Integration of Agricultural Knowledge with the Thai Language, Mathematics, and Science Subjects for First-year Elementary School of Thailand

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Abstract
The research is aimed at studying academic achievement and the effects of attitudes towards agriculture from teaching and learning through the integration of agricultural knowledge with the Thai language, mathematics, and science subjects of the first grade of elementary school in Thailand. This study was a true experimental design, which employed only the post-test control group design. Results of the study were as follows: 1) Teaching/learning which employed agricultural knowledge to integrate subjects could enhance the students’ knowledge of agriculture; and 2) Teaching and learning through integrated subjects made the students have increased attitudes towards agriculture.

Keywords: attitudes, integration, agricultural knowledge, Thai language subject, mathematics subject, science subject

Introduction

The Ministry of Education determined strategies and guidelines for the acceleration of quality and standard development of students in the 2012-2016 educational development plan. It focuses on curricular program improvement, teaching/learning process, measurement and assessment. In other words, it focuses on the development of the learning facilitation process and the provision of activities that supplement learners’ skills. This was aimed at making the learner
have systematic analytical thinking, as well as skills in science, mathematics, technology and foreign languages. It also promotes media production and learning materials both in normal and electronic forms, including learning content that improves consistency with current conditions. In other words, learners can learn by themselves through these learning materials (Ministry of Education, 2012).

In addition, this educational development plan promotes codes of conduct and good Thai citizenship in the education system. This could be classified into 4 aspects as follows: 1) promoting the construction of the learning process, instilling awareness of virtues, ethics, values of pride to be Thai, and the public in accordance with the philosophy of economy sufficiency; 2) promoting diverse learning integration on the basis of academics, life skills, arts, music, culture, religion, and being Thai; 3) promoting learning process development, practical activities for the development of citizens, disciplines, unity, democracy, and royalty to the King; and 4) promoting coordination networking among families, religions, and educational institutions for the development of codes of conduct for students (Ministry of Education, 2012).

Regarding strategies and guidelines for accelerating the development of the quality and standard of learning, at present the subject of Agriculture is a subject under the core curriculum of basic education, 2008, which is included in the learning content group on learning of occupations and technology (Ministry of Education, 2008). Apparently, agricultural teaching/learning hours at the elementary school level are very few. That is, the teacher cannot teach all agricultural contents as established. It is the basic knowledge and skills having an effect on the lack of good attitudes towards agriculture or the need for agricultural occupations of students in the future. Therefore, the integration in accordance with the educational development plan is an alternative to solving problems in facilitating agricultural teaching and learning activities. This idea is consistent with the opinions of guardians of the first grade elementary school pupils in Sangkaprachanussorn School (98.68%). They agreed that agriculture was essential for daily living, so they wanted their children to have agricultural knowledge about plants and animals. Besides, they wanted agricultural knowledge to be integrated with the Thai language, mathematics, and science subjects at a high level (Satiansiriwiwat et al., 2016a).

In addition, the school committee of Sangkaprachanussorn agreed that the integration of agricultural knowledge with the Thai language, mathematics and science subjects for the first grade of elementary school is a good matter because it instills agricultural knowledge into the students and they will realize the importance of agriculture (Satiansiriwiwat et al., 2016B). Accordingly, the agricultural
teachers and the concerned personnel, i.e., guardians and the school committee, have consistent opinions on the integration of agricultural knowledge into the Thai language, mathematics, and science subjects. Therefore, the team of researchers aimed at the facilitation of teaching/learning in the first grade of elementary school (Sangkaprachanussorn School). This would help solve the problem in inadequate agricultural teaching hours. Also, it was responsive to the needs of guardians, practices in accordance with the school committee and the policy of the Ministry of Education. Moreover, this was integrated to truly build the students’ good attitude towards agriculture. This can be a model for the management of education in the first grades of elementary schools throughout the country. This conformed to the goal of education in agriculture at the elementary school level, which focuses on building a good attitude and instilling the love of agriculture into students (Intorrathed, 2013).

Research Problem

Nowadays, there are very few teaching/learning hours devoted to agriculture at the elementary school level, i.e., the teacher cannot teach all agricultural learning contents as established. It is the basic knowledge and skills that have an effect on the lack of good attitudes towards agriculture or the need for agricultural occupations in the future.

Research Focus

1. Study the academic achievement results of teaching and learning through the integration of agricultural knowledge with the Thai language, mathematics, and science subjects of the first grade of elementary school in Thailand.
2. Study the attitudes towards agriculture resulting from teaching and learning through the integration of agricultural knowledge with the Thai language, mathematics, and science subjects of the first grade of elementary school in Thailand.

