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SCIENCE TEACHING ABILITY THROUGH PROJECT-BASED INSTRUCTION TECHNIQUES: CASE STUDY OF SCIENCE MAJORS, FACULTY OF EDUCATION, SUAN SUNANDHA RAJABHAT UNIVERSITY

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The purposes of this research were to 1) measure and evaluate science teaching ability through project-based instruction; 2) to study and analyze factors directly affecting science teaching ability through project-based instruction of science majors,Faculty of Education,Suan Sunandha Rajabhat University.The population in this research was 50 fifth-year science majors of Faculty of education, SuanSunandha Rajabhat University, who were in their internship during the second semester of the academic year 2015. The instruments used in this research were 1) a questionnaire investigating factors directly affecting science teaching ability through project-based instruction; and 2) a rating scale on science teaching ability through project-based instruction of science majors, Faculty of Education, Suan sunandha Rajabhat Universty. Both instruments were rating scales of 5 levels. The statistics used in this research were frequency, percentage, mean, standard deviation, Pearson correlation coefficient, and regression analysis. The findings were as follows. Part 1: Most science majors, Faculty of Education, Suan SunandhaRajabhat University, viewed their science teaching ability, consisting of 5 steps, in the assignments of two emesters as the 'high' level. Considering the detailed steps, the fifth step 'Evaluation' was ranked number one, followed by the second step 'Study, learn and encourage creative thinking'. 'Implementing the projects promote creative thinking' was ranked number three. The first step 'Preparation and forming the team before conducting the project' was ranked the last. Part 2: Factors affecting science teaching ability of science majors, Faculty of Education, Suan Sunandha were divided into 2 sections. 2.1 The overall opinion towards the factors affecting science teaching ability through project-based instruction of science majors, Faculty of Education, Suan Sunandha Rajabhat University was found at the 'high' level. Considering each factor, 'working together' in the team level factor was found the highest, followed by the individual factor and organizational factor. Environmental factor was found affecting the least. The detail was as follows. The most affecting factors in each factor level were 'teaching motivation' for the individual factor, 'team working' for the working together factor, 'policy and goal' and 'structure of science major program in Faculty of Education' for the organizational factor, and 'learning and teaching management through project-based learning according to the twenty-first century social value' for the environmental factor. 2.2 Factors affecting science teaching ability through project-based learning at the 0.05 significantly statistical level were found in three factors namely individual factor, working together factor, and organizational factor. Those had positive influence towards science teaching ability through project-based learning instruction.

Keywords: Science teaching ability, Project-based instruction techniques, Case study, Science majors.

