

The role of project based learning in promoting environmental stewardship: A case study of Bahrain Teachers College.

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Abstract: Undergraduate education majors were enrolled in a project based learning methods course in spring 2012. As a culmination, they prepared five year plans to promote environmental stewardship in primary public schools in Bahrain. Since all students plan to eventually teach science in the primary schools, it is hoped they will be able to implement at least some of their plan and foster environmentally friendly habits that last for the lifetime of their students.

Key words: Project based learning, teaching environmental stewardship, green schools, Bahrain

Background

Project Based learning-general Principles

Project based learning (PBL) creates a Gestalt shift from teacher-centered instruction focused on content memorization to student-centered instruction focused on active construction of new knowledge. The role of the teacher is not to transmit the facts to be memorized, as much as facilitate the development of meaning through the process of completing the project behaviors when the answer is not readily apparent (Tiong, 2004). Under the best circumstances, it allows students to become internally motivated and self-regulating (Costa, 2004). PBL is a traditional means of instruction that has been revived recently. Traditionally, students have done independent research projects culminating in a science fair or term paper. More recent incarnations include group projects, service projects, integration of information technology, and even meta-projects such as graduation e-portfolios.

There are a number of things to consider if taking a project based approach to instruction. If groups are going to be used, it needs to be decided if the students or teachers determine the groups, and if homogeneous or heterogeneous groupings are better (Cheong-Agnes, 2004). Project group members must have clear roles to insure participation from all. Teachers will have to determine the level of the student's discussion skills, and explicitly teach how to respectfully disagree. Students should reflect frequently on the progress of the project and adjust plans accordingly, so teachers may need to develop a reflective journal or log (Siang, 2004). Special attention should be paid to lower and higher ability student needs, such as providing scaffolding and/or extensions. Collaborations may need to be made with faculty from different departments, the library, information technology specialists, or industry.

Background on Bahrain Teacher's College

Bahrain is a small island kingdom located in the Arabian Gulf, connected to the eastern provinces of Saudi Arabia by a causeway. It was a British protectorate, and then achieved its independence in 1971. There has been a general movement away from a petroleum extraction economy towards a refining and banking based economy. The last few years have seen increased political and sectarian tensions between the Sunni-led government and the Shia majority.

The Bahrain Teacher's College (BTC) was founded in 2008 to help professional development of teachers as part of a larger education reform movement (<http://www.btc.uob.edu.bh/>). The Bahrain Ministry of Education is trying to refocus the K-12 public school system on preparing students to enter a knowledge based economy. Singapore has been chosen as a model for the new educational system because it is also a small, strategically located island nation, but with a public education system that consistently produces high quality, internationally competitive workers. Project based learning is a natural fit in this new

environment because it is much more similar to the globalized working environment than traditional lecture driven instruction.

Promoting stewardship in public schools: The Green Schools Project

The Green Schools Project was the culminating experience of the third year undergraduate course Project Work in Primary School, a teaching methods class that has been adapted from a similar course used to train pre-service teachers in Singapore by the National Institute of Education (<http://www.nie.edu.sg>). The timing of the Project Work course happens to coincide with the content courses of Environmental Science and Ecology, thereby providing an opportunity for interdisciplinary learning, with the content courses focusing on the science behind environmental issues, and the projects classes allowing for creative addressing of these issues by promoting environmental stewardship in public schools.

The Green Schools Project consisted of a final power point presentation and summary report given during the last two weeks of class (see appendixes A and B). There were fifteen core requirements, described below, mostly adapted from the text *Managing Project Work in Schools: Issues and Innovative Practices* edited by Ho Boon Tiong *et al.* (2004). Students were allowed to choose their own groups of three or four. They were told to pretend to be the science and math faculty at a local primary school: fourth, fifth, and sixth grade science teachers, as well as an optional sixth grade math teacher. The Ministry of Education had asked them to develop a five year plan to promote environmental stewardship among the students at their school both through direct instruction and through the way the entire school operates. During the first class, there was a large group brainstorming session of possible ideas, which allowed all groups to develop some general ideas and begin the project.