Research Methodology

Research General Background

This study was a true experimental design that employed only the post-test control group design having 3 steps as follows:

1. Developing the curricular program on the integration of agricultural knowledge with the Thai language, mathematics, and science subjects
2. Preparing an integrated learning plan on agricultural knowledge with the Thai language, mathematics and science subjects
3. Trying-out the teaching of knowledge integration on agricultural knowledge with the Thai language, mathematics and science subjects

Research Sample
1. The population consisted of the pupils of the first grade of elementary school in the 2016 school year.
2. The sample consisted of the first year elementary school pupils of Sangkaprachanusorn School.
   2.1. The first grade class 1/3 as the experimental group (24 students)
   2.2. The first grade class 1/2 as the control group (24 students)

Instrument and Procedures
1. Developing the curricular program on the integration of agricultural knowledge with the Thai language, mathematics, and science subjects
   The first step was to develop the curricular program by investigating the indicators and contents of the core learning content on the Thai language, mathematics and science subjects of the first grade of elementary school in accordance with the core curriculum of basic education, 2008. Also, it investigated the consistency of the indicator. Appropriate content and learning standards of the learning content of the Thai language, mathematics and science subjects, which could be integrated into agricultural knowledge, were selected. Agricultural knowledge was established and would be integrated with guardians and the school committee (Satiansiriwiwat et al., 2016A, B). Three scholars assessed the curricular program using the curricular program assessment form. The results of the assessment were analysed using mean, standard deviation and interpretation criteria on opinions according to Best (1981). The results of the assessment on quality of the integrated curricular program by the scholars were found to be at a very high level ($\bar{x} = 4.55$)
2. Preparing the integrated learning plan on agricultural knowledge with the Thai language, mathematics and science subjects
   The second step was to write the plan to facilitate learning in the Thai language, mathematics and science subjects for the first grade of elementary school based on the developed curricular program and the determination of teaching hours. The developed curricular program was analysed based on the principles, aims, and content of learning standards, learning time
structure, course structure preparation, determination of content and learning time, investigation of learning facilitation plan writing, as well as review of literature on measurement and assessment in accordance with the form as set by the school. Then, the learning facilitation plan was proposed to the assistant principal of the school. This aimed to check, give suggestions on objectives, facilitate teaching/learning activities, teaching media, correct content having consistency with the measurement and assessment using the learning facilitation plan assessment form. The results of the assessment were analysed using mean, standard deviation and interpretation criteria according to Best (1981). The results of the assessment of the quality of the learning facilitation plan were at a very high level ($x = 4.50$).

3. Trying-out the teaching of knowledge integration on agricultural knowledge with the Thai language, mathematics and science subjects

3.1. Trying-out teaching to measure academic achievement: it was conducted with the first grade pupils of elementary school for 30 h. The experimental group was divided into two groups: those who did not learn through the integration of agricultural knowledge (Control group) and those who learned through the integration of agricultural knowledge (Experimental group).

3.2. Trying-out teaching to measure the attitudes towards agriculture: The trying-out integrated teaching based on the lesson facilitation plan constructed in the second step lasted 30 h. This was conducted with the control group and the experimental group.

**Data Analysis**

1. Trying-out teaching to measure academic achievement:

1.1. The testing of the difficulty value of the testing form to approve academic achievement was inspected based on the KR20 formula.

1.2. The testing of differences in the scores of academic achievement between that of the control group and the experimental group was compared using the t-test (independent sample).

2. Trying-out teaching to measure attitudes towards agriculture:

2.1. The testing of the objectivity of the measuring form was checked and improved by three scholars using the Index of Item-objective congruence (IOC)

2.2. The testing of differences in an average mean score of the attitude towards agriculture of the control group and the experimental group was analysed using the t-test (independent sample).
Research Results

1. Developing the integrated curricular program on agricultural knowledge with the Thai language, mathematics and science subjects

The results show that the integrated curricular program consists of learning units, contents and some specimens of the integrated curricular program (Table 1).

