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Chapter

The Development Biology Authentic Learning of Mahasarakham University Demonstration School (Secondary), Thailand

Wutthisak Bunnaen

Abstract

This chapter presents the “Development of Authentic Biology Learning Activities, Mahasarakham University Demonstration School (Secondary)” research study. The study included a sample group of 160 students in Grade 10 at Mahasarakham University (MSU) Demonstration School (Secondary), Thailand, divided via purposive sampling into an experimental group of 80 students and a control group of 80 students. The experimental group used authentic learning techniques to study biology, whereas the control group used normal learning to study the same subject. The study used a quasi-experimental design to assess biology knowledge after learning in both groups as well as the experimental group’s attitude towards the active learning method. The instruments used include a set of authentic biology learning activities, biology knowledge tests, and an attitude questionnaire. Results show that students in the experimental group increased their knowledge of biology after engaging in authentic learning and had a positive attitude about learning via this method. Authentic learning activities in biology give students a better understanding of the subject, evidenced by higher knowledge test scores after authentic learning, and thus is an effective way to organize learning activities for students not only in biology but in other courses of study as well.

Keywords: authentic learning, biology, learning activities

1. Introduction

The Basic Education Core Curriculum in Thailand consists of eight core subjects: Thai language, mathematics, science, social studies, religion and culture, health and physical education, arts, careers and technology, and foreign languages. It is based on the belief that everyone can learn and develop themselves to their full potential. The Mahasarakham University (MSU) Demonstration School (Secondary) emphasizes the development of learners according to their aptitude and potential to study in higher education and in their future careers. This development creates a positive attitude towards the use of innovative information system technology and promotes the use of scientific processes. The learning activities employed at the school are able

to draw out the potential of learners according to their interests and aptitudes, cultivate virtue and ethics, and transfer cultural identity to international standards. A society that seeks knowledge of the truth cannot deny that research is a vital tool in finding answers. Understanding human behavior through teaching and learning is necessary to apply research to improve the quality of teaching and to use research results to solve problems and develop a sustainable society. The concept of teaching and learning research is therefore emphasized. Teaching and learning improvement bring innovative teaching and learning to classrooms and schools [1]. Many students in Thailand have not attained the expected foundational skills in education, as evidenced by the results of national examinations and international assessments [2]. Drop-out rates remain high at the secondary school level, which leaves too many young people exposed to the harsh realities of the labor market without the necessary skills to thrive [3]. Education is an important factor in developing people to have the qualifications society needs. Therefore, education must try to be consistent with complex and rapid social changes. A student-centered approach is one of the highest priority projects and one aimed at elevating student achievement, helping students develop twenty-first-century skills, and encouraging students to be good Thai citizens with morals and ethics. Furthermore, area-based educational reform guidelines, such as educational institutes, educational service areas, local government, and the provincial administration, can be considered important targets in terms of operations and must be consistent with the context of the area with limited time and budget. To assess achievement, the Office of the Basic Education Commission (OBEC), Thailand, which is responsible for promoting and managing basic education in the country, proposed new teaching and support methods including mentoring, coaching, and peer coaching. Active learning has received increased attention in the past several years; it has been a popular concept in Thailand for the last few decades. According to the vision of education policy in Thailand, the objectives are to develop a learning society by focusing on increasing educational opportunities and promoting active learning behavior in students. The main shift in learning is a change in focus from the teacher to delivering active learning to engage students with the material. Students are therefore actively involved while listening to formal presentations in the classroom. Most importantly, to be actively involved, students must engage in such higher-order thinking tasks as analysis, synthesis, and evaluation [4, 5].

Authentic learning is a form of learning innovation. It is a learning style that encourages students to create useful and tangible products to share with the world. Once educators provide the motivational challenge, they develop and provide the necessary criteria, planning, timing, resources, and support to boost student success. Teachers become guides or event managers. The facilitator is not a dictator.

Therefore, in the development of teaching and learning, focus is on students' learning potential. As a learner in the twenty-first century, it is essential that the MSU Demonstration School (Secondary) is responsible for teaching and learning at the basic educational level to develop a learning management model that gives learners the potential and skills they need for living and self-development at a higher level. Learning activities should emphasize connecting with real life and applying knowledge to keep pace with changes in society and technology. Authentic learning activities that highlight the importance of real-world learning can link knowledge with daily life and life skills development.

2. Objectives

1. To develop biology learning activities using authentic learning with Mathayomsuksa 4 students at the MSU Demonstration School (Secondary).

2. To compare knowledge scores in biology among students who learn via authentic learning with students who learn via normal activities.
3. To study the students' attitudes towards authentic learning before and after using the learning activity package.