The next step was to draft a Gantt chart, which is an organizing bar chart used extensively in large scale engineering projects. It clearly illustrates the timeline of project parts, dependency of interconnected parts, and leadership accountability. Students were asked to generate a draft chart of ten stewardship ideas, and then assign a time and a leader for each idea. The leader's assignment was -to coordinate with the content of their primary school classes. For example, if they decided to use grey water from the bathroom sinks to water plants in the school garden, the fourth grade science teacher would be the leader because that is when the water cycle is taught. The Gantt chart allows for tremendous flexibility to add and subtract projects as new ideas were introduced in both the Projects and Environmental Science classes. The final Gantt chart consisted of between fifteen and twenty ideas to promote environmental stewardship, with only four or five being repeated between groups. This structure allowed students -maximum creative expression, while still being readily gradable. For the final report and presentation, students explained their plan to implement all of the ideas, as well as explicate how they integrated the various general aspects of project work studied in the course. The course was

taught in a traditional fifteen week semester format, and week numbers are based on this schedule. Highlights of the course are outlined below, but adjustments would need to be made if working on a different schedule.

Set up and Introduction of Green Schools Project

As the Projects course introduced issues in managing projects, the students were asked to apply their new knowledge to the Green Schools Project. In the first week, the idea of reflective logs was introduced (Siang, 2004). There is a good deal of variability in reflective logs, from objective summary data, such as simply entering the time and actions taken, to qualitative summary data. In the projects class a few different styles of reflections were used in order to introduce the variety, as well as help with classroom management. Initially the focus was on promoting participation from all students in discussion (See Appendix C). Students were challenged to record their three best comments for the day in order to earn the participation points. This had the effect of increasing participation from shy students, while forcing higher level students to try and focus on quality instead of quantity. By the third week, students had to wait until the end of class to write their reflection, forcing them to reflect, summarize and synthesize the day's learning. As the semester went on, tardiness and professional behavior became an issue, so students were asked to keep track of their own participation through a point system. In the eighth week, students were challenged to summarize the participation of another, randomly assigned student. Finally, in the closing weeks, students were given the chance to write open ended, subjective reflections about what they had learned and how they planned to use it in their professional life. In the final Green Schools project, students had to develop reflection logs for their primary school students.

In the second week of class, students studied how to promote discussion and constructive criticism (Shaetzel, 2004). To practice this, as well as promote individual accountability in the final grades, every student had to lead a discussion of one the textbook chapters. The traditional teaching culture in Bahrain is lecture oriented, so this assignment introduced Bloom's taxonomy, and forced students to develop a question from each of the six levels. Ideally, they would incorporate co-operative learning strategies, such as think-pair-share or jigsaw, for the higher level questions. When linked with the participation points for speaking, the discussions became almost entirely student-centered. In the Green Schools project, generally students were able to discuss and disagree in a professional manner.

In the third week of class, students discussed group formation. After discussing the relative merits of student versus teacher choice in group formation (Cheong-Agnes, 2004A), the Green Schools project groups were chosen. As third year undergraduates, they were mature enough to choose their own groups, although this did create some tensions, due to the limited size of the groups and cultural prohibitions against mixed sex groups. They also had to choose one role from the four possible: fourth, fifth, or sixth grade science teacher, or sixth grade math teacher. These roles reflect their intended profession, so students took them more seriously than

generalized roles, such as speaker or recorder. During the course of the project, responsibilities were rotated so that every student had a chance to develop a complete skill set. In their final presentation, they had to develop a plan to form groups that was appropriate for their future student's developmental level. Most started with the teacher assigning groups in fourth grade, and the students choosing their groups by sixth grade.

Assessment of project work can be problematic (Cheong-Agnes, 2004B): It is usually more complex and subjective than a grading a multiple choice exam. In order to generate fair grades, the projects class used checklist rubrics for all aspects of the class. This allowed students to be assured of earning the grade they desired, while still allowing for creative interpretation of the course content. In the final Green Schools project, students were challenged to develop their own rubrics for primary science students doing one or more of their activities. Many of these were artistic and attractive visually, as well as informative for the students.