<table>
<thead>
<tr>
<th>Learning unit</th>
<th>Content</th>
<th>Some specimens of the integrated curricular program on agricultural knowledge with the Thai language, mathematics and science subjects</th>
</tr>
</thead>
</table>
| Plants around us | • Plant reading and writing  
• Writing plant names  
• Answering questions about what has been read | • A number and counting plants around us  
Living things and Processes of life  
(Compare differences between living things and non-living things) |
| Growing plants in a container | • Writing communications by using simple words and sentences  
• Describing steps of plant growing | • A number and Operation  
• Geometry (Distinguish triangles, quadrilaterals, circles and ellipses)  
Substances and Properties of Substances (type, properties of materials used for plant growing) |
| Taking care of plants to be grown | • Writing about taking care of plants | Measurement (Comparison of height)  
• Change process of the Earth (Explore, experiment and explain components and physical properties of soil in the local areal)  
• Astronomy and Space |
| Harvesting agricultural yields | • Writing short stories about their experiences | • Weighing  
• Tell length and weight, by using non-standard units of measure  
Structure of plants (Observe and explain characteristics and functions of external structures of plants) |
<table>
<thead>
<tr>
<th>Learning unit</th>
<th>Content</th>
<th>Some specimens of the integrated curricular program</th>
<th>Thai language</th>
<th>Mathematics</th>
<th>Science</th>
</tr>
</thead>
</table>
| Animals around us | • Reading and writing animal names  
• Telling the meanings of words and texts read | Add, Subtract and Mix addition and Subtraction of cardinal numbers | Living things and Processes of life (Specify characteristics of animals in the local area, and categorize them by using external characteristics as criteria) |
| Interesting animals | Structure of animals | • Principles of Thai language Usage  
• Write spellings and tell meanings of words. | – | Structure and function of animals (Observe and explain characteristics and functions of external structures of animals) |
| Benefits of animals | • Thai literature and Tales  
• Telling about insights obtained from reading or listening to literary works for children in prose and inverse | Analyse and find answers to problems and mix problems of cardinal numbers | • Benefits of animals  
• Verbally present their work for others to understand |
| Importance of agriculture | Producing food | Writing a story | Computation of incomes and expenses | Nature of Science and Technology (Arrange data obtained from exploration and verification into groups and present results) |
| Income generating | Listening, Viewing and Speaking | Incomes and expenses records | Nature of Science and Technology (Make a record and explain results of the exploration and verification by drawing pictures or writing short texts) |
| Processing of agricultural yields | Products from plants | Reading and writing names of plant products | Mathematical Skills and Processes | Substances and Properties of Substances (Observe and specify apparent characteristics or properties of materials) |
2. Writing the integrated learning facilitation plan of agricultural knowledge with the Thai language, mathematics and science subjects

Interesting details are presented in Table 2.

**Table 2. Some specimens of the integrated learning facilitation plan of agricultural knowledge with the Thai language, mathematics and science subjects**

<table>
<thead>
<tr>
<th>Learning unit</th>
<th>Content</th>
<th>Thai language</th>
<th>Mathematics</th>
<th>Science</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Processing of agricultural yields</strong></td>
<td>Products from animals</td>
<td>Reading and writing names of animal products</td>
<td>• Plus and minus</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Write and read Hindu-Arabic and Thai numerals</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Showing quantity of objects or cardinal numbers</td>
<td></td>
</tr>
<tr>
<td><strong>Agricultural business</strong></td>
<td>Goods exchange, selling, and buying</td>
<td>Reading sentences and passages</td>
<td>Construction of trading problems</td>
<td>Verbally present their work for others to understand</td>
</tr>
<tr>
<td><strong>Interesting plants</strong></td>
<td>Plants around us</td>
<td>Thai vowels and consonants (1 h)</td>
<td>Plus/minus (1 h)</td>
<td>• Local plants</td>
</tr>
<tr>
<td></td>
<td>Growing plants in a container</td>
<td>–</td>
<td>2D geometry (1 h)</td>
<td>• Classification of plant types (1 h)</td>
</tr>
<tr>
<td></td>
<td>Taking care of plants grown</td>
<td>Writing a record (1 h)</td>
<td>Measurement of length and height (1 h)</td>
<td>Soil components (1 h)</td>
</tr>
<tr>
<td></td>
<td>Agricultural yield harvesting</td>
<td>–</td>
<td>Weight comparison (1 h)</td>
<td>The sun (1 h)</td>
</tr>
<tr>
<td><strong>Interesting animals</strong></td>
<td>Animals around us</td>
<td>Spelling section (2 h)</td>
<td>Problem of positivity on plus and minus (1 h)</td>
<td>Local animals (1 h)</td>
</tr>
<tr>
<td></td>
<td>Structure of animals</td>
<td>–</td>
<td>–</td>
<td>Structure and function of animals (1 h)</td>
</tr>
<tr>
<td></td>
<td>Benefits of animals</td>
<td>Enjoyable tales (1 h)</td>
<td>–</td>
<td>Benefits of animals (1 h)</td>
</tr>
</tbody>
</table>
3. Trying-out the teaching of integrated agricultural knowledge with the Thai language, mathematics and science subjects

3.1. Learning achievement: This is a comparison of academic achievements based on the teaching of integrated knowledge of agricultural knowledge with the Thai language, mathematics and science subjects. The comparison was conducted between the group of pupils who did not learn through integrated teaching (experimental group and the group of pupils learning through integrated teaching (Control group)). It was found that there was a statistically significant difference in academic achievement at 0.05. The average score of the experimental group was higher than that of the control group by 9.42 (Table 3).

