Cape Cod Cranberry Growers' Association (CCGA)
Implementation Stories from STEM PBL Field Testing Teachers

Institution/Grade level: High school freshmen in Maryland

Course: Problem Based Learning Course (stand alone 0.5 Credit Course)

Class size/group size: 121 students

Challenge level: Open

Details of Implementation:

This was not the first STEM PBL Challenge I field-tested – I field-tested the RSL Fiber Systems Challenge with grade 10 (see page 9). I implemented the CCGA Challenge in my Problem Based Learning Course, which is a stand-alone course.

I facilitated the class by introducing the Challenge. Students were randomly assigned to working groups. I monitored student discussions and answered questions by redirecting students to ask each other within their own group. The students were "acting as consultants" and had to create a "bid" for the redesign of the cranberry bog. I showed the select pieces of the Challenge as appropriate.

As freshmen, this is their first year in their PBL Course. Our main focus is working on collaboration, as many of our 9th grade students confuse this with cooperative and/or group work. Therefore, constant monitoring, and at times direct intervention, was necessary to redirect students and/or groups to stay in collaborative mode.

There were numerous problems within several teams, and other teams had few problems, if any. Constant monitoring, and occasional verbal redirects were necessary. There were no problems with the Challenge itself, but in assisting students in understanding our program's goals for the module within the course. Anecdotal records were kept and these were reviewed with students.

Our students had access to computers with Internet access and all of the software programs accessible within our STEM program.

Our 1st year PBL course has 3 main foci:

1. Acclimating our students to working with professionals in a professional manner (soft skills).
2. Working with peers in randomly selected groups – getting over the "like/don't like" aspect and focusing on the professional approach.
3. Collaborative skills.

Presentation is not the main emphasis in the 1st year course. Thus, students were asked to create a media and or model/poster and then to present their ideas to their classmates. Students were permitted note cards as necessary. These presentations were not videotaped and were not peer reviewed. However the product/plan itself was reviewed and students were permitted to ask presenters questions regarding their product or plans.

Assessment:

The groups were asked to self-evaluate their presentation in terms of important points, not presentation skills or style. Team participation was assessed via journal entries on self-evaluation/reflection and peer evaluations and teacher observations. Collaboration checklists were also implemented.

Instructor Comments:

This was the students' 3rd Challenge in their 1st course. They were excited to be able to use some of the skills they were learning in other classes. The experience was a positive one. The students would have loved a chance to have a webinar with the parties involved, to ask questions and then to present their ideas.

Student Comments:

"[This project increased my confidence in my science skills] by making me think more inventively."

"It helped with my understanding of the scientific process and solving problems."

"The Challenge had nothing to do with our science class. Chemistry doesn't deal with cranberry bogs."

"It has shown that the science and engineering skills we have learned are actually paying off."

Fall 2010

FloDesign and RSL Fiber Systems
Implementation Stories from STEM PBL Field Testing Teachers

Note: As part of our Alliance Schools Program, which connects secondary and post-secondary institutions by geographic region to create a student pipeline to higher education, these Challenges were taught jointly by a high school teacher and a university professor.

Institution/Grade level: Freshman through senior year high school students and university students in Texas

Courses: Digital Electronics and Principles of Engineering (high school; after school); Electrical Engineering (university)

Class size/group size: 14 students (6 from high school and 8 from university)

Challenge level: Open

Details of Implementation:

This was the first time a STEM PBL Challenge was field-tested jointly by high school and university students in Longview, TX. Two Challenges were tested: RSL Fiber Systems and FloDesign. Four groups combining high school and college level students were assembled (6 high school students and 8 college students in total). The groups were presented with open-ended Challenges, which they completed over a 6-week period. The high school and university students connected for 2 hours once a week after school with the instructors, alternating campuses over 6 weeks.