Introduction

Nowadays, teaching and learning are geared towards the twenty-first century skills. Twenty-first century skills require 1) core subjects in learning and teaching such as English, reading or the art of language use, important languages of the world, art, Mathematics, Economics, Science, Geography, History, and Government and Citizenship; 2) principle concepts for the twenty-first century such as global conscience; basic knowledge of Finance, Economy, Business and Entrepreneurship, Citizenship, Health, and Environment; 3) learning and innovation skills such as creative thinking and innovation, critical thinking and problem solving skills, communication and collaboration; 4) information technology skills such as background knowledge on media and information technology; 5) life and working skills such as flexibility and ability for adaptation initiation and self-direction, social skill and cross-cultural learning, productivity, leadership and responsibility; and 6) supporting system for twenty-first century education such as standard and evaluation for twenty-first century, curriculum and instruction for twenty-first century, professional development for twenty-first century and learning for twenty-first century. (Worapot Wongkitrungruang and Athip Jittarerk, 2011) To achieve the aforementioned skills, there should be an appropriate learning and instructional design. Project-based instruction is the teaching method that promotes problem solving skills, creative thinking, team working, productivity and innovation, and communication skills. (Peera Phanasuthon, 2014) Moreover, project-based instruction emphasizes experimenting direct experience in interested topics under the guidance of the teachers. (Paitoon Sinlarat, 2014) According to National Education Act 1999, amendment, issue two (2002) and amendment, issue three (2010), section 22, section 24 (2), section 24 (3), section 24 (5) regulate the direction for educational management as follows:Section 22 Education shall be based on the principle that all learners are capable of learning and self-development, and are regarded as being most important. The teaching-learning process shall aim at enabling the learners to develop themselves at their own pace and to the best of their potentiality. Section 24 (2) Provide training in thinking process, management, how to face various situations and application of knowledge for obviating and solving problems; Section 24 (3)Organize activities for learners to draw from authentic experience; drill in practical work for complete mastery; enable learners to think critically and acquire reading habit and continuous thirst for knowledge; Section 24 (5) Enable instructors to create the ambiance, environment, instructional media and facilities for learners to learn and be all-round persons, able to benefit from research as part of the learning process. In so doing, both learners and teachers may learn together from different types of teaching-learning media and other sources of knowledge; Science projects are activities that promote student's logical thinking skills, creative thinking, problem solving via scientific method, science process skills, science attitude. Furthermore, scientific project also helps construct patience, self-confidence, and problem solving through scientific method in their daily life. (Pimpan Dechakupta, 2006) According to international education achievement of Thai students from Programme for International Student (PISA 2012), The Institute for Promotion of Teaching Science and Technology (IPST), along with Organization for Economic Co-operation and Development (OECD), the results of PISA from 2000-2012 reveal that Thai students made under-average international scores. From PISA 2012, Asian countries were in the top 7 of the PISA ranking out of 65 countries; China-Shanghai was number one on the rank followed by Singapore, China-Hong Kong, China-Taipei, Korea, China-Macao, and Japan. Thailand was number 50 on the list while Vietnam was number 17. Moreover, Trends in International Mathematics and Science Study (TIMSS) 2011 reveals the average score of mathematics evaluation for grade 4 students (458), which is ranked number 34, while the average score of 500. Among Asian countries, there are five countries which make it to the top five of the rank; Singapore (606), South Korea (605), Hong Kong (602), China-Taipei (591), and Japan (585). For Science score, Thai students score 472, under the average score of 500, and was put on the 29th of the rank. Among Asian countries, the top three of the rank are South Korea (587), Singapore (583), and Japan (559). (Office of the National Education Commission (ONEC), 2014) According to the needs and significance of project-based instruction as mentioned earlier, Faculty of Education, Suan Sunandha Rajabhat University, being the long-history teacher producing institute, aims to develop the teaching and learning methods.

Research Objectives

1) Measure and evaluate science teaching ability through project-based instruction of science majors, Faculty of Education, Suan Sunandha Rajabhat University;
2) to study and analyze factors directly affecting science teaching ability through project-based instruction of science majors, Faculty of Education, Suan Sunandha Rajabhat University.

Research Methodology

The research methodology is divided into 6 stages as follows:

Stage 1: Study of the body of the knowledge to conceptualize the research framework

1. The researcher follows these procedures to figure out the body of knowledge for project-based instruction: 1) Definition and concept of project-based instruction 2) Definition of scientific projects 3) Objectives of creating scientific projects 4) Types of scientific projects 5) Evaluation of scientific projects 6) Scientific project exhibition 7) Concept concerning factors and ability in science project-based instruction
2. The researcher collects related Literature
3. The researcher analyzes the above information to state the factors affecting the ability in teaching science through project-based instruction for science majors, Suan Sunandha Rajabhat University and design evaluation form for project-based instruction.
4. The researcher conceptualize the research framework

Stage 2: Research Population Designation

The population in this research was 50 fifth-year science majors of Faculty of education, SuanSunandha Rajabhat University, who were in their internship during the second semester of the academic year 2015.

