The Impact of Using Professional Development Workshops in Biotechnology on Life Science Teachers’ Knowledge, Willingness and Confidence in Incorporating Biotechnology Skills in the Science Classroom

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ABSTRACT

The purpose of this project is to examine if the results of increasing the use of biotechnology skills in the life science classroom in the school year 2011-2012 will continue into the 2012-2013 school year. Four professional development workshops on biotechnology skills (pipetting, gel electrophoresis, blood typing and ELISA) were given in 2011-2012 to life science teachers and equipment lockers were established for each of the workshops. The lockers contained all equipment needed to perform the activity as well as curriculum materials. Of the seven life science teachers, all but one checked out at least one locker with 4 teachers checking out all four. One professional development workshop on Microarrays will be given during the 2012-2013 school year and the other lockers will be reviewed. Data will be collected using pre/post surveys on teacher knowledge of biotechnology skills, confidence and willingness to use the lockers in their classroom. The number of teachers checking out the lockers and the total number of students impacted will be recorded and a teacher journal reflecting on comments of life science teachers made during informal sessions will be completed.

RATIONALE

The purpose of this project is to examine if the results of increasing the use of biotechnology skills in the life science classroom in the school year 2011-2012 will continue into the 2012-2013 school year. As an ICORE participant in 2011, I received a grant with the purpose of increasing the use of biotechnology in the science classroom. I felt that the best way to reach as many students as possible would be to conduct a series of professional development workshops for teachers. It was hoped that these teachers would then take their new biotechnology skills back to their classrooms. Four professional development workshops were organized and presented during the science department’s professional learning communities.
The money from the grant was then used to purchase equipment to establish equipment lockers that teachers could use in their classrooms. In addition, curriculum was written and included in the lockers. Pre and post surveys were done in order to examine if teacher’s attitudes and comfort level changed from before the workshops to after. The project was successful in that 6 of the 7 life science teachers utilized at least one of the lockers with 4 teachers using all four. The survey demonstrated that the professional development opportunities increased their confidence and willingness to incorporate the skills into their classroom. Three teachers had admitted that because they were not knowledgeable about biotechnology lab skills, they did not want to teach these skills in the classroom. The one teacher who did not utilize any of the lockers felt that her students would not “be able to do them.”

Advancements in the biological sciences are increasingly dependent upon biotechnology. It is imperative that the skills and knowledge needed for scientific research and science based jobs be included in the high school curriculum. According to Moreland, Jones, and Cowie (2006), “Teacher knowledge was identified as the most important factor influencing ease of providing technological experiences, particularly for primary teachers” (p. 145). Mansius and Hanegan (2008) demonstrated that while many teachers incorporate the topics of biotechnology into their classrooms very few use the equipment necessary for biotechnology. Many current teachers have not been exposed to these technology based skills and so have difficulty incorporating them into their curriculum (France, 2000). This was supported in the study by Mansius and Hanegan which identified reasons as to why teachers did not incorporate lab based biotechnology skills into their course. These reasons were identified as: time, money, no standard on biotechnology in the curriculum and lack of teacher confidence in using equipment related to biotechnology. The lack of knowledge and skills by high school teachers is a limiting factor in student involvement in biotechnology. Students will be unable to develop necessary skills if teachers are not knowledgeable and comfortable with emerging technology. When teachers are uncertain with respect to biotechnology, that topic may be avoided. Mangione-Leslie, Dockers, and Wavering (2005) found that a correlation between knowledge and confidence; if a teacher did not have confidence in what they were teaching, there was no increase in knowledge of that topic by the teacher. As such, students are graduating without vital skills or career awareness needed to meet the demands of a job force increasingly dependent
upon biotechnology. While the need for biotechnology education is not argued, the lack of teacher knowledge and skills limit the use in the classroom. Additionally, in the current financial climate, funding for equipment is not available.

It is hoped that the professional development, inquiry activities and the use of biotechnology equipment in a real world setting taught last year will encourage teachers to continue to take these skills into the classroom to engage and encourage students to realize the importance of science and biotechnology. Students will be able to develop necessary skills enabling them to be active participants in scientific inquiry, problem solving and the academic and workforce-focused pathways to careers in biotechnology. This knowledge is necessary for the highly skilled jobs of the future.

The University of Florida’s Center for Precollegiate Education and Training (CPET) offers programs to teachers to assist them in the use of biotechnology in their classrooms. Their mission is to, “…promote and support the use of the facilities and faculty of the research university in the preparation and enhancement of science and technology teaching at the secondary education level” (retrieved 6/23/11 from http://www.cpet.ufl.edu/about.html). As a 2011 participant teacher in CPET’s ICORE Program (Interdisciplinary Center for Ongoing Research Education) as well as a 2012 participant teacher in the Bench to Bedside Program (B2B), I was immersed in the use of biotechnology to teach biological concepts. This program makes available to participants equipment lockers to use in their classrooms. As such, the equipment and resources are limited to those who participated in the program and are dependent on a time schedule as all ICORE and B2B participants have access to these lockers; use is limited to one week. This would be a wonderful program to institute at our school and eventually at the district level. The purpose of this project is to examine the impact of using professional development workshops in biotechnology on life science teachers’ knowledge, willingness and confidence in incorporating biotechnology skills in the science classroom.