Students utilized the Whiteboards for 4 weeks and had two weeks to build and test their prototypes, and to implement their solutions. Electronic labs and computer labs were available to students at both the high school and university level to use as resources. Instructors made themselves available to students over the 4-week period during which students completed their Whiteboards. The instructors encouraged students to work on their own during the last two weeks of the Challenge, which was used for prototype building and implementation.

Students designed, built and tested their solutions. They prepared PowerPoint presentations, which were presented to the class, and technical reports based on the results of their research and prototype testing.

Fall 2010

Assessment:

Assessment was based on students' PowerPoint presentations and technical reports. The university students were graded for their participation in the Challenge. The high school students, who participated in the Challenge as an extra-curricular activity, did not receive a letter grade.

Instructor Comments:

Our experience has been a positive one. We could tell that both groups of students gained from the experience: the high school students were energized by working with their older, more experienced peers, while the university students were eager to lead and include the high school students in the Challenge.

We found that students like to be presented with problems that are real, not a textbook experiment. They like to feel that their solutions can make a contribution to society. At the same time, students somewhat resisted the open-ended format in that they did not like the idea of having several possible solutions to one problem.

Student Comments:

The following comments were obtained from participating high school students.

"Honestly, no [it did not increase my confidence in my science skills] because I realize that there is so much that I still need to learn."

"I feel like I can research and take care of some things on my own, without having to ask for help as often. Also, it let me strengthen my reasoning and deduction skills."

"It did help me a lot because I learned key aspects about energy conversions, mechanical advantage calculations, and energy storage methods, which before I didn't know anything about."

TTF Watershed Partnership
Implementation Stories from STEM PBL Field Testing Teachers

Institution/Grade level: College sophomores in Massachusetts

Course: Biology

Class size/group size: 20 students

Challenge level: Structured

Details of Implementation:

This was my first time implementing a STEM PBL Challenge, which I implemented over one 4-hour time slot. Students performed their research in the library and used multiple study rooms to break out into smaller group discussions. I gave the students a checklist of Challenge-related concepts with which they were to check off “Know/Don’t Know/Think I Know” prior to watching the Introduction, Organizational Overview and Problem Statement videos.

I showed the videos mentioned above and established the teams. I gave the students their Whiteboards and study rooms to work in, then circulated to ask and answer questions, though the students actually needed very little guidance/prompting from me.

We reconvened for the Discussion video after which I sent the students back to revise their work. Students were asked to use a different colored pen to revise their Whiteboards post Discussion. We ended the day with the students’ PowerPoint presentations.

During the next class I asked the students to go through the “Know/Don’t Know/Think I Know” checklist a second time once they completed the Challenge so they could self-evaluate what they learned. Students were also asked to create a concept link, rather than an entire concept map, during the first class (there was not enough time to complete an entire concept map). I asked them to revisit this concept link in the second class, so they could see what they learned. I also assigned an individual project report, which was due a few days later.

Overall, the teams worked well. I think the time crunch helped to keep students focused. Some students clearly did better quality research than others, but they all contributed. I allowed the students to use laptops with wireless Internet, the library facilities (though few used these), and reference librarians (no one accessed this service).

Assessment:

I graded the students’ individual project reports, but did not assess team participation. I plan to work team assessment into the next Challenge.

Spring 2011

Instructor Comments:

My reaction was that students seemed to like problem-based learning! They were engaged in solving the problem, and most pushed themselves and their teammates to better understand the issues. I was impressed with the solutions the student teams developed. I taught these students zero environmental science. In fact, we had only met once when I introduced this Challenge.

Student Comments:

"Simply being able to come up with solutions and understanding how they work has definitely increased my confidence."

"This has made me use my science skills to get at a conclusion and as a result has made me more confident in myself."

"The experiment didn't feel very scientific. Mostly, I looked stuff up on Google and discussed it, which I do a lot of anyway."

"Seeing the research side of science helped me to remember that science is not just results. There is a lot of work put in before results are obtained."