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STUDENTS AND TEACHERS ENHANCING PERFORMANCE IN SCIENCE (STEPS)

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Students and Teachers Enhancing Performance in Science (STEPS)

Synopsis:

The purpose of the exploratory study is to evaluate the impact of an innovative technology integrated summer camp. The camps merged anatomical concepts with various forms of technology. The participants were middle and high school students and teachers from the surrounding school districts. The participants used virtual dissection tables, mini-drones, and virtual reality goggles. Data was gathered from the participants' completed exercises, questionnaires, and open-ended questions.

Students & Teachers Enhancing Performance in Science (STEPS)

Abstract

Technology was originally believed to the panacea for our nation's "failing schools." Currently, technology is now seen as an expensive way of making antiquated pedagogical practices "cooler." However, today's students and teachers need more than access to technology; the need teachers who are talented and creative while being motivated to be creative. Over the past 10 years, technology has been infused into the everyday life from education, daily activities and careers. Digital Natives have an expectation and need for technology use or development in their formal and informal learning. Technology can be used as a tool to support the student learning and teacher dissemination of concepts. The development, implementation and testing of technology rich inquiry based learning environments can engage and motivate students interested in STEM fields. This research project aimed to follow the goals of the ITEST (*Innovative Technology Experiences for Students and Teachers*) program to: 1) increase student awareness of STEM and ICT careers; (2) motivate students to pursue the education necessary to participate in those careers, and /or (3) provide students with technology-rich experiences that develop their knowledge of related content and skills (including critical thinking skills) needed for entering the STEM workforce. The various technologies the participants used were virtual dissection tables, mini drones and virtual reality goggles. In addition, the results of this research will be used in developing and implementing innovative educational experiences for both 6-12th grade students and teachers. In conclusion, the students were motivated to learn more about STEM careers, they enjoyed learning with the various forms of innovative technology.

Introduction

Many educators and policymakers focus on improving student learning in STEM because worker's proficiency in STEM fields is considered vital to the health of economy (Atkinson and Mayo, 2010, PCAST 2012). Experts have stated technology can be used to support teaching and learning biological concept and techniques. Careers is the STEM fields have evolved and required learners to be more savvy in different forms of technology. Biology in particular using virtual reality has given students the opportunity to walk through cells and parts of the body, view forensic crime scene, dissect the human body. Surgeries have been done from millions of miles away requiring the surgery to efficient. Research has shown teachers that are not comfortable with new technology either refrain from using or makes students experiences non-eventful. The need to develop and implement programs that train science teachers (Baker, Warren and Keller, 2010) on innovative technology to engage, motivate and develop the skills of 6^{th}-12^{th} grade student learning about STEM fields.

Vision and Change in Undergraduate Biology education (2011) suggest making the instruction more student -centered and access to real-world application and scenarios. Therefore, students will participate in an adaptive culture of "digital learning" (how we use technology tools) and not "digital plumbing" (technology infrastructure). Thus, students will be exposed to 3-D Imaging (Settapat et al, 2014), which provides the opportunity for students to experience a realistic view of the human anatomy.

The lack of underrepresented minorities in STEM related field has been related to the need of the increase and maintain pipelines of development. These pipelines have to start earlier than undergraduate and high school; they must start in middle school or earlier. The use of technology to engage and develop the students can contribute to increase motivation of underrepresented minorities in STEM fields.

Objective: To observe the participation of underrepresented minorities in a STEM summer camp integrated with innovative technology. We will see if the use of the technology and activities will motivate and increase their awareness for STEM careers while learning scientific concepts.

Model

- Scientific Concepts
- Virtual Reality Googles
- Mini Drones
- Foresenic activites
- Virtual Dissection Table
- Presentation

- Middle School High School Students
- EBTIC Ambassdors

- Increase Interest in STEM
- Increase STEM knowledge /Skills
- Increase number of Minorites Interst in entering STEM Careers

Program Description

Exploring Biology through Inquiry Summer Camp

The Exploring Biology through Inquiry Summer camps were developed to provide students and teachers the opportunity to experience innovative technology in an inquiry learning environment. During the one week camp the participants worked on anatomy and physiology based projects integrated with technology. The technology included virtual reality goggles, Mini drones, Virtual Dissection table and forensic laboratory. After each activity the participants discussed possible STEM careers related to the activity. At the conclusion of the camps the students and teachers presented a presentation.

The project is significant because it will be used in developing and implementing innovative educational experiences for both 6-12th grade students and teachers. The experiences can be taken back to the classroom and used for the coming school year. In addition, outcomes from the project can provide a baseline need to continue the development and re-evaluation of effective technology rich learning environments.

Week One, 6-12th grade Teachers participating in the Teachers Exploring Science through Inquiry (TESI).

WEEK ONE				
Teacher Development				
Monday	Tuesday	Wednesday	Thursday	Friday
Science Curriculum Development	Use of Mini-Drones Blood Flow	Virtual Dissection Table	Forensic Dissection Oral Cavity	Presentation of Developed Lesson plan

Inquiry Learning Environments Using Apps in Instruction Use of Virtual Reality Googles	through Heart Career Discussion	Muscular System Career Discussion	and Skeletal System Career Discussion	

The following Week Two 6-12th grade students participating in Exploring Biology through Inquiry Camp (EBTIC) will participate in four learning modules with the goal of increasing their awareness of possible STEM careers, motivation in participating in a STEM career and academic development.

