

Assessment of Pre-College Education and Outreach Program Effectiveness

Summary of 2010-2011 Report

Selected excerpts are presented from Dr. Liles and Ms. Lambeth's detailed assessment of the ERC-RMB's numerous pre-college education and outreach initiatives.

Excerpts from the Assessment of the 2010 Bio-Engineering Institute Summer Camp

In Summer 2010, there was a one-week Bio-Engineering Institute summer day camp for high school students. Drs. Cindy Waters (NCAT) and Steven Abramowitch (Pitt) organized and directed the camp. The Bio-Institute was adapted to introduce high school students to basics in bioengineering, including Tissue Engineering and Regenerative Medicine.

Plan

18 Bio-Institute Summer Camp participants were given pre- and post- general and content-specific assessments to determine the overall quality of the camp experience, as well as to assess change in understanding related to Tissue Engineering and Regenerative Medicine concepts. Prior to data collection, assessment personnel, instrumentation, and procedures were approved by the NCAT IRB.

Summary of Results

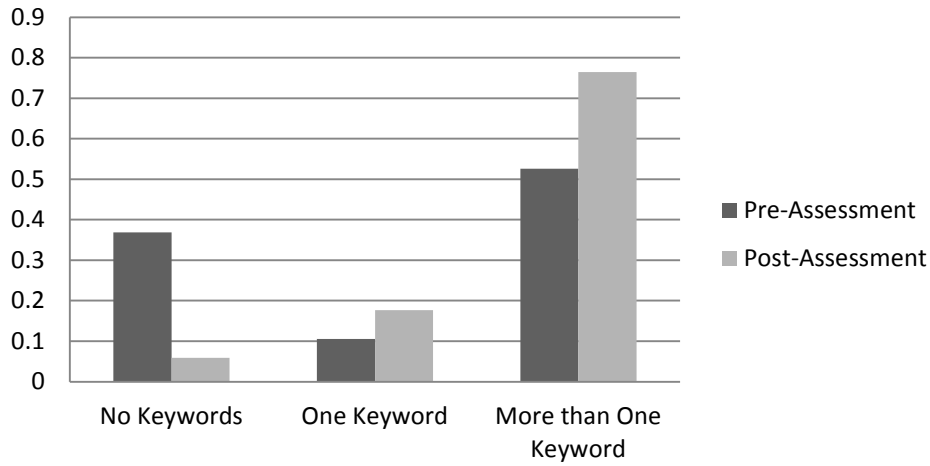
General assessment data indicated the following. Bio-Institute participants ranged from 14-17 years old (M Age = 15.5), and most participants reported having just completed the 9th grade (n = 7). Participants were predominantly male (n = 11) and African American (n = 14). All participants indicated that they (a) held US citizenship and (b) planned to attend a 4-year college. Further, most participants (n = 11) stated they intended to pursue degrees in either bioengineering or STEM-related disciplines. The majority of participants (n = 10) indicated that they learned of the Bio-Institute through one or both parents. Most participants (82%) stated they had prior experience with science experiments and/or science fairs. 26% of the participants reported that they hoped to learn more science through their participation in the Bio-Institute, whereas 23% stated they wanted to increase general knowledge and skills. Most participants strongly agreed or agreed that they were taking part in the Bio-Institute in order to learn more about "biomedical and skin engineering." Likewise, they strongly agreed or agreed that they were interested in science and engineering prior to participating in the Bio-Institute. Focus groups were conducted both for participants and camp counselors

Content-Specific Assessment data suggested that at the beginning of the Bio-Institute participants demonstrated an elementary understanding of the definition of tissue engineering, and tissue. By contrast, post-assessment data revealed that participants experienced a substantive change in understanding and learning related to (a) the meaning of tissue engineering, (b) what makes up tissue, (c) how tissues or cells communicate, (d) DNA, (e) ways to grow new tissue, (f) where stem cells come from, and (g) the fate of an implanted scaffold. Though participants established an adequate and positive trend in understanding and learning across all concepts, four topics remained challenging, specifically:

