



PBL and the New Ecological Paradigm: Fostering Environmental Awareness Through Project-Based Learning

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Introduction

Sustainability is a major and growing concern worldwide. The topic has received significant media attention, and innumerable organizations have released sustainability goals. In 2015, the United Nations published the seventeen interrelated Sustainable Development Goals, that promote economic, social, and environmental sustainability (United Nations, n.d.). The Association of Southeast Asian Nations recently affirmed similar goals in a June 2019 statement (“ASEAN leaders’ vision statement,” 2019).

The most broadly cited definition of sustainable development comes from the Brundtland Report, “Our Common Future,” which reads, “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland, 1987, p. 40). This is taken to incorporate two primary outcomes: firstly, that the needs of the world’s poor must be met (via either empowerment or measures to address income inequality) to ensure social stability and further development for all, and secondly, that there are limitations on resource availability driven by natural abundances and regenerative capacities on the one hand and by the technological capacity to extract and exploit the resource on the other (Brundtland, 1987).

In Thailand, a founding member of ASEAN, the need for sustainability education is now recognized publicly, spurred on in particular by unabashed concern about air pollution. Air pollution-induced mortality is now well over 30,000 per annum (out of about 550,000 deaths per annum), placing it seventh overall and first among environmental causes (Institute for Health Metrics and Evaluation, 2018). Issues like these trigger interest in sustainability and a pressure to incorporate it in curricula. Thailand has not been complacent about sustainability curricula, although explicitly incorporating them into EFL has not been emphasized.

This report introduces a project designed in response to this need to introduce students to sustainability and explores the impact of this project on students’ environmental worldview. The project was implemented in an intensive English for academic purposes (EAP) course at a university in Thailand. This 10-week course prepares students to enter an English-medium bachelor’s degree program. The main goals of the program are to develop language proficiency; however, this is accomplished through engagement with meaningful real-world content. This could be classified as the weak form of “Content and Language Integrated Learning” (CLIL), which has the goal of helping “learners develop their target

language competency as a primary aim and their subject/theme/topic knowledge as a secondary aim” (Ikeda, 2013, p. 32). The principles of Project-Based Learning (PBL), which is gaining recognition as an effective approach to learning (Chen & Yang, 2019), informed the design of the project.

The inclusion of both linguistic and content goals is consistent with the mission statement of the intensive English program: “to provide educational experiences which cultivate students’ academic English communication skills; to foster their ability to be self-reflective and responsible learners; and to stimulate their curiosity about the world” (Mahidol University International College, 2019). This mission emphasizes language outcomes but also acknowledges the importance of content.

The project is completed over the course of the academic term. After the teachers introduce the topic of sustainability through readings, lectures, and activities, each student is provided a choice of a multinational corporation to investigate. Sustainability is explained and understood through Elkington’s (1997) Triple Bottom Line (TBL) framework, which emphasizes three aspects of sustainability: social, environmental, and economic (otherwise formulated as people, planet, and profit). The teachers then introduce research techniques and source analysis. They also guide a structured approach to essay development. Each student investigates the performance of his or her chosen company through the lens of the TBL framework. Students share their findings through presentations, structured academic discussions, and extended essays.

After reviewing relevant literature on PBL, this report explains the New Ecological Paradigm (NEP) scale. It then provides the results of pre- and post-project administrations of the NEP to students in the intensive English program and interprets the results. Finally, it discusses implications for further iterations of the same project and for projects implemented in other contexts.

Literature Review

The project on sustainability was designed to align with the principles of PBL. Educators have advocated the use of PBL in language education since at least the 1980s (Stoller & Meyers, 2019), and PBL has been applied widely in diverse types of English language education, including general English (GE), English for academic purposes (EAP), English for specific purposes (ESP), and English for occupational purposes (EOP) (Chitchuen & Sanpatchayapong, 2016). The application of PBL is certainly not limited to language learning, and the effectiveness of PBL is increasingly being recognized in a variety of contexts (Martín et al., 2014).

The benefits of PBL are increasingly being recognized. Chen and Yang (2019) performed a meta-analysis of research about PBL published from 1998 to 2017, which included data from nine countries and 189 schools, and found that PBL “has a medium to large positive effect on students’ academic achievement compared to traditional instruction” (p. 71). Noted benefits include a shift from teacher-centered to student-centered learning and from memorization to investigation (Grant, 2011) as well as improved critical thinking (Horan et al., 1996), academic skills (Ducker, 2013), and cooperation (Beckett, 2002).

While projects are used widely in education, not all project work would be considered PBL. Larmer and Mergendoller (2010) explain this by analogy: “In 21st Century Project Based Learning, it is the project that is the main course — it contains and frames curriculum and instruction” (p. 1). The primacy of projects in PBL is central to its definition. While the many sets of criteria defining PBL have been proposed, they tend to converge on certain aspects of this approach to education. Typical lists of criteria include from four to seven criteria (e.g., Condliffe et al., 2016; Larmer & Mergendoller, 2015; Martin et al., 2014; Ravitz, 2010); however, Grant (2011) proposes only two criteria: “driving question or problem” and “production of one or more artifacts as representations of learning” (p. 11). These sets of criteria tend to exhibit certain similarities: the project must be well integrated into the course, the students must be given a compelling question, and they must be allowed some freedom in their investigation.