3. Research hypotheses

1. Students who use the authentic learning method will have higher biology knowledge scores after studying than they had before studying.
2. Students who use the authentic learning method will have higher biology knowledge scores than students who use normal learning activities.
3. Students who use the authentic learning method will have a better attitude towards the method after using it.

4. Research methodology

4.1 Population and sample

4.1.1 Population

The study population included 280 Mathayomsuksa 4 Students in science and mathematics at the MSU Demonstration School (Secondary).

4.1.2 Sample group

The sample group included 160 students in Grade 10 divided via purposive sampling into an experimental group of 80 students and a control group of 80 students.

We employed a quasi-experimental design as follows:

$(O_1 - X - O_2)$

$(O_1 - C - O_2)$

where O_1 is the pre-test (Pretest); X is the use of innovation (Treatment); C is the control group; O_2 is the posttest and qualitative research based on descriptions, observations, and interviews with teachers and effective learning activities.

4.2 Research tools

1. Authentic Learning Biology Activity Kit.
2. Biology Knowledge Test.
3. Authentic Learning Attitude Questionnaire.

4.3 Construction and qualification of research tools

The construction of research tools proceeded according to the following steps:

4.3.1 Building and Finding Quality Authentic Learning Activity Kits

1. Design a set of authentic learning biology activities for Mathayomsuksa 4 science students.
2. Determine the validity of the learning activity set by having a specialist check for consistency of content using the following scoring criteria:

Grade level + 1 when sure it's appropriate.

Grade level 0 when unsure.

Grade level – 1 when sure it is not suitable.

Analyze the content-consistency index of the learning activity series using Index of Item-Objective Congruence (IOC). IOC values of 0.50 or greater were selected. Results from an expert content validation examination showed an average of 0.96, indicating that the content-content-based learning set was applicable.

3. Have an expert assess the suitability of the learning activity set using a five-level suitability rating scale as follows:

5 = most suitable.

4 = very appropriate.

3 = moderately appropriate.

2 = less suitable.

1 = least appropriate.

The experts' suitability assessment average score is used as the following points ([6], p. 100):

4.51–5.0 = suitable.

3.51–4.50 = very suitable.

2.51–3.50 = moderately appropriate.

1.51–2.50 = less appropriate.

1.00–1.50 = least appropriate.

If the expert opinion suitability mean is 3.51 or greater, the learning activity set is appropriate and can be used for evaluation results. The determined mean suitability of 4.91 is the most appropriate.

4.3.2 Building and searching for a quality Authentic Learning Attitude Questionnaire

1. Create an attitude test per authentic learning activities for Mathayomsuksa 4 science students.
2. Find straightness in the attitude measurement model by verifying content validity using the following scoring criteria:

Grade level + 1 when sure it's appropriate.

Grade level 1 when in doubt.

Grade level – 1 when sure it is not suitable.

Analyze the content-validity index of the attitude measurement form. Subjects with an IOC value of 0.50 or greater were selected. The results of an expert content validation examination showed an average of 0.96, indicating that the attitudes were content-based and could be used.

3. Have an expert assess the suitability of the learning activity set using a five-level suitability rating scale as follows:

5 = most suitable.

4 = very appropriate.

3 = moderately appropriate.

2 = less suitable.

1 = least appropriate.

The experts' suitability assessment average score is used as the following points ([6], p. 100):

4.51–5.0 = suitable.

3.51–4.50 = very suitable.

2.51–3.50 = moderately appropriate.

1.51–2.50 = less appropriate.

1.00–1.50 = least appropriate.

The mean of suitability was determined, that is, if the expert opinion average was 3.51 or higher, the attitude scale was considered appropriate and can be used. The suitability of experts found the mean of 4.80 to be the most appropriate.

4.3.3 Construction and Quality of Biology Literacy Test

1. Create a biology knowledge quiz of 40 questions, covering the content used in teaching, and Bloom's revised taxonomy.
2. Determine the test's validity via expert content validation (IOC) and by analyzing the test's content integrity index by choosing an item with an IOC value of 0.50 or greater.

5. Data analysis

1. Analyze the results of expert evaluation of the quality of tools.
2. Analyze the results of the knowledge test before and after authentic learning in the experimental group and before and after normal learning in the control group using mean, percentage, and standard deviation.
3. Analyze and compare the average results of the knowledge test in the experimental group before and after authentic learning using t-test.
4. Analyze and compare the average results of the knowledge test in the control group before and after normal learning using t-test.

5. Analyze and compare the mean results of the knowledge test in both the experimental and control groups using t-test.
6. Analyze the results of attitude measurement in the experimental group before and after authentic learning using mean, percentage, and standard deviation.
7. Analyze and describe data from observation and interviews with students and subject teachers.

