# Seed By Design

## Reflection

Comments from Joyce G. Valenti

The learning experience is an excellent way to integrate math, science, and technology. I found that my seventh graders and tenth graders thoroughly enjoyed the entire experience and the heterogeneous grouping of my students was fine for the learning experience. The fact that students work in cooperative teams and that there is a diversity of activities within the learning experience helps to meet the needs of all learners. The activity certainly engages students' interest and presses them toward learning. The learning experience can accommodate all learning styles and all academic levels. It also can provide gender equity. I found the girls were just as engaged as the boys in all aspects of the activity.

To better meet the needs of all learners, the teacher may need parent volunteers or students from high school classes to come and assist in the logistics of the trial runs. If graphing the data by using the guidelines outlined in the procedure is desirable for all students, access to graphing calculators or graphing software can aid in the mechanics of accomplishing the task.

The learning experience can support student progress toward attainment of the learning standards by having students keep a "learning log" throughout the entire time. The "learning log" can be collected at the end of each day for the teacher to read to monitor students' progress and also modify or further expand on directions given.

The learning experience can expand connections to other learning standards. More extensive mathematical analysis can be achieved. One way to accomplish this is to use a digital camera or video cam to record actual seeds to computer memory. With the help of "digitized software", students can analyze structure of the seeds (e.g. surface area and the distance traveled for wind seed dispersal). Test runs of student-designed "artificial wind-dispersed" seeds could also be videotaped. This would allow teams to view "instant replay" trial runs for further observations and comments. Students could also take their redesigned "artificial seeds" and using one variable at a time, generate hypotheses to test the new seed under other controlled circumstances. Some examples include varying wind speed and varying wind intensity.

The entire learning experience allows students to construct their knowledge. The learning experience can be performed not only by Life Science students, but Biology, Applied Sciences, Physics, Technology, and Math students. Modifications can be made to any level. It can be a stepping-stone for other

connections between "mother nature" and technological applications. It is a learning experience that could relate to a future bioengineering problem in the real world. It provides the process for real-world application and problem-solving strategies.

It is a learning experience that supports the creative spirit and curious nature of students. It is challenging, doable, FUN, and SAFE. Cost is minimal. The supplies provided to student teams can be modified according to the material resources available. Input for modifications of these supplies can be also provided by teacher and students as a pre-activity exercise.

Assessment targets group accountability (the design and cooperative roles) and individual accountability (graphing component, class participation, and self-reflection). Extensions of this learning experience include:

- connecting bioethics/philosophical issues with follow-up class discussions. For example: What if we control the seed-dispersing mechanisms of our planet?
- opportunity to practice technical skills (writing statement, criteria, possible solutions, optimization, explanation statements, etc.).
- opportunity for student teams to engage in skills of engineering design such as producing technical drawings of their seed design (top view, several side views) and use of CAD drawings.
- further investigations of the student-designed "artificial wind-dispersed seeds" by varying the wind speeds (modeling the Beaufort Scale of Wind Speed used in Earth Science classes).
- performing trial runs of student-designed "artificial wind-dispersed seeds" outside the classroom for data collection in the physical world environment
- providing all student teams with a standard artificial seed prototype and have them compare the performance level of the prototype seed to their seed design.
- assessing knowledge constructed by individual students through:
  a) creating a problem-solving activity that includes a future scenario of a seed dispersal disaster and how the applied technology could provide the seed dispersal mechanism;
  b) writing a test question where students must compare two hypothetical seeds (observations and important measurements provided) and choose the seed which would disperse more efficiently and provide a thorough explanation for choice.

I would like to acknowledge Mr. Patrick Haines, a regional biology mentor who inspired me with the topic of seed dispersal. I greatly modified the CIRBM Seed Dispersal Lab to adapt to the Life Science and High School Biology classes and to emphasize the learning standards.