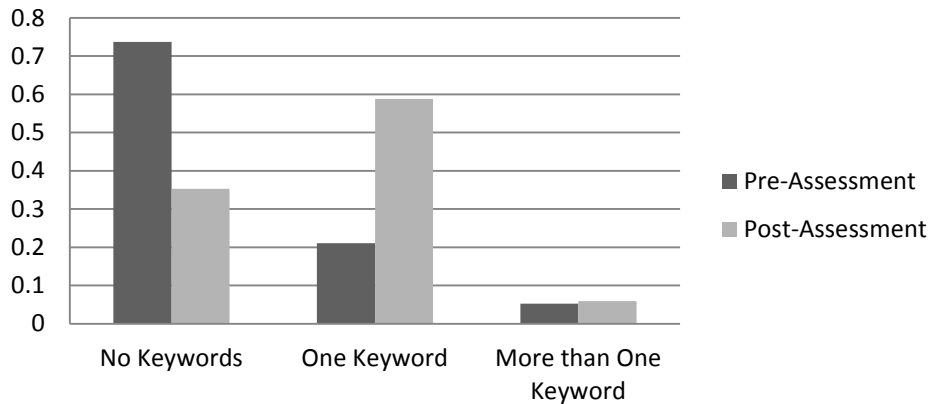
- Human development processes;
- Internal cellular instruction;
- Human body repair processes;

- Three approaches to fabricate new tissue.

What is tissue engineering?



How do cells or tissues communicate with each other?



Camp counselor focus group discussions suggested that camp participants may have lacked some foundation knowledge in order to understand the material. Still, camp counselors indicated that the students seemed to become more interested in science as the camp progressed.

Excerpts from the Assessment of the 2010 REU/RET/YS Programs

Overview

During the six-week research experience, RETs/REUs/YS received classroom and laboratory-based intensive learning experiences, forwarding cutting-edge research surrounding the development and utilization of “smart” metallic biomaterials. Participants were challenged to think with creativity and innovation concerning realistic application of their growing knowledge base.

Plan

Briefly the assessment plan used surveymonkey.com to have REU/RET/YS participants to complete online pre-/post- assessments. The survey questions were designed to encourage participants to explore their thinking surrounding “research and development in a multidisciplinary environment that values diversity of thinking, innovation, and entrepreneurship.” REU/RET/YS participants were also asked to participate in weekly focus groups concerning their research experiences and to complete satisfaction questionnaires following REU/RET activities e.g., field trips and guest lectures.

Excerpts from Results

Understanding of Bioengineering

This varied in the beginning of the program. The media were the main source of introduction to bioengineering, but family and teacher/school counselors were popular too. Participants expected laboratory work to have the greatest value in furthering their understanding of bioengineering. Participants indicated that bioengineering mostly applied to career choice and academic major course of study. They reported greatest understanding of biodegradable alloys as an application in solving societal problems.

Following the research experience, all participants rated their understanding of the bioengineering field as average or above average. Their bioengineering definitions also informed learning. Participants largely credited this learning to laboratory work and interactions with their REU/RET coordinators, researchers, and scientists. After completing the program, more participants indicated that they had given thought to the usefulness of bioengineering in obtaining their academic and career goals. Participants further indicated that bioengineering applies best to their career choice and academic major course of study. Participants’ responses suggested that following the research experience they had given more thought to bioengineering and its useful applications to society. In the post-assessment, participants ranked biocompatible coatings and scaffolding and tissue engineering highest in their usefulness in solving societal problems.

