

Applying integrated learning and Psychological Approaches in Teaching Biology to English as Second Language Science Major Students through Integration of Western Curriculum into Thai Ministry of Education Biology Core Curriculum

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Abstract: *The purpose of this study is to integrate western curriculum into English Programs at the upper secondary level education. English is used as the medium in transferring core subjects (English, Science, Math) and selected requirements such as Social Studies, History, Religion, Art, and Computer to predominately English as Second Language (ESL) students. This challenges ESL educators to continually improve techniques and tactics in transferring their specific subjects to students. In this study, lectures taught from US undergraduate university level biology textbook combined with integrated learning and psychological approaches fulfilling the core standard required by Thailand's Ministry of Education to study three consecutive years of biology at high school level for science major students from M4-M6 (Grades 10 to 12). The study sample group consisted of 24 science major students at M4 level and 22 students at M5 level. This study was performed at the Demonstration School of Rajabhat Suan Sunandha University with the intent of building a strong biology foundation in English and inspiring students preparing for university level studies. Observed results from two progressive academic years exhibited students' improved proficiency to understand the biology content through students' class performance in class interaction and discussion, online research in preparation for performing laboratory experiments and writing preliminary scientific reports prior to instructor's teaching of experiment procedures, assignments in concept map and mind map format, PowerPoint presentation in group and assessment as individual students.*

Keywords: *Western curriculum, Thai government curriculum, English Placement Program, English as a Second Language (ESL), integrated learning and Psychological approach.*

I. Introduction

Biology is considered a mandatory core subject taught for three consecutive years from Mathayom Suksa levels 4-6 (Grades 10-12, upper secondary school level) geared in preparation for the university track in compliance with the Thai Ministry of Education under the Thai Government. Students choose their major, Science-Math (Science Majors) or English-Math (Art Majors), starting from Mathayom Suksa 4. Prior to the upper secondary level, students follow the same curriculum from Prathom 1-6 (Grade 1-6, elementary school level) and three years of Mathayom Suksa 1-3 (Grade 7-9, lower secondary school) under the mandate of the Ministry of Education Thailand. The primary language in Thailand is the Thai language. Eight required subjects from the National Curriculum include: Thai language, mathematics, science, social studies, religion and culture, health education and physical education, arts, careers and technology, and foreign languages (Ministry of Education Thailand, intro-ed08).

English as has been incorporated into the government curriculum to a minimum of a few hours per week depending on grade level (Ministry of Education Thailand, 2017.) Some government operated schools, schools under government universities, or a number of private schools provide English Programs at the

Mathayom Suksa level 1-6 where the required subjects are taught in English with the exception of Thai language. At the primary or elementary level, a few government or private schools also offer variations of English Programs such as Mini English Programs or even Bilingual Programs (core subjects taught in Thai and English). No matter which educational programs students originated from, the Mathayom Suksa 4 level (M4) for Science-Math (Science major) students, are required to enroll for biology as a science core subject for 3 consecutive years, a total of 6 semesters with three-50 minutes sessions per week where the language of instruction is predominately or solely English. At the end of their sixth semester of biology, the students would have covered biology as a prerequisite university level biology in the English language in preparation for university entrance as biology or applied biology majors, medical programs, or any other science field they choose to specialize in. Thus, students at the end of the M6 academic school year should be proficient enough for university level biology. In this study, a pre-biology test was given prior to any biological lecture or any form of class participation exhibited a gap in their biology as well as English proficiency. The pre-test, revealed that the students did not meet the passing 50% criteria. The pre-test consisted of multiple choice, matching, short answers, and identification from colored image. The pre-test assessment served as guideline for the best approach to mentor each group of students entering M4 level since each incoming group have shown variation in English and Biology background as experienced in many classrooms (Smithsonian.com, 2019). After the written pre-biology assessment test, further assessment was carried out through interactive discussion with individual students within a whole class setting to establish their field of interest in which they are prepping for towards university level, their attitude and commitment as tentative learners, and initiative and temperament to set criteria and guidelines for teaching (Tanner K. and Allen K., 2004).

Class discussion was carried out with the intent to stimulate student to be accustomed to active learning mode and to challenge students to gradually step out from their comfort zone and become comfortable in an interactive environment they might not be accustomed to. This method was initiated to prepare students for integrated learning of the subject matter using positive conditioning to bond with students and assist them to have the drive to overcome fear of learning a new subject containing many linked systems and new technical terms in a foreign language. Moreover, the content of lecture material was from an international textbook used to apply into the biology curriculum under Ministry Education Thailand (Drubin G.D. and Kellogg R.D., 2012). The psychology of Positive Reinforcement Theory according to behaviorist scientist B.F. Skinner where a desired stimulus is introduced to encourage certain behavior was practiced. Positive reinforcement was found to be the force of effectiveness in student-instructor bonding where students were rewarded through recognition of achievement as they answered and commented in class discussion, presentation, assignments accomplished and especially when they were able to link the biological systems into a mind map format. English is not their native language and each student's English background vary from minimum to good; thereby, multiple approaches were needed to enhance and reinforce learning. Concept map or mind maps is essential for thought processes and understanding of biological concepts and mechanisms and how they link together into a whole functional system (Udeani U., and Okafo P.N., 2012). Students applied their innate ability to learn through insight and intuition to respond during class or in essence, they essentially exhibited the use of their biological nature of learning where the brain is considered a flexible, self-adjusting biological system that shapes itself in response to incoming challenges (John Abbot and Terry Ryan, *Unfinished Revolution*. Chapter 1). Applying potential of the human mind and system as the backbone for mentoring students is an ongoing study, conducted at the Demonstration School of Suan Sunandha Rajabhat University, English Program, for two consecutive academic school year of 2017-2018 and 2018-2019 will continue into the third year of the 2019-2020 academic school year. The third-year biology students will be challenged with more integrated learning in forms of presentation where they prepare their own dialogue in English for video clip or movie format presentations (Nisamranchit S. and Ngiwline P., 2018) of biological functional systems, debate on biological issues of global interest, and biology experiments (National Science Teachers Association, 2019) of the cumulative learned biological topics.

