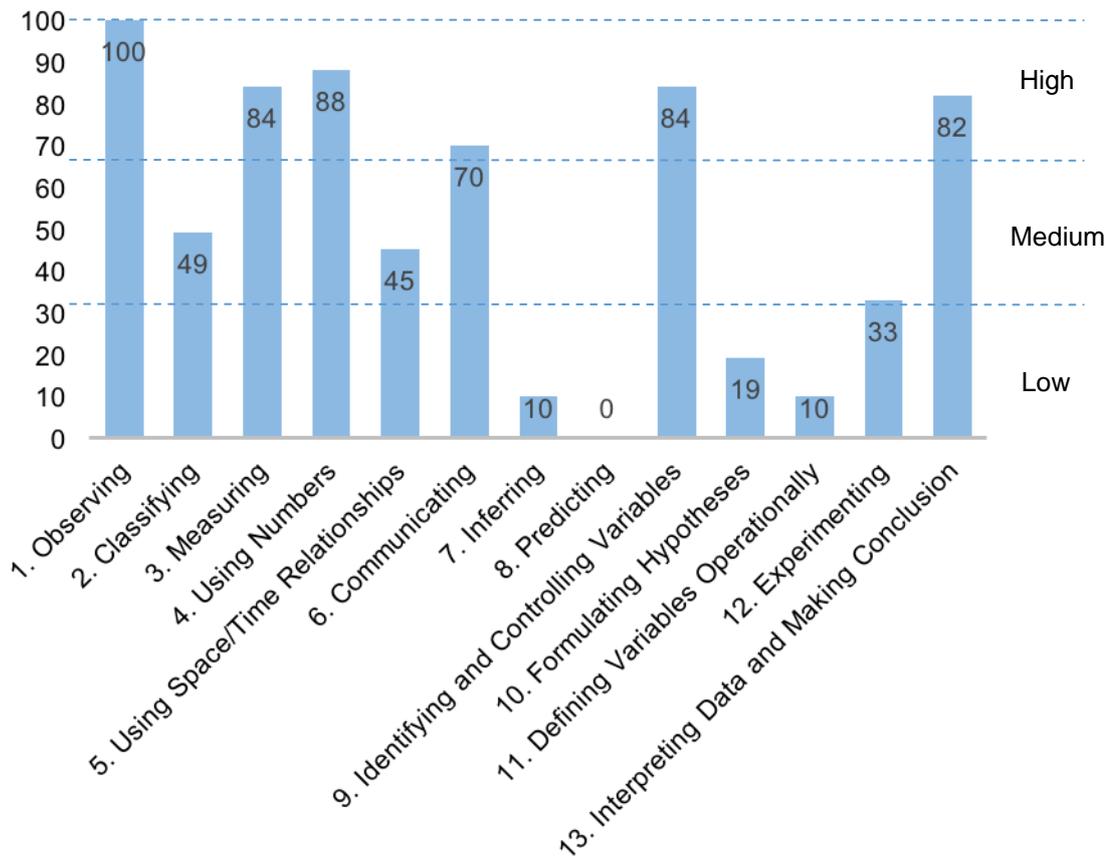


Figure 1 Percentage of frequency and level of science process skills developed in kindergarten

#### 4. Conclusions and Discussion

The results in Table 3 showed that there were 12 skills: observing, classifying, measuring, using numbers, using space/time relationships, communicating, inferring, identifying and controlling variables, formulating hypotheses, defining variables operationally, experimenting, and interpreting data and making conclusions which were developed in the kindergarten students. Specifically, the skill of observing occurred in all the inquiry projects. But, there was no skill of predicting developed in any of the inquiry projects. In Figure 1, it was revealed that the skills of observing, measuring, using numbers, communicating, identifying and controlling variables, and interpreting data and making conclusion were at a high level. Classifying, using space/time relationships and experimenting were found to be at a medium level. Inferring, predicting, formulating hypotheses, and defining variables operationally were found to be at a low level. Furthermore, it was found that there were misunderstandings in the inquiry project report: (1) the defining variable operationally was reported as a conclusion; and (2) the statement of the expected outcome of an experiment based on prior knowledge is the skill of predicting.

In conclusion, the results showed that many science process skills were developed in the kindergarten students during the inquiry science project. Therefore, promoting inquiry projects in kindergarten level would enhance children's science process skills. Not only basic science process skills, but also integrated science process skills. However, some misconceptions and error were found in the use of science process skills and that need to be corrected. The misconception of the definition of science process skills such as the skill of predicting might be a reason as to why this skill did not occur in the inquiry projects. Thus, a professional development program is needed for kindergarten teachers and educators to develop effective inquiry projects. Appropriate guidance of the teacher during do inquiry project is required to scaffold the children in gradually developing their science process skills [6]



## References

- [1] The Haus der kleinen Forscher foundation. "Pedagogic approach of the Haus der kleinen Forscher foundation: A guide to facilitating learning in science, mathematics, and technology", online: [http://www.haus-der-kleinen-forscher.de/fileadmin/Redaktion/Englisch/Practice/Pedagogic\\_Approach\\_Kleine\\_Forscher.pdf](http://www.haus-der-kleinen-forscher.de/fileadmin/Redaktion/Englisch/Practice/Pedagogic_Approach_Kleine_Forscher.pdf)
- [2] Bransford, J. D. "How people learn : brain, mind, experience, and school" (Expanded ed.), Washington, D.C., National Academy Press, 2000
- [3] Ostlund, K. "What the research says about science process skills", *Electronic Journal of Science Education*, 2(4), 1998, 1-8.
- [4] Rodranga, W., and Nuankeaw, J. "Development of students' thinking skills with science process skills activities" (2nd ed.), Bangkok, Institute of Academic Development (IAD), 1999
- [5] American Institutes for Research in the Behavioral Science. "Science— a process approach", Product Development Report No. 8, online: <http://file.eric.edu.gov/fulltext/ED064066.pdf>, 1971
- [6] Worth, K. "Science in Early Childhood Classrooms: Content and process", SEED Paper, 2010, online: <http://ecrp.illinois.edu/beyond/seed/worth.html>.