Focus on Specific Issues in Project Learning

In the eighth week, the projects class focused on differentiated learning (Chia & Keng, 2004. Yin, 2004). Some general strategies, such as heterogeneous groups based on ability, will help both higher and lower ability students. In the best case scenario, higher ability students learn management skills by peer tutoring lower ability students. In reality, there is the danger of frustration, and the higher ability student attempting to do the entire project. This is where clear monitoring by the teacher can help to force the use of roles, and the sharing of responsibility. Interestingly, the creative and kinesthetic aspects of most project based learning, means that some students labeled as lower ability will show themselves to actually be cases of bright but bored students. In the Green Schools projects, students needed to explain which aspects of their projects would appeal more to which type of learner. Scaffolding and open-ended projects were the most common strategies to integrate all levels of learners. Finally, once students have understood the choices needed to become more environmentally responsible, they can choose to act like stewards in their personal life, regardless of academic ability.

The role of sixth grade math teacher was in many ways the most difficult, the Bahrain national curriculum does not lend itself explicitly to environmental issues, so these students often ended up taking jobs not wanted by the others. To address this, week 10 focused on problem based approaches, with an emphasis on primary math. Using free downloads from Facing the Future's Real World Math textbook (<http://www.facingthefuture.org>, 2012), students explored real word problems in sustainable design and carbon footprint calculations. For the Green Schools project, they need to integrate one of these lessons, but they were encouraged to develop their own or explore the other lessons in the textbook.

In week eleven, the projects class focused on industry or non-profit partnership. Students were introduced to the work of the United Nations Environment Program (<http://www.unep.org.bh/>), whose west Asian regional office happens to be located in Bahrain.

For the Green Schools project, students need to use their local knowledge to create a theoretical partnership. These ranged from getting local organic farmers to help start a school garden, to visiting wastewater treatment plants, or helping a local non-profit to plant mangrove seedlings. It is recommended, however, to have students show some evidence of having actually contacted the proposed industry or non-profit, so as to increase the likelihood they will actually pursue the idea in the future.

Week twelve focused on integrating story and drama into the project (Tan & Netto-Shek, 2004). Traditionally, science and math are considered serious subjects in Bahrain, so the idea seemed rather foreign to most students. However, after the discussion and a few example techniques, most were able to at least think of some theoretical possibilities. Some improvisation techniques, such as hot seat, lent themselves to regular classroom practices (Stinson, 2004). In the Green Schools project, ideas included having primary students act out the water cycle, pretend to be members of a food web, or even have a year-end play integrating the environmental learning from grades four through six. This was one of the most fun aspects of the project for both students and the instructor.

In week thirteen, the last week before final presentations, the projects class focused on integrating information technology (Chee *et al*, 2004) and libraries (I-Sha & Ping, 2004) into the project. Due to the rapidly changing nature of technology, the textbook was already outdated. Furthermore, the reality of most Bahraini school libraries is a paucity of space and materials. Students seemed intrigued by the level of quality of the libraries in Singapore, but at a loss for how to create the same in Bahrain. Fortunately, Internet access is spreading rapidly in the Bahraini public schools, which will allow for more research opportunities than in the past. In the Green Schools project, student ideas ranged from the basic, such as power point and word processing, to the advanced, such as on-line magazines and videos of environmental stewardship in action. With the lowering of cost and ease of technology use increasing, it is hoped that all of the future teachers will use technology on a daily basis in their classroom.

To conclude their presentation, students were asked to honestly speculate on how much of their Green Schools project could actually be implemented when they teach. Most of the students honestly predicted that only one or two of their ideas might take hold. They predicted a lack of support and understanding by the administration, fellow teachers and parents, as well as a need to focus on the core curriculum, would prevent the public schools from adopting their ideas. While this is frustrating, change takes time. One or two projects may plant the seed for systemic change.

Conclusion:

The integration of project based learning with sustainability may seem like a natural fit. However, both concepts are foreign to the public school teaching in Bahrain, so it often felt like too much, too fast. When comparing the final products with the first day brain storm, it was obvious that students had many more ideas about how to promote sustainability education both within the classroom and in the daily operations of the school. Even if most of them could not be implemented immediately, the idea is there, and may be implemented in the not too distant future. However, one obvious strength of project based learning is the possibility for kinesthetic learning to integrate traditionally marginalized students. This approach allowed for the development of discussion and presentation skills about project learning, but failed to actually create change. Ideally, the following semester students should choose to implement one of their favorite project ideas at the teacher's college, thereby putting the ideas of sustainability education into practice, thereby raising awareness among all campus visitors.