II. Methodology

Participants The study sample consisted of 24 upper secondary Science Major (Science-Math) students, Mathayom Suksa 4 (Grade 10) of academic school year 2017-2018. The study continued to follow up on students' progress to Mathayom Suksa 5 (Grade 11) of academic school year 2018- 2019 where 22 students remained in the Science-Math major from switching to the English-Math major at the end semester 1. Continued study will be in progress from the same student sample group in the academic school year 2019-2020.

III. Performance Assessment

- Course curriculum depicting breakdown of study topics and of grading assessment.
- PowerPoint lecture (English language) from international textbook with uploads onto classroom site and textbook reference for further reading.
- Class participation during class discussion and class attendance.
- Tests and Exams: close book tests, open book test with use of one A4 cheat sheet
- Extra credit assignment in mind map and concept map format
- Draft of scientific laboratory report prior to experiment -Group Presentation graded as group and individual participation.

IV. Procedure

-Course curriculum: Students were shown their course curriculum in intervals throughout each semester at the beginning of each biology course, prior to beginning of each topic to be covered, prior to tests, midterm exam and final exam material coverage.

-PowerPoint Lecture: Each day of class lecture consists of student interaction through questions and discussion. Students were encouraged to help each other as a class in answering partial or full answers. Topics taught in past lectures were brought back into discussion in order for students to grasp how each topic are linked as a system.

-Class participation and attendance was encouraged as 20% of grade assessment to induce interactive learning in order to promote integrated learning of biology subject.

-Tests and Exams: close book tests, open book test with use of one A4 cheat sheet. Various test assessment using closed book and open book was carried out to determine the root cause for inducing good test performance.

-Extra credit assignment: Mind map and Concept map format was given prior to closed book tests and exams to stimulate student preparation in advance for testing. A concept map helps breakdown main topic into detail and the mind map serves to link and integrated each area of study topics together for thought organization and processes.

-Draft of scientific laboratory report format prior to experiment provides background search of the specific experiment through literature and online research prepares students to research on their own as individuals and as a group. Students were briefed and given basic direction of writing scientific report and were assigned to turn in report from their own research.

-Group Presentation graded as group and as individual participants. Partial assessment of students presented as a group to encourage group collaboration. Each student was also assessed from their presentation skills and

question answering level during presentation. As an audience, each student was also assessed for their participation in asking qualitative and sound questions.

V. Results

Provided course curriculum with assignment and grade breakdown served its function to help students keep track of details and content coverage. Showing the course curriculum throughout the biology course conditioned the students to repetitive viewing of grade breakdown prior to beginning of each topic to be covered, prior to tests, midterm exam and final exam material coverage was intended to induce students to add value to their potential scores by stimulating to diligently conserved all points. All except for 2 students showed interest through asking questions and follow up on their cumulative scores throughout each course. PowerPoint lecture printouts allowed students to take notes as various topic covered were emphasized and carried over to class questions and discussion. Students were encouraged to help each other as a class in answering partial or full answers. Topics taught in past lectures were brought back into discussion in order for students to grasp how each topic link as a system. Through student feedback through discussion and answering, it was observed their progress in linking content for a better understanding. Class participation and attendance was encourage by allowing students to achieve full 20% of grade assessment if they attend all sessions and participated interactive learning approach which in turn promote students to depict discussion topic in more detail and integrated learning into their learning processes. This was shown effective during class sections through each question asked or posed for discussion received attention and response in trying to answer question. The lack of full answer from one student would further be joined by class members to add on to existing answer until satisfactory understanding was achieved as a whole class. Tests and Exams in hard copy format is a passive form of response and thus not every student showed a satisfactory understanding of the content, especially in close book exams. Open book testing where students were permitted to prepare their own cheat sheet on an A4 single.

VI. Discussion

The application of multiple approaches for engaging students with English as their second language resulted in a positive classroom atmosphere where student showed growing ease of their English capabilities and biological knowledge in active integrated learning as the result. Success was most evident as students expressed knowledge through presentation content and skills, quality of discussion to posed questions as individuals and as group collaboration, and their alacrity in vocal request for more knowledge. In addition, when cheat sheets, concept maps, and mind maps were assigned in preparation for tests, the student exhibit detailed thought process that expanded and linked each topic to express and integrate biology a whole functional system. The preliminary laboratory scientific reports induced and prepped students to anticipate performing laboratory experiments. Students showed initiation and satisfactory quality of research which would serve in preparation for extension of their learning at the experimental laboratory level. After the first biology course, academic year 2017-2018, M4 students interacted and discussed biology in English with increase fluency and ease. Since English is considered the universal language of instruction for teaching biological science, textbook and lectures in English language was used in reference to instruction. In conclusion, western classroom learning material and approach was incorporated into the required Thai curriculum to bring about a positive and engaging environment for teaching and learning biology. Moreover, teacher bonding with each individual student within the classroom was through understanding how the human mind works, especially adolescent minds, and the use of positive reinforcement to increase students' attitude towards learning.

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