The statistics used in the data analysis include mean, standard deviation, test results and hypotheses, and independent t-test.

6. Results

The Authentic Learning Biology Learning Activity Kit for Mathayomsuksa 4 students at the MSU Demonstration School (Secondary) emphasizes the use of actual operations in the learning environment. The learning activity set was sent to five experts to assess consistency and suitability. It was found that the learning set had an average suitability score of 0.96, which was higher than the specified criteria of 0.50. This means the content is relevant and applicable. Experts found the mean of 4.91 to be the most appropriate. **Tables 1–3** present the results of the study.

| Students | Sample (n) | Total score (N) | Pretest | | | Posttest | | |
|--------------------|------------|-----------------|---------|-----------|------|----------|-----------|------|
| | | | Total | \bar{x} | S.D. | Total | \bar{x} | S.D. |
| Experimental group | 80 | 40 | 717 | 8.96 | 1.73 | 1039 | 12.98 | 2.31 |
| Control group | 80 | 40 | 598 | 7.47 | 1.93 | 603 | 7.53 | 1.88 |

Table 1.
Results of biology knowledge test analysis in experimental and control groups before and after learning.

| Item | Pretest (N = 40) | | Posttest (N = 40) | | <i>t</i> | P |
|--------------------|------------------|------|-------------------|------|----------|-------|
| | \bar{x} | S.D. | \bar{x} | S.D. | | |
| Knowledge (n = 80) | 8.96 | 1.73 | 12.98 | 2.31 | -12.51 | .000* |

*Significant .05.

Table 2.
Results of comparative analysis in experimental group before and after authentic learning using paired t-test.

| Item | Pretest (N = 40) | | Posttest (N = 40) | | <i>t</i> | P |
|--------------------|------------------|------|-------------------|------|----------|-------|
| | \bar{x} | S.D. | \bar{x} | S.D. | | |
| Knowledge (n = 80) | 7.47 | 1.93 | 7.53 | 1.88 | -.236 | .814* |

*Significant .05.

Table 3.
Results of comparative analysis in control group before and after normal learning using paired t-test.

7. Results

Biology knowledge test analysis results show an average score of 8.96 in the experimental group prior to authentic learning and a score of 12.98 after authentic learning, whereas the control group had an average score of 7.47 before normal learning and a score of 7.53 after normal learning (**Table 1**).

Comparative analysis of the results shows a mean score of 8.96 in the experimental group prior to authentic learning and a score of 12.98 after authentic learning, with an average increase of .05 (**Table 2**). Results in the control group show negligible difference in scores among the control group either before or after normal learning (**Table 3**). Comparative analysis of the mean results of the biological knowledge test in both the experimental and control groups shows that students in the experimental group had higher scores on the biology knowledge test overall (statistically significant at the .05 level) compared to the control group (**Table 4**).

Attitude measurement results show an average score of 4.51 or greater for all survey questions in the experimental group, suggesting that students who used authentic learning had a positive attitude towards it.

| Item | Pretest (N = 40) | | Posttest (N = 40) | | t | P |
|--------------------|------------------|------|-------------------|------|--------|-------|
| | \bar{x} | S.D. | \bar{x} | S.D. | | |
| Knowledge (n = 80) | 12.98 | 2.31 | 7.53 | 1.88 | -16.31 | .000* |

*Significant .05.

Table 4.

Comparative analysis of the mean results of the biological knowledge test in both the experimental and control groups.

8. Discussion

Authentic learning is a form of learning innovation in which the facilitator is not a dictator and students are allowed to make meaningful and useful in real life or simulated work. It gives learners the opportunity to connect directly to the real world. Our study shows that the Authentic Learning Biology Learning Activity Set had an average consistency value of 0.96, which is greater than the specified criteria of 0.50. This shows that the learning activity set is relevant to the content and can be used. Expert evaluation results found that the mean of 4.91 was the most appropriate, which is similar to results from a study by Noi-nont [7]. This study assessed learning in students and found that those students assessed using a simulation model had higher scores in every aspect including motivation for learning (statistically significant at the .05 level) compared to students in the normal assessment group.

Designing a biology laboratory around authentic learning methods that is suitable for the learner and uses real-world situations facilitates learning by having students participate in and work on real-world problems. It engages learners with practice exercises, role playing, case studies, and involvement in a virtual community of practice [8].

The results of this study show that students in the experimental group increased their biology knowledge scores from 8.96 to 12.98 after authentic learning. Students in the control group had an average score of 7.47 before normal learning and a score of 7.53 after normal learning. These results suggest that authentic learning activities give students a greater level of knowledge and understanding of the content. It is an effective way to organize learning activities for students that can be adapted and applied to other courses of study [9, 10].

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