Table 3. Comparison of academic achievement between the experimental group and the control group

<table>
<thead>
<tr>
<th>Sample group</th>
<th>N</th>
<th>$\bar{X}$</th>
<th>S.D.</th>
<th>t</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental group</td>
<td>24</td>
<td>31.62</td>
<td>4.05</td>
<td>-5.88</td>
<td>0.00*</td>
</tr>
<tr>
<td>Control group</td>
<td>24</td>
<td>22.20</td>
<td>6.71</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *Statistically significant at 0.05
3.2. Attitudes towards agriculture: It was found that the control group and the experimental group had a statistically significant difference at 0.05 in attitudes toward agriculture. The experimental group had an average score of attitude higher than that of the control group by 0.27.

Table 4. Comparison of attitudes toward agriculture from integrated teaching and learning of agricultural work with the Thai language, Mathematics and science subjects of the first grade of elementary school (Sangkaprachanusorn school) between the experimental group and the control group

<table>
<thead>
<tr>
<th>Sample group</th>
<th>N</th>
<th>X</th>
<th>SD.</th>
<th>t</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental group</td>
<td>24</td>
<td>2.80</td>
<td>0.23</td>
<td>4.345</td>
<td>0.00*</td>
</tr>
<tr>
<td>Control group</td>
<td>24</td>
<td>2.53</td>
<td>0.21</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *Statistically significant at 0.05

Discussion

The results of the study showed the difference in the academic achievement of the control group and the experimental group with a statistically significant difference at 0.05, i.e., an average score of the experimental group was higher than that of the control group by 9.42. This implies that teaching and learning of the Thai language, mathematics and science can be integrated into agricultural knowledge. This includes knowledge about plants (78.66%), knowledge about animals (73.33%), and knowledge about the importance of agriculture (70.66%). Almost all the guardians (98.68%) agreed that agriculture is important to daily life of humans and they wanted the pupils to perceive the importance of agriculture more than ever (Satiansiriwiwat et al., 2016A). This conformed to the school committee that wants to instil agricultural knowledge and the importance of agriculture into students more than ever (Satiansiriwiwat et al., 2016B). However, it was opposed to the guardians of the first grade elementary school pupils, who wish to bring agricultural knowledge to integrate with the 3 subjects: the Thai language (73.68%), Mathematics (56.58%) and Science (78.95%) (Satiansiriwiwat et al., 2016A). According to the results of the study, it can be seen that the guidelines for the integration of agricultural knowledge into the Thai language, mathematics and science subjects were correct. Close attention should be paid and practiced continually. Importantly, the teacher must have knowledge and understanding of
sufficiency of agriculture. Also, he must have a good attitude towards agriculture and this will make the guidelines successful in the future.

Regarding the comparison of attitudes towards agriculture between the control group and the experimental group based on the integrated teaching and learning of agricultural knowledge of the Thai language, mathematics and science subjects, it was found that the experimental group had a higher average score than that of the control group with a statistically significant difference at 0.05. This clearly implies that integrated teaching and learning could make the pupils (experimental group) have a better attitude than the control group. The results of the study can confirm the opinions of the guardians of the first grade pupils at Sangkaprachananussorn School, who wanted agricultural knowledge to be integrated into the Thai language, mathematics and science subjects. Almost all of the guardians (98.68%) realized that agriculture is important for the daily life of man. Thus, they wanted their children to have agricultural knowledge (Satiansiriwiwat et al., 2016A). This also conformed to the opinions of the school committee because they wanted the pupils to perceive the importance of agriculture and to instil agricultural knowledge into them (Satiansiriwiwat et al., 2016B).

Conclusions

The presented study included curricular program development, writing of the learning facilitation plan and trying out the teaching of the control group (not learning through integrated teaching) and the experimental group (learning through integrated teaching). The findings show that the academic achievement score of the experimental group was higher than that of the control group with a statistically significant difference at 0.05. This means that the integration of agricultural knowledge with the Thai language, mathematics and science subjects has an effect on the agricultural knowledge of the first grade elementary school pupils.

Moreover, trying-out teaching to measure attitudes toward agriculture between the experimental group and the control group was done. It was found that the experimental group had a higher average score on attitudes than that of the control group with a statistically significant difference at 0.05. Therefore, the integration of agricultural knowledge into the Thai language, mathematics and science subjects creates more positive attitudes toward agriculture than before.
References