After a thorough review of the literature, Thomas (2000) proposed a set of five criteria for PBL: centrality, driving question, constructive investigations, autonomy, realism. Thomas' (2000) criterion of centrality requires that the project be a major component of the course. The project should not appear only at the end of the course for review; it should be completed over a relatively long span of time, and should typically involve several deliverables. The project should be fully integrated into the overall progression and objectives of the course. Thomas' (2000) second criterion, driving question, indicates that the project should lead students to engage with key content by challenging them with a question, which presents an "ill-defined problem" (p. 3). This question should motivate students to investigate using a variety of methods, and it should be open to multiple means of inquiry. Thomas' (2000) third criterion, constructive investigations, indicates that the project should "involve the transformation and construction of knowledge" (p. 3); that is, completing the project should push students to learn new content and skills. According to this criterion, the project is not designed for review; it is directly involved in the students' creation of new knowledge and acquisition of new skills. Thomas' (2000) fourth criterion, autonomy, emphasizes the importance of student voice, choice, and freedom of exploration. Projects should not have a specific desired outcome set by the teachers, and they should not be overly supervised or closely scripted. Thomas' (2000) final criterion, realism, argues that projects should be authentic, "not school-like" (p. 3). The content, audience, problems, and means of judging the projects should all be as close to authentic as can practically be achieved. All of these criteria can be followed to a greater or lesser extent; however, PBL projects should adhere to most of these criteria.

The criteria for PBL also inform other projects in the intensive English program, including projects on city sustainability, innovation, human rights, and current events in ASEAN. A full description of the project on ASEAN is available in a previous publication (Nanni & Pusey, 2020).

Methods

The sustainability project has three goals: to improve students' academic English; to foster intrinsic motivation, research skills, and critical thinking skills; and to raise students' environmental awareness. This project was created nearly a decade ago. While the linguistic goals of the project have been previously investigated, and are assessed each term through the battery of assessments used in the program, this report is a first attempt to investigate whether the goal of cultivating students' environmental awareness is being met. The investigators hypothesized that this application of PBL would shift students' beliefs toward a more pro-environmental worldview as measured by the NEP.

The New Ecological Paradigm (NEP) was created as a challenge to the "human exceptionalism paradigm" (Dunlap & Catton, 1994, p. 5), or the belief that humans exist separately from the rest of nature and that nature exists for human exploitation. Dunlap and Van Liere (1978) published the original New Environmental Paradigm Scale in 1978. Their research was inspired by the environmental movement that was active in the United States during the 1960s and 1970s (Anderson, 2012). Dunlap, Val Liere, Mertig, and Jones (2000) later published a revised scale, which they called the New Ecological Paradigm. The revised scale expands the coverage of issues, reverses some items (so that selecting "strongly agree" on every item does not indicate a strongly ecological worldview), and updates some terminology (Dunlap et al., 2000). The revised NEP consists of 15 Likert-scale items, each of which presents five choices ranging from "strongly disagree" to "strongly agree." The revised NEP was selected for this study as it is a well-established means of evaluating subjects' orientation towards nature.

The design of this study includes a pre-test, in which students in the intensive English for academic purposes program completed the NEP survey via Google Forms. The survey was distributed to all six sections of the course, 131 students in total. They completed the NEP survey before receiving any instruction or completing any activities on sustainability. The students then received the treatment, which was the sustainability project and the associated readings, lectures, activities, discussion, and writing

tasks. Finally, the students completed the post-test, which was a second administration of the NEP survey via Google Docs.

Results

The results of the pre- and post-surveys are presented in Table 1. A total of 121 students completed the surveys out of 131 students registered in the course, yielding a response rate of 92%. Each of the 15 items on the NEP received a score on a five-point Likert scale, ranging from 1 (“Strongly disagree”) to 5 (“Strongly agree”). The results of the pre- and post-surveys and the difference between the two appear in Table 1.

TABLE 1

Results of Pre- and Post-Treatment Administrations of the New Ecological Paradigm (NEP) Survey, Grouped by Sustainability Factor

NEP Item	Factor	Attitude Shift Regarding Sustainability Pre- to Post-PBL Attitude	Degree of Attitude Shift: + is more positive attitude towards sustainability; - is more negative.	Average Degree of Attitude Shift by Factor
* 2. Humans have the right to modify the natural environment to suit their needs.		* more negative	* -10.38%	
7. Plants and animals have as much right as humans to exist.	*Antianthropocentrism	more positive	6.88%	-3.58%
* 12. Humans were meant to rule over the rest of nature.		* more negative	* -7.24%	
* 4. Human ingenuity (i.e., creativity and intelligence) will ensure that we do NOT make the earth unlivable.		* more negative	* -8.10%	
9. Despite our special abilities, humans are still subject to the laws of nature.	* Antiexceptionalism	neutral	-0.59%	-3.54%
* 14. Humans will eventually learn enough about how nature works to be able to control it.		neutral	-1.93%	
3. When humans interfere with nature, it often produces disastrous consequences.		more positive	4.75%	
* 8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.	Balance of Nature	* more negative	* -15.23%	-1.72%
13. The balance of nature is very delicate and easily upset.		more positive	5.31%	
5. Humans are severely abusing the environment.		more positive	11.69%	
10. The so-called “ecological crisis” facing humankind has been greatly exaggerated.	Eco-crisis	* more negative	* -6.04%	3.98%
15. If things continue on their present course, we will soon experience a major ecological catastrophe (i.e., disaster).		more positive	6.28%	
1. We are approaching the limit of the number of people the earth can support.		more positive	5.28%	
* 6. The earth has plenty of natural resources if we just learn how to develop them.	Limits of growth	* neutral	* 1.08%	4.17%
11. The earth is like a spaceship with very limited room and resources.		more positive	6.15%	

