DEVELOPMENT OF LEARNING ACTIVITIES INTEGRATED INTERDISCIPLINARY USING ENGINEERING DESIGN PROCESS FOR PRIMARY 4 STUDENTS DEMONSTRATION SCHOOL SUAN SUNANDHA RAJABHAT UNIVERSITY

Natapon Youpensuk[*] & Phimpaphai Chiuphae[**]
Demonstration school of Suan Sunandha Rajabhat University,
1-U-Thong Nok Dusit Bangkok, Thailand
E-mail : Natapon.yo@ssru.ac.th, Phimpaphai.ch@ssru.ac.th

ABSTRACTS

This research the objective of this study 1) To develop learning activities an integrated interdisciplinary for students in grade 4 at the Demonstration School of Suan Sunandha Rajabhat University Effectively passed the criteria. 2) To study the consistency index of the interdisciplinary integrated learning management plan. of students in grade 4 at the Demonstration School of Suan Sunandha Rajabhat University. A sample group of students in grade 4 of Suan Sunandha Rajabhat Rajabhat University Demonstration School, Academic Year 2023, consisted of 95 people, by purposive sampling. The research instrument consisted of an integrated interdisciplinary learning management plan using the Engineering Design Process, 3 lesson plans: : Lesson 1 Zoo topia, Lesson 2 Amazing Herb and Lesson 3 Eco home. Statistics used to analyze the results: The effectiveness of the learning management plan (E1/E2) and Index of Consistency (IOC)

The results showed that Development of learning activities an integrated interdisciplinary for students in grade 4 at the Demonstration School of Suan Sunandha Rajabhat University The efficiency was at 80.27/81.70, which passed the specified criteria. and has the consistency index of the interdisciplinary integrated learning management plan at a level greater than 0.50

Keywords: Learning Activities Integrated Interdisciplinary, Index of Consistency, The effectiveness of the learning activities

INTRODUCTION

Current advances technology, economic change, society and politic impact on life, society, resources and environment in positive and negative way. Overall human development is major key to deal with global change. The human development should be initiated since human begin learning. Thus, education play important role in human adaptation and development (Issarasena Na Ayutthaya W, 2017). Goal of education is to provide human resources for the future nation's workforce. Current world, the social evolution causes the requirement of labor market change. This is major reason that youth need to prepare for competition in the labor market. Preparation is not only the knowledge in school but it gathers from applies knowledge and skills in several situations and context in the 21st century (Klainil S, 2012)

According to above reason, it makes aware that knowledge and comprehension only a science is unable to develop people to be primed for current social. Implement knowledge to solve problems and create new thing is able to develop people to have the knowledge, abilities and future needed skills. Currently, knowledge of Science, Technology and Career, Engineering, Mathematics, Social study, Thai, English, Morality and Art is combined using by emphasizing the process of thinking and problems solving. Apply learning knowledge in

classroom to utilize through a holistic knowledge perspective. This concept believes that knowledge unable to separate in everyday life, but knowledge associate with various things and surrounding situation. Student requires connecting classroom lesson to real life and able to build new innovation (Rachel, 2008) results in higher quality population and able to solve national problems in other aspects. Thus, integrated teaching and learning assist students to learn how to integrate knowledge with living balance in life (Academic Department Siam Technology, 2007)

Integrated learning management plays important in student development leading students to learn reality from practical work and experienced in operations. An image between reality and the lesson is reflected. Leaner can connect learning that students understand the relationship between the lesson and actual practical work resulting in their can apply to everyday life such the concept of English philosopher John Locks who indicate that children only interested in the essentials and often using thing in life because there have no enough time and energy to learn everything, Instructor should select teaching only the essential things which it can be useful in life (Dewey J, 1959). The researcher selects to develop an integrated interdisciplinary learning plan. This learning plan is arranged by brainstorm attending of several instructors in various subject areas. The activities have connections with all subjects that make students sight the consistency (Untinagon P, 2021). In this learning management, teachers in the related subject should collaborate by considering synonymous content or indicators and designing learning activities in their own subjects to connect with other subjects through content or indicators (Institute for the Promotion of Teaching Science and Technology, 2014) and then build an interdisciplinary learning unit. The students can practice several activities by yourself from real experiences in daily life and emphasize on providing knowledge and skills with students. This learning make leaners have process of living according to the national strategy for developing and strengthening human resource potential (Museum of Science, 2007)

