Strengthening Students’ Science Foundation and Exposing Them to Their Career Opportunities in Biotechnology in Hopes That Those Students Will Obtain a Science Degree

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Title: Strengthening students’ science foundation and exposing them to their career opportunities in biotechnology in hopes that students will obtain a science degree

Abstract:
The reason for conducting this study is due to the decreased rates of students that pursue degrees in science. It is not clear if the reason for this slump is due to students not being able to finish these degrees because of their difficulty or if they just don’t see the career opportunities in these fields. This study aims to strengthen students’ science foundation and expose them to career opportunities in biotechnology. The hope is that this study will increase the probability that students will obtain a science degree. In order to do this I will first teach students the basic foundations of biotechnology. I will then have them complete virtual labs, followed by wet labs, and finally an activity that will tie all of the concepts together so they understand how to complete a method and what it means.

Rationale:
A concerning trend that seems to be emerging from students in our schools is that students are either not enrolling in science majors, or they are enrolling in the major but are not sufficiently prepared in the sciences to stay in those majors. In a study done in 2003, 24,599 8th grade students were surveyed and asked if they would pursue a degree in science. Out those only 827 students said that they would pursue a degree in science. From the 827 8th grade students that said they would pursue a degree in science only 176 were pursuing that degree 6 years later (Mau, 2003, pg 238).

It seems that somewhere between completing high school and entering the first 2 years of college these students decided that pursuing a science degree was not for them. Whether it was from a lack of exposure to the careers or a lack of preparedness in the sciences we do not know. We do know that 583 students switched to non-science degrees and 68 dropped out of school altogether (Mau, 2003, pg 238). This seems to imply to me and that the students thought that the science degree was too hard and that the other degrees would be easier to accomplish.

This attitude that if the students can’t do it then they should quit is not solely the fault of the student, it seems this is something we the teachers are showing them. In 2009, ACT Inc. who conducts the ACT examination for students entering college surveyed 2,761 teachers from high schools around the country. They found that teachers who have students that are not college bound tend to have lower standards of education for those students as opposed to students who are college bound. Therefore, non college bound students are receiving lower rigor in their classes than students who are college bound (ACT Inc.,2009, pg.34).

The area of biotechnology is not only for students who graduate with a post-secondary education but also for students who have simply earned a high school diploma. Those students who are graduating with only a high school
diploma can still enter the field of biotechnology as a lab assistant. Those students who become lab assistants directly out of high school can make between $24,000 and $33,000 a year (Grillo, 2007, pg.8). The caveat however is that these students must have 1 to 2 years experience in a lab. However, The only way these students can receive this experience is if we the teachers give the students the opportunity to receive this experience. If we allow them to learn about these techniques they could eventually support them in their endeavor to pursue biotechnology jobs after high school. But even before that happens the students must know of their opportunities in these fields, and if teachers are selling the students short because they deem the students are not capable of college they will not be exposed to these types of opportunities.

The first part of this research will attempt to strengthen the foundations of students in the sciences so that they are prepared to tackle these classes in college. Since that seems to be the reason that students change their science majors I think that if we as teachers try to prepare them more effectively they will be able to pursue these science majors in college. In order to accomplish this I will attempt through my action research interventions to go from students understanding basic concepts in science to being able to see those concepts as part of a big picture. This will allow students to see the relevancy of what they are learning and will hopefully aid in their comprehension of the concepts being taught.

The second part of this action research will help give the students the necessary skills they need to be able to work in a lab if they feel that is something they want to do. I will also expose them to the types of careers that are out there for people in the biotechnology field both out of high school as well as after graduating from a post-secondary institution. Since I teach research at a high school that has approximately 38% economically disadvantaged students, a lot of these students work after school and while they are in college if they do attend college. I feel that if I try to expose and prepare these students when they graduate they can be placed in jobs that can promote their future education and not simply a job that will make them money.