Creativity and Innovation

In the pre-assessment, some REU/RET/YS participants indicated that they were unsure about their understanding of creativity and innovation. However, they expected the discussions about creativity and innovation to enhance their understanding of the bioengineering field. They expected their work in the laboratory to further their understanding of creativity innovation. All participants reported expectations that creativity and innovation would enhance their academic and career development. They indicated that creativity and innovation applied most frequently to their academic major course of study. All RET participants agreed or strongly agreed that creativity and innovation would enhance their teaching and their students’ learning. Participants expected creativity and innovation to be most valuable to the development of, and long-term medical/scientific usefulness of, scaffolding and tissue engineering.

Participants indicated that they had a better understanding of creativity and innovation at the end of the program. The lecture/speaker series and laboratory work were perceived most valuable in furthering that understanding. Participants also concluded that an understanding of creativity and innovation could be useful to their academic and career goals, more so than indicated in the pre-assessment. Specifically, they expected the exposure to creativity and innovation received in

the REU/RET program to enhance their academic and career development. By contrast, they retained the notion that creativity and innovation still best applied to a special interest/hobby and their academic major course of study. Participants' responses agreed that creativity and innovation enhanced their understanding of the bioengineering field. At the end of the program, they had given more thought to creativity and innovation and its scientific applications to societal problems. They reported that creativity and innovation would be most helpful to the development and usefulness of biocompatible coatings and scaffolding and tissue engineering. The RET participants did not expect creativity and innovation components to enhance their teaching or positively impact student learning.

Entrepreneurship

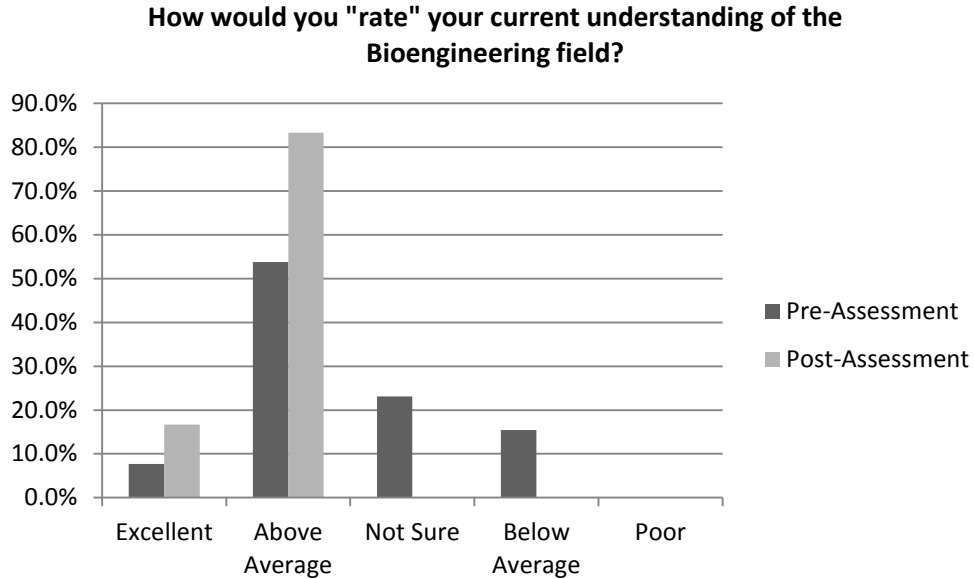
A small portion of the REU/RET/YS participants initially reported that their understanding of entrepreneurship was below average. Participants further believed entrepreneurship applied most to their career choice. They expected the lecture/speaker series to have the most value in advancing their understanding of entrepreneurship. The participants indicated that entrepreneurship would be most helpful to the development of, and long-term medical/scientific usefulness of, scaffolding and tissue engineering.