From the current world situation indicate that students should be developed in both knowledge and skills and process of solving problems at the elementary level. Instructor requires finding teaching methods that will encourage students to think about solving problems in daily life or determined situations. Thus, students can think, act, solve problems and live life happily with others. Learning that emphasize to develop solving problem skills cause students understand cause and results and effect of problem. Furthermore, leaner can be further developed to solve various problems. Therefore, promoting the learning process of students to be effective, it is necessary to use appropriate principles or methods. The researcher is therefore interested in development of interdisciplinary integrated learning activities using engineering design processes for students in grade 4 serve as a guideline for teaching and learning that encourage students have increasing ability to think and solve problems. The interdisciplinary integrated learning by using engineering design processes enhances students to face various challenging problem situations and their knowledge and abilities in Science, Technology and Career, Engineering, Mathematics, Social Study, Thai, English, Morality and Art are applied to solve problems through the engineering process.

Research objectives

1. To study the consistency index of interdisciplinary integrated learning activities by using the engineering design process of students in grade 4 at Demonstration School of Suan Sunandha Rajabhat University

2. To study the effectiveness of interdisciplinary integrated learning activities by using the engineering design process of students in grade 4 at Demonstration School of Suan Sunandha Rajabhat University

RESEARCH METHODOLOGY

This research, the researcher used research protocol as a pre-experimental design in One-Shot Case Study by collecting quantitative data (Creswell & Creswell, 2018) by using the Index of Conformity (IOC) and evaluated the efficiency (E1/E2) of the interdisciplinary integrated learning activities using the Engineering Design Process.

Target group

1. The target group for this research was 95 students in grade 4 at Demonstration School of Suan Sunandha Rajabhat University, academic year 2023 which was obtained from the purposive sample selection**.**

Research tools

The researcher used research tools which were 3 interdisciplinary integrated learning plans using the Engineering Design Process. Statistics used to analyze the results included efficiency of learning activities E1 / E2 and the index of consistency (IOC: Index of Consistency)

1. Assessment of the consistency of interdisciplinary integrated learning activities using the Engineering Design Process divided into 2 parts as follows:

Part 1 has a 3 - level estimation model which each number indicated a different meaning: + 1 means appropriate, 0 means not sure, and – 1 means not appropriate or improve according to Chotika Pasripon (2015: 97)

Part 2 was the part of recommendations regarding the interdisciplinary integrated learning plan using the Engineering Design Process, evaluated by experts.

2. Interdisciplinary integrated learning plan using the Engineering Design Process which was a learning activity that integrated all 8 subject groups. There were 3 learning plans as follows:

Lesson Plan 1, Unit 1: Animals kingdom,	Topic: Zoo topia	5 hours.
Lesson Plan 2, Unit 2: Plants kingdom,	Topic: Amazing Herb	5 hours.
Lesson Plan 3, Unit 3: Medium of Light,	Topic: Energy-saving home (Eco home)	5 hours.

Data Collection

3.1 Conformity assessment form for interdisciplinary integrated learning activities using the Engineering Design Process. The researcher collected data on the consonance assessment form according to the steps as follows:

1. The researcher presented the consistency assessment form of interdisciplinary integrated learning activities using the Engineering Design Process to 3 experts.

2. The researcher received the consistency assessment form from the evaluation by the experts to consider and interpret results.

3. The researcher modified and developed learning activities as recommended by experts.

4. The researcher received the completed learning activities and tested it with the target group.

3.2 Interdisciplinary integrated learning management plan using the Engineering Design Process. The researcher collected data on the efficiency of the interdisciplinary integrated learning activities management using the Engineering Design Process according to the following steps:

1. The researcher received the designed learning activities and tested it with the target group.

2. The researcher collected data on the effectiveness of learning activities during class though the scoring of activity sheets from all 3 learning management plans.

3.The researcher used the data to calculate the efficiency of the learning management process (E1).

4. After the target subgroups had completed all 3 learning plans. The researcher collected data on performance after learning using the learning achievement test for 8 subjects

5. The researcher used the data to calculate the efficiency of achievement after learning management (E2).

Data Analysis

The researcher performed data analysis using statistics. Data analysis was as follows:

4.1 Data analysis assessed the consistency of interdisciplinary integrated learning activities.

After collecting the data from the conformity assessment form, the obtained data was analyzed to evaluate the index of consistency of interdisciplinary integrated learning activities using the Engineering Design Process evaluated by 3 experts with 3 level estimation and determined mean and interpreted the numbers that the mean must be greater than 0.67 considered as be consistent.