The purpose of this study is to strengthen students’ science foundation and expose them to their career opportunities in biotechnology and to determine if this will increase the probability that students will obtain a science degree.

**Action Research Intervention:**

**Lectures/TED Talks**

I will conduct several lectures at the beginning of the class period on the topics that will be discussed that day. Some of these topics include a basic lecture on what proteins and DNA are. If the students are to understand the higher-level concepts they must understand the basics first. These lectures will be short, teacher directed, and will be for the purpose of communicating basic facts about what we will be learning in class that day. On some days I will wrap up a lesson with a TED Talk that is relevant to the information that has been covered that day in class.
Virtual Labs and Wet Labs
After every mini-lecture the students will participate in a virtual lab. The virtual labs that will be used will include virtual PCR and virtual DNA extraction. The students will have a handout that they will fill out in their student notebook as they complete the virtual lab. Once they have finished filling out the handout we will move on to the actual wet lab, which will match the virtual lab they just completed. The wet lab will also include a handout that they will fill out in their student notebook as they complete the lab. Questions will be asked on the handout and the will be used as part of their assessment piece. I will use these wet labs to give the students the skills they will need to obtain jobs in a lab right either during high school or right out of high school.

Articles and Additional Activities
Once the lecture, the virtual lab, and the wet lab have been completed the students will then read an article on some sort of genetic disease or genetics related study. For example, the students will have an article related to Huntington’s disease, which will examine what Huntington’s disease is, the current methods of screening and its implications, and current research being conducted in this area. I will then relate the current research with the activities that we have been doing and how researchers use the methods to screen for Huntington’s disease and determine genetic family trees. This will hopefully give students the intended outcome of seeing these concepts as part of a big picture and therefore strengthening their foundation in the science behind the activity.

Connections to Bench to Bedside Summer Institute:
I will be addressing basic topics such as DNA, proteins, and basic lab techniques such as pipetting. I will also be doing virtual and wet labs for PCR and DNA extractions. I will then be applying these concepts to genetic trait trees, genetic diseases, and genetic counseling to adhere to my study, which is showing students the concepts as part of a big picture. All of the concepts listed above are activities or topics that were addressed in the Bench to Bedside Summer Institute. I will also be incorporating power points used in the Bench to Bedside Summer Institute by various speakers in my class lectures to reinforce this connection.

Data Collection and Analysis:
The data that I will collect will be both quantitative and qualitative. In terms of qualitative data I will incorporate a teacher’s journal. I will use this journal to reflect upon my action research intervention and will adjust what I am implementing in the classroom as I see necessary depending on student responses. I will also implement a student notebook to keep track of student learning during the labs and activities.
In terms of quantitative data I will give the students an overall pre-test at the beginning of the unit followed by a post-test at the end of the unit. This data will be averaged to determine the overall learning gains of the students. I will also perform statistical data measurements (such as standard deviations) to determine if the difference between the pre-test and post-test is statistically significant. I will also give the students a semantic differential survey on their career awareness of biotechnology related careers before and after the unit to determine if their interest as well as their knowledge of biotechnology careers has changed. I will determine changes in these values and track those for my study.

**Literature Cited:**


**Budget and Budget Justification:**

I will need materials to complete the Gel Electrophoresis portion of my research. I will use the Carolina Biological Kit called: Nature’s Dice. I have the equipment to do it, but not the reagent kit. Those materials will cost $141.00 from Carolina Biological.

I will also need to borrow a locker from CPET to perform the DNA extraction and PCR portion of the labs. However I have not budgeted any money for that portion of the labs.

I will also use the Science Take Out Kit for Huntington’s disease but I already have that lab therefore no money is required for that lab.

Whatever cannot be covered by the grant given to me by CPET will taken out of my school fund and LHHS.

**Permissions:**

In order to conduct this study I will contact my Assistant Principal and I will provide him with this proposal so that he is aware of what I am doing in the classroom with the students. I will also inform the students of the study ahead of time.