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Appendix A: Presentation Grading Form for Group Presentation with Power point.

<i>Quality of presentation</i>	<i>Points Earned</i>
<p>Content:</p> <ol style="list-style-type: none"> 1. Title slide 2. Present summary introduction. 3. Include a five year Gantt chart for your plan: Clearly explain who will do what and the timeline for completion. 4. Multiple ideas for promoting stewardship at the 4-6 Grade level. 5. Grade appropriate plan for forming teams. 6. Grade appropriate plan for promoting discussion skills 7. Give one sample rubric for a project. 	<p>/50</p>

<p>8. Summarize the reflective log you will use with students.</p> <p>9. Explain how you will integrate gifted and lower ability students.</p> <p>10. Give at least one example of problem based approaches.</p> <p>11. Give at least one example of a potential Partnerships with Industry</p> <p>12. Give at least one example of use of Storyline or Drama.</p> <p>13. Give at least one example of an IT or Library Partnership.</p> <p>14. Conclude by speculating on which parts of your project will be the easiest and which will be the hardest to implement.</p> <p>15. References slides- 7 sources in APA format.</p>	
<p>Project is professional in appearance. The presentation is laid out with effective use of headings, font styles, and white space.</p>	
<p>Project is complete (15 slides min.).</p> <p>Critical vocabulary is translated into Arabic.</p>	
<p>At least five images are used, and are integrated throughout the presentation.</p>	
<p>Rules of grammar, usage, and punctuation are followed. Spelling is correct.</p>	
<p>Presentation shows originality and integration.</p>	
<p>Oral Speaking Skills:</p>	

Group Integration: A. All four members speak approximately equal amounts of time. B. Group member speaking about each project item coordinates with Gantt Chart lead. C. Presentation lasts from 30-50 minutes. Volume:	
Eye contact	
Speed	
Enthusiasm	/50

Appendix B: Final Green Schools Paper Rubric

1. A graphic organizer for the entire class, this could be your Gantt chart.
2. Present summary introduction. Include a five year Gantt chart for your plan.
3. Clearly explain who will do what and the timeline for completion.
4. Multiple ideas for promoting stewardship at the 4-6 Grade level.
5. Grade appropriate plan for forming teams.
6. Grade appropriate plan for promoting discussion skills.
7. Give one sample rubric for a project at each grade level.
8. Summarize the reflective log you will use with students.
9. Explain how you will integrate gifted and lower ability students.
10. Give at least one example of problem based approaches.
11. Give at least one example of a potential Partnership with Industry.
12. Give at least one example of use of Storyline or Drama.
13. Give at least one example of an IT or Library Partnership.
14. Conclude by speculating on which parts of your project will be the easiest and which will be the hardest to implement.
15. Your summary paper should present in writing the above categories in a formal 8-12 page paper.
16. Be sure to cite your textbook and at least seven other sources of information using APA style both in-text and at the end.

Appendix C: Daily Reflection Log

Name _____

Time of arrival _____ Take one point for every minute late. _____

Time of arrival from break _____ Take one point for every minute late. _____

Amount of time spent actively studying without distractions since last class _____.

Give yourself one bonus point for every minute beyond one hour _____.

- 1. Review: What do you remember from last class? Record any interesting thoughts, or questions that have come to mind since then.**

Grade the quality of your response _____/20

- 2. What was your best contribution to today's class? It could be a question, a comment, or something else, like building a model.**

Grade the quality of your response. Consider your English language skills, your past studies in Environmental Science, and Bloom's taxonomy. _____/20

3. What was your second best contribution to today's class? It could be a question, a comment, or something else, like building a model.

Grade the quality of your response. Consider your English language skills, your past studies in Environmental Science, and Bloom's taxonomy. _____/20

4. What was your second best contribution to today's class? It could be a question, a comment, or something else, like building a model.

Grade the quality of your response. Consider your English language skills, your past studies in Environmental Science, and Bloom's taxonomy. _____/20

5. What I learned! Please complete the following statement:

Before today, I thought _____, but after today's class I think _____.

Grade the quality of your response. _____/20

Your total daily participation score _____/100

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