4.2 Data analysis for efficiency of interdisciplinary integrated learning activities.

Data analysis for efficiency of interdisciplinary integrated learning activities using Engineering Design Process analyzed by calculating the efficiency of the learning management process (E1) from examining the activity sheet at the end of the learning management plan 1, 2, and 3. Evaluated the success of the work pieces in the integrated interdisciplinary learning in all 3 plans and calculated the efficiency value of achievement after learning management (E2) from the 21st century skills test from learning activities.

Conceptual framework

The development of interdisciplinary integrated learning activities used the engineering design process in grade 4 at Demonstration School of Suan Sunandha Rajabhat University. According to review of related documents and research, the researcher has formulated a research concept consisting of:

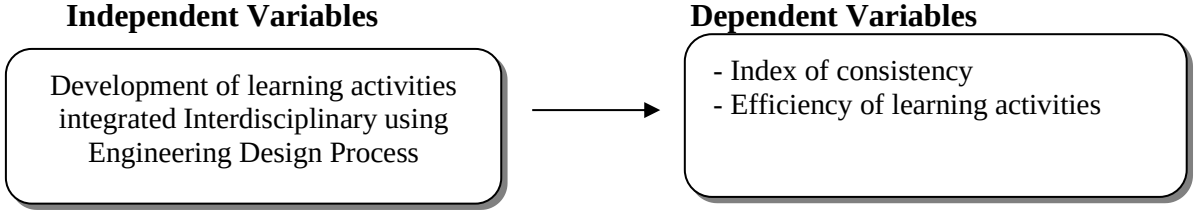

Diagram 1: Conceptual framework

RESEARCH RESULTS

The results from the data analysis obtained from the questionnaire responses of the sample group can be summarized as follows:

1. The consistency index of interdisciplinary integrated learning activities

The research results found that the index of consistency of interdisciplinary integrated learning activities in primary 4 at Demonstration School of Suan Sunandha Rajabhat University

that were studied according to interdisciplinary integrated learning management activities using Engineering Design Process. It was found that every level had a consistency index value more than 0.50, indicating that the learning management activities could be used in actually teaching.

2. Effectiveness of interdisciplinary integrated learning activities

Table 1 Mean percentage score during study from the evaluation of the activity sheet and the success of the work piece and from testing students' learning achievement for 8 subjects by organizing activities learning using the Engineering Design Process

During leaning score			**Post-leaning score**			**Effectiveness**
Full score	mean	E_1	Full score	mean	E_2	E_1/E_2
90	72.24	80.27	160	130.72	81.70	80.27/81.70

From Table 1, it was found that students who studied by organizing learning using the Engineering Design Process had mean scores from the evaluation of activity sheets and the success of the work piece score was 72.24 out of a full score of 60, showing that the efficiency of the process (E1) was 80.27. As for the results of the test measuring academic achievement in 8 subject groups, 20 points per subject. From organizing activities integrated learning has a total mean score of 130.72 points out of a total of 160 points. Process efficiency (E2) was 81.70. Therefore, organizing learning activities using the Engineering Design Process in grade 4 students has efficiency (E1/E2) been 80.27/81.70, more than the determined assumption 80/80.

DISCUSSION

This study discussed the development of interdisciplinary integrated learning activities using the engineering design process in grade 4 students. The researcher discussed important and interesting issues. The results were then discussed as follows:

From the development of interdisciplinary integrated learning activities, it was found that the consistency index of interdisciplinary integrated learning activities had a consistency index value of more than 0.50, showing that every step can actually be used for teaching which was in accordance with the determined assumptions. Because of interdisciplinary integrated learning activities that uses the Engineering Design Process had main content was designed in accordance with the learning objectives. The content was consistent with the learning objectives and standards. There were varieties of learning activities provided understanding of the content of all 8 integrated subject groups. This learning activities enhanced student have the opportunity to apply content from each subject in practicing activities and solving challenging issues that arise in class. Group learning activities promoted problem solving to develop creative pieces of work and present work in a way that others can understand. The measurement and evaluation were consistent with the learning objectives and activities. Interdisciplinary integrated learning activities using Engineering Design Process followed the guidelines for evaluating the effectiveness of learning management demonstrated by Suwit Mulkham and colleagues (2006, 208) that the content of learning management plans were designed consistent with the learning objectives and the specified time in each step of teaching was appropriate. Learning content that was consistent with the learning objectives was scheduled for each step of teaching appropriate to the activities or tasks assigned to students. There were activities before study and review to prepare and create motivation to connect previous knowledge with new learning which promoting learning skills and thinking processes. There were a variety of measurement and evaluation.