Following the research experience, no participants rated their current understanding of entrepreneurship as below average or poor, with the majority of the participants rating their understanding as above average. Participants believed that lecture and laboratory work contributed most to their understanding of entrepreneurship. At the end of the program, participants' responses indicated more often that a better understanding of entrepreneurship would be useful to their academic and career goals. Participants were divided on their belief that entrepreneurship would enhance their academic and career development. Focus group discussions suggested that REU and RET participants may have related to the information about entrepreneurship based on how it would be most useful to them individually. Entrepreneurship applied most to career choice and career change. It could be argued that RET participants who were not interested in changing careers may not have viewed entrepreneurship as integral their career development. Nonetheless, RET participants reported that information concerning entrepreneurship would enhance their teaching and positively impact their students' learning. Focus group discussions suggested that one way entrepreneurship may be helpful in the classroom is that it can serve as a bridge to connecting scientific and business concepts. Participant responses also indicated that while some were unsure, most participants expected discussions concerning entrepreneurship to enhance their understanding of the bioengineering field. Participants expected entrepreneurship to be the most helpful to the development and usefulness of biodegradable alloys and biocompatible coatings.

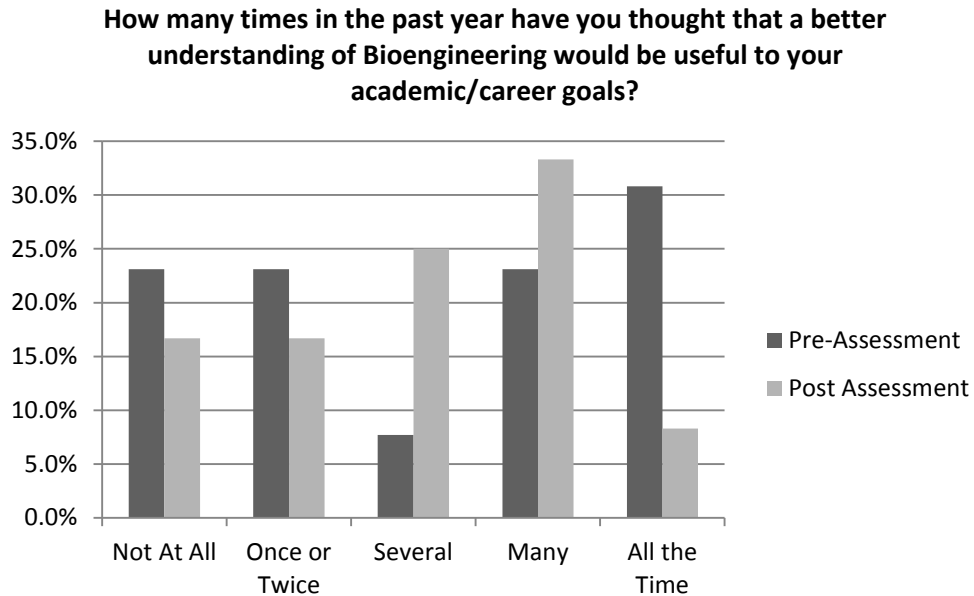
Future Plans

Efforts to improve the ERC-RMB sponsored REU/RET program will be largely predicated upon summer 2010 participant feedback, including several proposed changes to this year's program. In 2011, there will be more focus on recruiting local RET participants. Researchers will be asked to provide a brief summary of their work to be sent to REU/RET participants prior to the beginning of the program. REU/RET participants will then be asked to indicate the line of research in which they would prefer to be involved during the program. For orientation, the first few days of the program will be devoted to lectures on the research topics. Efforts will be intensified to connect RET participants with technology that will aid them in their classrooms.

As well, efforts will be enhanced to provide RET's with instruction in teaching module development. More field trips will be offered. From an assessment point of view, efforts will be put forth to establish clear student learning outcomes for REU/RET experiences.



Prior to the research experience, many participants indicated that they were Unsure or Below Average in their understanding of the Bioengineering field. Following the research experience, all participants rated their understanding of the Bioengineering field as Average or Above Average. Their definitions of Bioengineering also show growth.



Following the research experience, more participants indicated that they had given thought to a better understanding of Bioengineering being useful to their academic/career goals.