To Clone Or Not To Clone, Hmm…..? That Is the Question

The purpose of this research study is to determine the impact of teaching the development and advancement in science and medical inventions, specifically cloning, on student knowledge and the attitudes related to biotechnology in a Human Body Systems course.

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Abstract:

Emphasis will be on student understanding of how biotechnology has been developed and used in science in relation to the process of cloning. This should enable them to evaluate the scientific, societal, environmental and ethical effects it has had. In addition, it should allow them to make informed and balanced decisions about issues relating to the subject.

At the conclusion of this research, the students should possess the ability to discuss, explain the aspects of cloning to others, including but not limited to what it is (definition) and critically analyze any problematic issues faced regarding cloning as well as stating scientific and medical gains developed as a result of it.

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Rationale:

I am entering my 2nd year in the teaching arena and am privileged to be an instructor at a high school that offers Career Technical Education (CTE) programs. These programs enable students to obtain state certification through testing upon course completion. With this certification the students have the opportunity to transition into the work force during or directly after high school graduation while awaiting entrance into a post secondary school. Some students opt to work in "industry" verses obtaining a college degree. Either way, exposure to the many facets of biotechnology advances, applications and research will aide in preparing them for the work and/or college world. As an instructor I have the privilege and responsibility of impacting the lives of so many through the art of education by imparting knowledge, sharing experiences and by role modeling my passion for the field of science and education.

The Human Body Systems class, the 2nd class in a series of 4, targeted for this research study consists of high school juniors and seniors. My goal is to introduce fundamental concepts and to pique their interest in biotechnology through career awareness while getting them "college or industry "ready using advanced techniques and applications. Cognitive learning of scientific concepts can have a great impact on a student's interest and attitude when learning new material.

Education through science will enable the student to participate in discussions about science, to be skeptical, to question claims made by others about scientific matters, and to make informed decisions about the environment, their own health and well-being (Driver, Newton, & Osborne, 2000; Goodrum, Hackling, & Rennie, 2001; Kolsto, 2001; National Science Council, 1996).

I have found that in order to help students engage in the practice of a scientist, learning context must be chosen so that students can make sense of it, which then in turn, gives them a responsibility to participate critically. Research regarding cloning, as a teaching tool, will involve analysis, synthesis, evaluation, knowledge and comprehension. These are part of the constituents listed on Bloom's

Taxonomy of low and high ordered categories as it pertains to categorizing questions, objectives or responses (Henson, 1993, p. 124).

According to Di Berardino, (1999)," when scientists first discovered anesthesia, atomic energy and recombinant DNA, we did not know if these breakthroughs would lead to deleterious applications. The choices we make for the application of knowledge reside in ethical decisions by humans. Animal cloning, like other research was initiated to seek fundamental knowledge for the benefit of humankind. In addition to expanding the knowledge of cellular development and molecular biology, as well as cancer and aging, cloning has now been applied to enhance medicine and agriculture". There is still a diversity of opinion on using biotechnology and a cultural pluralism about the usage of cloning.

The purpose of this research study is to determine the impact of teaching the development and advancement of science and medical inventions, specifically cloning, on student knowledge, understanding and attitudes in relationship to biotechnology during a Human Body Systems course.

Interventions:

1. **Instructional Technology** using iPad (What Is Cloning, The Clone Zone; http://learn.genetics.utah.edu/content/tech/cloning/whatiscloning/ Provides visual and technological applications.

2. **Group Discussions:** The students will be directed to engage in discussions with their peers in order to reflect on their own experiences, thoughts and feelings regarding science, technology and the topic of cloning. (instructor guidance if students are off topic; self –directed learning encouraged). Dialogue is generally considered a powerful instrument for reflection (Wells, 2000).

3. **Daily Reflective Journaling** (instructor prompts provided). Students will document a journal entry that reflects their "hands on'" experiences, draw conclusions from experiments and complete a fictional form that laboratory researchers use to write down their findings and conclusions during research..

4. **Lab activities:** Provides hands on experiences with the focus on biotechnology's effectiveness in the study of cloning (ex: Click-n-Clone, What Is Cloning, etc.).

5. **Cloning Research**: A 6 page APA formatted written research report to be presented orally to the class enables students to complete further study for greater understanding of the cloning process.

6. **Cases Online**: Benefits –vs.-ethical issues surrounding cloning.

7**. Guest Speaker Presentation**: Dr. Houda Darwiche (The Age of Cloning)

Connection To Bench to Bedside Summer Institute:

The power point presentation (Dr, Houda Darwiche: The age of Cloning), lab activities (ex: Click-n-Clone) and possibly other materials from the equipment locker checkout from BTB will be utilized to complement this lab.

Data analysis:

1. **Qualitative and Quantitative Data**: collected using the Likert Scale via a pre and post survey. Questionnaires/surveys will assess their knowledge of, interest in and personal ethical evaluations of the cloning process.

2. **Level of Understanding Assessment Model:** 1 finger = I do not understand
2 fingers = I have minimal understanding
3 fingers = I understand but need additional explanation
4 fingers = I understand & can explain it to others

3. **Rubric**: Student and instructor each to generate for evaluation of a 6 page APA formatted research project. Student to self grade; an average of the two will be used for final assessment.

4. **Post Test**: To assess the student's knowledge of the content presented, the process, and ethical element of cloning. Students to compose cumulative questions from instructional videos, cloning activities, class discussions and research project content.

Literature Cited:

Di Berardino, Marie A. (1999) 12 Federation of American Societies for Experimental Biologies, Office of Public affairs.

(Henson, Kenneth, T. (1993, p. 124). Methods and Strategies for Teaching in Secondary and Middle school, 2ed. New York, Longman.

Niewswandt, M. (2007). Student Affect and Conceptual Understanding in Learning. Journal of Research in Science Teaching, 44, 98-937.

Wells, G. (2000). Dialogic Inquiry in Education, Cambridge: Cambridge University Press.

Budget Justification:

Miscellaneous Lab Materials: cost to be determined at a later date.

Bus chartered Field Trip to UF NIH (lab activities, science campus tour): cost to be determined.

Permission:

Principal approval for UF field trip

Parental signature for field trip