Effectiveness of interdisciplinary integrated learning activities in grade 4 at Demonstration School of Suan Sunandha Rajabhat University passed the determined criteria 80/80. The students who received the interdisciplinary integrated learning management using the Engineering Design Process had an efficiency value during the learning management process (E1) of 80.27 and an efficiency value assessed from academic achievement of 8 Subject group after learning management (E2) was 81.70, therefore, organizing learning activities using the Engineering Design Process in grade 4 students have an efficiency (E1/E2) was 80.27/81.70 more than the determined assumption of 80/80. This was consistent with Anussara Chalermsri (2012) who developed an integrated learning activity set within the second grade science subject group. It was found that the created activity set was effective according to standard criteria was 82.08/80.14.

SUGGESTIONS

Suggestions for applying research results

1. Teachers should adopt an integrated interdisciplinary learning management using Engineering Design Process to be adapted for teaching students in other grades.

2. Teachers should consider the time period for organizing each learning activity and taking into account the students as important. There was some flexibility in terms of study time but teachers should plan to manage time with students to be consistent with every learning activity.

Suggestions for further research

1. There should be a study on the quality of interdisciplinary integrated learning management along with other teaching processes such as cooperative teaching using 5E or 7E inquiry techniques or other teaching techniques.

2. Organizing interdisciplinary integrated learning in 8 learning groups subject content should be selected to consistent with the assigned teaching topic to achieve measurement and evaluation that is most direct and clear.

ACKNOWLEDGEMENTS

This research owes its success to the contributions of many people. Most appreciations go to those experts for theiradvice and also to Suan Sunandha Rajabhat University for their valuing this research and funding support. Specialthanks also go to the director and the teachers at Demonstration School of Suan Sunandha Rajabhat University for their kind support.

REFERENCE

Chalermsri, A. (2012). Development of integrated learning management activity sets within the science subject group, Grade 2, Srinakharinwirot University Demonstration School, Prasarnmit (Primary Division). Institute of Intellectual Strategy and research. Srinakharinwirot University.

Cresswell, J.W. & Cresswell, J.D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed) Thousand Oaks, California: Sage Publication, lnc.

Dewey, John. (1959). Dictionary of Education. New York: Philosophical Library.

Harkunarak, A. (2009). Knowledge for the people. Educational package for sustainable development: Thinking predicting about “Education for sustainable development in the Thai context”. Nonthaburi: Thai Environment Institute.

Institute for the Promotion of Teaching Science and Technology. (2014). Basic knowledge of STEM. (1 st edition). Bangkok: Institute for the Promotion of Teaching Science and Technology, Ministry of Education.
Klainil, S. (2012). Thai science education: development and recession. Bangkok: IPST.
Mulkham, S. O. (2006). Writing a learning management plan that emphasizes thinking. (Printed 2). Bangkok: E.K.Book.
Museum of science. (2007). Engineering is elementary: Engineering for children. Received March 13, 2023 from http//www.mos.org/eiei/index.php (2007.)
Untinagon, P. (2021). The Development of Integrated Learnimg Management Model to Enhance 21st Century Skills for Primary Students of Demonstration School Suan Sunandha Rajabhat University. Journal of Roi Kaensarn Academi, 6(12), 49-59.
Rachel, B. J. (2008). Science, technology, engineering, and math. Retrieved March 10, 2023, from http://www.learning.com/press/pdf/Science-Technology-Engineering-Mathematics-STEM-Report.pdf
Siam Technology School. Academic Department (2007). Integrated learning management. Retrieved November 18, 2023 from http://61.19.86.230/km/images/date/developing.pdf
Issarasena Na Ayutthaya, W. (2017). Things to know about STEM Education (STEM education), 2nd edition. Bangkok: Chulalongkorn University Press.