**ACTION RESEARCH INTERVENTION**

There were seven life science teachers at Celebration High School who participated in the professional development workshops on biotechnology during the 2011-12 school year. Of those
seven teachers, all but one utilized at least one equipment locker and four teachers utilized all four. One of the seven teachers has left our school and a new biology teacher has been hired. To extend the project from last year into this year, I will develop a new professional development workshop on microarrays and establish an equipment locker to go with that using the mini-grant from B2B. I will also review the previous workshops and equipment lockers. The new biology teacher will receive one-on-one professional development assistance if needed. The professional development will take place during a regularly scheduled PLC during the first half of the year. Objectives are to familiarize life science faculty with a microarray and their uses. A hand-on approach will be used with the teachers doing the same microarray that the students will be doing. An equipment locker will be established with necessary supplies and curriculum.

**CONNECTIONS TO BENCH TO BEDSIDE SUMMER INSTITUTE**

The concepts for the professional development workshops and the equipment locker idea came directly from my involvement in ICORE and B2B. I received an additional grant last year for $2000 which allowed me to purchase equipment for the lockers and the mini-grant this year from B2B will allow me to develop an additional equipment locker on Microarrays. All of the lockers have equipment and curriculum based on what I learned in the summer institutes: Pipetting, gel electrophoresis, blood typing, ELISA and Microarrays.

**DATA COLLECTION AND ANALYSIS**

Both qualitative and quantitative data will be collected. The number of times the lockers are utilized, number of students impacted and using a Likert Scale for the pre and post survey will allow collection and analysis of quantitative data while analysis of open ended questions on the survey and journal entries will allow a qualitative aspect to be utilized. Quantitative data can be displayed using charts and appropriate graphs while themes and supporting quotes will used to analyze qualitative data.

Data will be collected by administering a pre-/post- survey identifying participating teachers’ knowledge on biotechnology, confidence in implementing biotechnology skills in their classrooms as well as willingness to utilize the lockers and associated activities. A timeline of when teachers plan on implementing the skills will also be determined. With the End of Course
(EOC) exams in biology, many teachers feel a time constraint in doing labs and activities that may require more time than available. Last year, many of the teachers did the activities after the EOC exam in May. This allowed them approximately 5-6 weeks of time to do “fun” things that were not able to be done during the school year. A log on locker check out will be maintained to see the number of times they are checked out, the number of students impacted and when in the curriculum they were utilized. I will also keep a journal reflecting on comments and thoughts observed during information conversations with participating teachers.

REFERENCES


BUDGET

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PERMISSIONS

None needed
APPENDIX

Pre Survey

1. How confident are you with the biotechnology skills you learned last year? (1 not at all and 5 is extremely confident)

   - Pipetting
     1  2  3  4  5
   - Gel Electrophoresis
     1  2  3  4  5
   - Blood Typing
     1  2  3  4  5
   - ELISA
     1  2  3  4  5

2. Will you incorporate these skills in your classroom?
   Yes          No

3. Do you plan on using the equipment lockers?
   Yes          No

4. If yes, which ones?
   Pipetting   Gel Electrophoresis   Blood Typing   ELISA

5. If you plan on using the equipment lockers and biotechnology skills in your classroom, when do you think you will do this?

6. Would you like help in your classroom when you implement these skills? Why or why not?
7. Please comment on how comfortable you feel using the equipment lockers and curriculum in your classroom.

8. What do you feel are constraints to implementation of biotechnology in your classroom?

9. Additional comments.

Post Survey

1. How confident are you with the biotechnology skills you learned this year as well as last year? (1 not at all and 5 is extremely confident)

   Pipetting
   1  2  3  4  5

   Gel Electrophoresis
   1  2  3  4  5

   Blood Typing
   1  2  3  4  5

   ELISA
   1  2  3  4  5

   Microarrays
   1  2  3  4  5
2. Did you incorporate these skills in your classroom?
   Yes
   No

3. Did you use the equipment lockers?
   Yes
   No

4. If yes, which ones?
   Pipetting  Gel Electrophoresis  Blood Typing  ELISA  Microarray

5. If you used the equipment lockers and biotechnology skills in your classroom, when did you do this?

6. Did you receive help in your classroom when you implemented these skills? Why or why not?

7. Please comment on how comfortable you felt using the equipment lockers and curriculum in your classroom.

8. What do you feel were constraints to implementation of biotechnology in your classroom?

9. If you used the skills and equipment lockers, please comment on student reactions. Do you feel students were engaged and learning? Do you have examples to support your thoughts?
10. Additional comments.