Stage 3: Research Instrument Construction

The instruments used in this research were to…

1. Study documents on approaches and theories in order to state independent and dependent variables by the analysis of factor levels affecting the ability in science teaching ability of science majors, Faculty of Education, Suan Sunandha Rajabhat University. The researcher adopted the approaches of Owen (1998), Steers (1997), Robbins (2001), and ONEC (2001) to create a research framework in order to cover the variables of individual factor level, team working factor level, organizational factor level, and environmental factor level.
2. Measure and evaluate the ability of project-based instruction for science. The researcher applied the concept and theories based on those of the Institute of Academic Quality. (Chachanon Thanirat, 2012) The ability of project-based instruction for science includes the readiness preparation and the team preparation, learning and creative thinking encouragement, project implementation, project presentation and project evaluation.
3. Designate the structure of variables according to the following steps.
   3.1 Outline the structure, important lists, and indicators for every variable.
   3.2 Examine the structure of variables, important lists, dependent and independent variables, content coverage, the number of items, the language accuracy, the technique of questionnaire construction in order to consider the content about factors affecting project-based instruction.

4. Construct the instruments for this research which include the followings.
   4.1 A questionnaire investigating factors directly affecting science teaching ability through project-based instruction of science majors, Faculty of Education, Suan sunandha Rajabhat Universty.
   4.2 A rating scale on science teaching ability through project-based instruction of science majors, Faculty of Education, Suan sunandha Rajabhat Universty.

Both instruments were rating scales of 5 levels. The quality of the instruments was examined by the experts for the content and experts for evaluation for the content validity and reliability.

1. For the validity, the researcher designates the action definition of the variables, the indicators, item construction, item examination by the experts in accordance with the content and the language appropriateness as in the form of Item Objective Congruence or IOC.
2. After having been examined the validity by the experts, the instruments were reexamined for the reliability by having the fifth-year science majors of another Rajabhat University do the questionnaire.
3. For the criteria of scoring, the researcher has divided into two parts.

The first part is the questionnaire about factors affecting the ability of teaching science through project-based instruction of the science majors, Faculty of Education, Suan Sunandha Rajabhat University.

Level of opinion	**Scoring**
The highest level of what really happens	5 points
The high level of what really happens	4 points
The average level of what really happens	3 points
The low level of what really happens	2 points
The lowest level of what really happens	1 point

The second part is the questionnaire about the ability of teaching science through project-based instruction of the science majors, Faculty of Education, Suan Sunandha Rajabhat University.

Level of opinion	**Scoring**
The highest level of ability	5 points
The high level of ability	4 points
The average level of ability	3 points
The low level of ability	2 points
The lowest level of ability	1 point

Stage 4: Data Collection

The researcher has collected the data according to the following steps.

4.1 Send the letter asking for permission from the principals of the schools where the fifth-year students are teaching during their internship to join the research project.
4.2 Send the questionnaires to the participants and collect them.
4.3 Examine the answered questionnaires before the data analysis stage.

Stage 5: Data Analysis

The researcher has analyzed the data by using SPSS for Windows according to the following information.

5.1 The personal data of the informants and the checklist items are analyzed by frequency and percentage.

5.2 The data of levels of opinions towards factors affecting science teaching ability of the fifth-year science majors, Faculty of Education, Suan Sunandha Rajabhat University were analyzed by Mean, Standard Deviation, Pearson Product Moment Coefficient Correlation and Multiple Regression Analysis.

The interpretation of the average points from the questionnaire is as follows.

The average points between 1.00-1.49 refer to the lowest degree of what really happen or the ability of teaching.
The average points between 1.50-2.49 refer to the low degree of what really happen or the ability of teaching.
The average points between 2.50-3.49 refer to the average degree of what really happen or the ability of teaching.
The average points between 3.50-4.49 refer to the high degree of what really happen or the ability of teaching.
The average points between 4.50-5.00 refer to the highest degree of what really happen or the ability of teaching.

Stage 6: Research Presentation

Research Result

The research presentation has been divided into two parts. The first part concerns with the science project-based teaching ability of the fifth-year science majors, Faculty of Education, Suan Sunandha Rajabhat University. The second part deals with factors affecting science project-based teaching ability of the fifth-year science majors, Faculty of Education, Suan Sunandha Rajabhat University.