Note. The overall average degree of attitude shift is 4.87%.

Overall, the average student appeared to think more positively about sustainability after the PBL work than before, but there were some relatively strong negative changes as well. All of these were in questions that had been written so that a positive response (4 or 5) indicated a negative attitude about sustainability. It is possible that the ESL student respondents did not fully understand the questions, but since the post-PBL result was the second time that they had seen the NEP instrument, this is unlikely. It is more likely that they see human ability and intelligence as able to resolve sustainability issues eventually.

Discussion

The NEP is meant to measure five factors: balance of nature, eco-crisis, antiexceptionalism, limits of growth, and anthropocentrism (Cordano et al., 2003). The pre- and post-test data show that the degree to which participants' worldviews shifted on average varied significantly by factor. To calculate the mean score for each factor, the scoring of the reversed NEP items (those marked with an asterisk in Table 1) is again reversed so that a higher score always indicates a more pro-ecological worldview. The average change in the pre- and post-test scores for each of the five factors is shown in Table 2.

TABLE 2
Summary of Changes in NEP Scores Grouped by Factor

Factor	Items*	Change from Pre- to Post-Test
Balance of nature	3, 8, 13	-1.72%
Eco-crisis	5, 10, 15	3.98%
Antiexceptionalism	4, 9, 14	-3.54%
Limits of growth	1, 6, 11	4.17%
Antianthropocentrism	2, 7, 12	-3.58%

Note. The full list of NEP items appears in Table 1. The results in the "Change from Pre- to Post-Test" column have been rounded to the nearest hundredth.

The greatest shift in the mean score appeared in the factors of eco-crisis and limits of growth. These changes show an overall shift towards a pro-ecological worldview recognizing that the environment is being abused, that the ecological crisis is real, that the crisis could lead to disaster, and that Earth's resources are limited. These changes were consistent with the content that students would have engaged with during the project while learning about sustainability and studying their chosen company's performance.

In contrast, the third- and fourth-largest changes were in an anti-environmental direction in the factors of antiexceptionalism and antianthropocentrism. Both factors involve belief in society and trust in human ingenuity more than the natural order. One explanation for this change is the emphasis that the sustainability project placed on innovation and ingenuity. The students read and discussed case studies where sustainability problems were solved and where serious environmental issues were successfully addressed. This may have influenced their views on what types of change are possible and what rights humans have to implement change. The change in the final factor, balance of nature, was negligible.

There are several limitations to this study. For practical reasons, control group data was not collected. While the results of the pre- and post-tests are promising, the results are not generalizable to other contexts. Even with these limitations, however, the results of this study have implications for future iterations of the project. One significant implication is that the teachers should be sure to give clear context for case studies. Since many of the cases discussed are selected because they are exemplary success stories, they are not typical of companies' performance. The issue of rights should also be better

integrated into the project, and therefore, the course. Furthermore, there was limited direct discussion of animal and ecological rights; adding this aspect would complement the other material covered in the course.

This initial research suggests that the participants engaged meaningfully with key concepts related to sustainability. The content that teachers choose for their language classes is not neutral. Even in a classroom where the primary goals are linguistic, well-chosen content that is relevant to the students' goals and that responds to critical issues can stimulate engagement, challenge learners, and begin the process of addressing real-world issues.

Conclusion

This report has presented a project developed in the context of the intensive English program at a Thai university. The program has a clear linguistic goal: to help learners develop the language skills necessary for them to succeed in an English-medium bachelor's degree program. The program also aims to "stimulate [students'] curiosity about the world" by integrating cognitively challenging, real-world content in a manner consistent with CLIL and PBL. Sustainability, being a topic of grave concern to governments, organizations, and individuals around the world, provides a wealth of compelling content. The results of the NEP survey conducted before and after students' completion of the project shows that their orientation towards the environment did shift during the academic term. This project represents one approach to teaching language through PBL focusing on sustainability, yet similar projects could be implemented in a wide range of educational contexts. The language, content, and scaffolding of the project could be altered to suit the learners' proficiency, age, and background knowledge. The core of the project — a driving question leading learners to engage with the concept of sustainability and to consider the connection between humans and the environment — would remain fundamentally the same. In this trying time, it is hoped that educators in diverse contexts will implement projects that foster learners' awareness of sustainability.

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