Part One: The science project-based teaching ability of the fifth-year science majors, Faculty of Education, Suan Sunandha Rajabhat University

The science-major students of Faculty of Eduaction, Suan Sunandha Rajabhat University have been trained to apply project-based instruction during their internship throughout both semesters of the academic years. According to the five stages of the evaluation, the science-major students view the science project-based teaching ability at the ‘high’ level. The science-major students have the highest ability of ‘evaluation stage’ (stage 5), followed by ‘creative thinking encouragement’ (stage 2), and ‘project implementation for promoting creative thinking’ (stage 3). ‘The preparation stage’ is viewed the lowest ability among all.

Stage 1: The preparation stage

For this stage, the science-majors students rate the ability at the ‘high’ level. In detail, ‘observation’ and ‘condition examination’ are rated the highest ability, followed by ‘guidance’, ‘teaching procedure’ and ‘team assignment for project-based learning’ which are rated equally.

Stage 2: The learning and creative thinking encouragement stage

For this stage, the science-majors students rate the ability at the ‘high’ level. In detail, ‘cooperation’ and ‘counseling’ are rated the highest ability, followed by ‘guidance’ and ‘objective designation’. ‘Various

methods of study' and 'challenging activities for project-based learning' are rated the lowest ability among all.

Stage 3: The implementation stage

For this stage, the science-majors students rate the ability at the 'high' level. In detail, 'counseling' is rated the highest ability, followed by 'monitoring the quality of projects' and 'cooperation'. 'Assisting the learners in initiating the project' is rated the lowest ability among all.

Stage 4: The presentation stage

For this stage, the science-majors students rate the ability at the 'high' level. In detail, 'making comments for each project presentation' is viewed the highest ability, followed by 'selecting the means of presentation'.

Stage 5: The evaluation stage

For this stage, the science-majors students rate the ability in 'identifying the appropriate criteria' at the 'high' level.

Part Two: Factors affecting science project-based teaching ability of the fifth-year science majors, Faculty of Education, Suan Sunandha Rajabhat University

The research presentation in Part Two has been divided into two parts: 1) opinions about factors affecting science project-based teaching ability of the fifth-year science majors, Faculty of Education, Suan Sunandha Rajabhat University; and 2) factors affecting science project-based teaching ability.

2.1 Opinions about factors affecting science project-based teaching ability

The fifth-year science majors, Faculty of Education, Suan Sunandha Rajabhat University, generally view the four factors affecting science project-based teaching ability at the high level. The 'working together' factor is viewed the most affecting level, followed by the individual factor and the organizational factor. The environmental factor is viewed at the lowest level of affecting.

The individual factor is generally viewed at the high level of affecting. In detail, the 'motivation for teaching' factor is viewed the most affecting level, followed by 'creative thinking' and 'attitude' factor. The 'skill' factor is viewed at the lowest level of affecting.

The 'working together' factor is generally viewed at the high level of affecting. In detail, the 'team working' factor is viewed the most affecting level, followed by 'counseling' and 'communication' factor. The 'leadership' factor is viewed at the lowest level of affecting.

The organizational factor is generally viewed at the high level of affecting. In detail, the 'policy and goal' factor and the 'structure of science major in Faculty of Education' factor are viewed the most affecting level, followed by 'mission and strategies' factor. The 'organizational culture' factor is viewed at the lowest level of affecting.

The environmental factor is generally viewed at the high level of affecting. In detail, the 'project-based instruction for the twenty-first century' factor is viewed the most affecting level, followed by 'implementation of project-based instruction' factor and the 'technology' factor. The 'budget management' factor is viewed at the lowest level of affecting.

2.2 Factors affecting science project-based teaching ability

There are three main factors affecting the science project-based teaching ability: the individual factor, the 'working together' factor, and the organizational factor as seen from the regression equation below.

Science project-based teaching ability = 0.503 + 0.531 (the individual factor) + 0.421 (the 'working together' factor + 0.311 (the organizational factor)

Discussion

There are some issues for discussion as follows.

1. According to the research result, the 'preparation' stage has found at the lowest level. This might be because the teacher has to be very accurate on the content area of teaching. The team members need to make agreement on the particular topic and raise the questions concerning the topic. This stage is very challenging for the students. (Vicharn Panich, 2012) Therefore, they rate themselves at the lower level because they have less experience in project-based instruction. This result is complied with Siriwan Chatmaneerungruang et. al (2010) that the experience of teaching directly affects the comprehension and the implementation in order to set the goal for the science projects. For the 'evaluation stage' which is rated at the highest level, this is because the evaluation criteria and objectives are clear enough to follow. (ONEC) The evaluation is set to follow the stages of authentic assessment to achieve the goal and objectives by the cooperation of the teacher and students.
2. As mentioned earlier that three factors including the individual factor, the 'working together' factor and the organizational factor affect the science project teaching ability in the positive way. The 'motivation for teaching' factor is viewed the most affecting level. This might be because motivation (Siriwan Serirat, 1996) is the drive in order to encourage people to achieve the goal. They will devote, be active, be responsible and do every way to accomplish the goal.

For the 'working together' factor, the 'team working' factor is viewed the most affecting level. This might be because project-based learning is initially activated by the teacher and then need the cooperation of the team members to think and implement the project together. (Dussadee Yo-lao et. al, 2014)

For the organizational factor, the 'policy and goal' factor and the 'structure of science major in Faculty of Education' factor are viewed the most affecting level. This might be because the encouragement and the support from the faculty and the university are very important to the students' understanding about project-based instruction. Without the active support from the organization, the goal might be very difficult to be achieved.

Recommendations

1. Recommendation for research application 1) There should be the urgent development in preparation for project-based instruction as the research finding showed that the 'preparation' factor was found the lowest in the rank. The prepared area included basic knowledge on project-based instruction and communication skills for team understanding.2) The higher education institutes or the scientific institutes should develop the positive attitude towards science, the awareness of the significance of science as well as dissemination of modern science teaching methods as the finding showed that individual factor affected teaching ability the most.
2. Recommendations for further studies 1) There should be further studies on conditions and problems of project-based instruction in all learning areas.2)There should be further studies on strategy development to upgrade science teaching ability. 3)There should be further studies to develop websites and appropriate online media on learner-centeredness, suitable teaching method guidelines for particular learning contexts as well as investigating enquires concerning science pedagogy as information sources publicized for interested people to upgrade the quality of teaching.

References

1. ONEC. (2001*). Research Report on Factors Affecting Science and Technology Project of Students in Japan and Thailand*. Bangkok: ONEC.
2. Panjasuwan, J. (2009). *Science Projects*. Bangkok: Academic Promotion Publishing House.
3. Thaneerat, C. (2012). *The Developmen tof Teaching Process on Project-Based Learning by Blended Learning to Enhance Creative Thinking Process for the Course in Print Media of Public Relations's Promotion in Performance Arts for Bachelor Degree's Student*. Bangkok: KMUTT Publishing.
4. Grudmanee, T. (2007) *An analysis of factors affecting the organiztional effectiveness of school-based management schools under The Office of The Basic Education Commission*. Bangkok: Chulalongkorn University Printing House.
5. Yolao, D. et. al. (2014). *Projectbased in Social Network for Twenty-first Century Skill*. Retrieve from http://www.slideshare.net/se7ensom/22-0159-pbl#.
6. Sirimahasarkorn, B. *Science Project Implimentation*. Third edition. Nonthaburi: Book Point.
7. Srmarut, B. (2008). *An analysis of factors affecting the effectiveness of graduate studies at Rajabhat University*. Bangkok: Chulalongkorn University Printing House.
8. Thipkiri, M. (2000). *Science Project*. Bangkok: The Master Group Management.
9. Phukiet, L. (2006). *Science Project: Intrigrated Teaching and Learning Management for Development*. Bangkok: Chulalongkorn University.
10. Saiyos, L and Saiyos, A. (220). Learning Evaluation Techniques. Bangkok: Kid's Club.
11. Panich, V. (2012). Bicycle Learning Model for PBL.