WEEK TWO				
6-12 Graders Enrichment Program				
Monday	Tuesday	Wednesday	Thursday	Friday
Assessments Virtual Reality Googles Cellular Structures Career Discussion	Use of Mini-Drones Blood Flow through Heart Career Discussion	Virtual Dissection Table Muscular System Career Discussion	Forensic Dissection Oral Cavity Career discussion	Presentation Exit Survey

Population

Seventeen EBTIC participants were middle school and high school students from school districts that surrounded the university. 8 of the participants were female while 9 were male. All the participants are having minority representation in STEM fields, 13 attend middle school while 4 attended high school.

The six EBTIC ambassadors were undergraduate students who volunteered to work with the summer camp. Four of the ambassadors were female and two were male. All of them were from minority backgrounds. They had task of teaching and tutoring on the science content and technology.

Instruments and Data Sources

During the summer camp demographic data was recorded achieved their application. The participants completed exercises with each scientific topic, science motivation questionnaire and exit survey. The EBTIC ambassadors and parents were also given a Post survey at the conclusion of the program.

Results

The demographic data was taken from their application. The preliminary data were extracted from the middle and high students' completion of the Science Motivation Questionnaire by Shawn M. Glynn. In addition, a survey was given to the student participants, EBTIC ambassadors and parents; the teacher data was not included in the present results.

The Project Director focused on the student's career motivation with STEM careers. Specific questions were examined 7, 10, 13, 23, and 25, which addressed the students' motivation. As noted in the graph, we observed the student's motivation to careers in STEM. Each question related to STEM career.

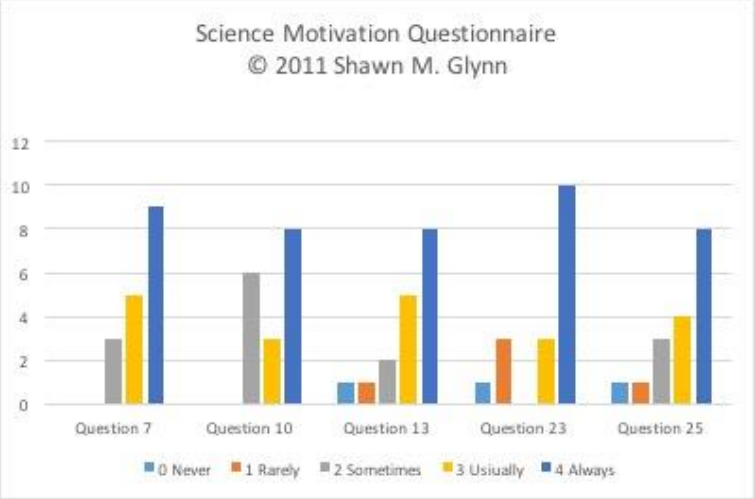

Figure 1, Career Motivation for Science Motivation Questionnaire

Career Motivation

7. Learning science will help me get a good job.

10. Knowing science will give me a career advantage.

13. Understanding science will benefit me in my career.

23. My career will involve science.

25. I will use science problem solving skills in my career.

Question 7 showed the participants answered 53% Always, 29% Usually and 18% Sometimes and 0 % for the others. Question 10 the participants answered the following: 47% Always, 18 % Usually and 35% Sometimes and 0% for the others. Question 13 the participants 47% Always, 29% Usually, 12% Sometimes, 6% Rarely and 6 % Never. Question 23 the participants answered 59% Always, 18% Usually, 18% Rarely and 6%

Never. Question 25 the participants answered 47% Always , 24% Usually, 18% Sometimes, 6% rarely and 6% Never.

What is your overall satisfaction rating of the camp?

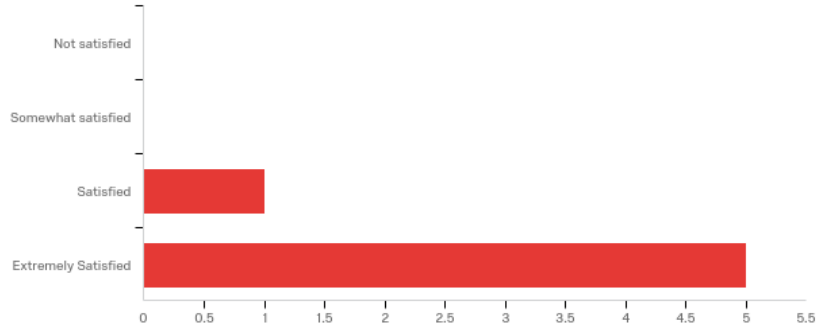

Figure 2., EBTIC Student Participants

The student participants stated that 83.3 % was extremely satisfies while 16.7% were satisfies, so overall they enjoyed the summer camp.

Have you ever thought about being a high school teacher?

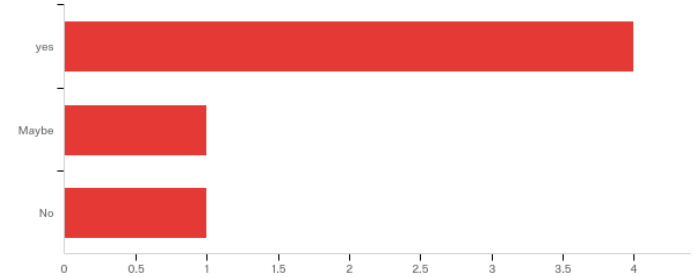

Figure 3. EBTIC ambassador interest in Teaching

The EBTIC ambassadors were questioned if they would be interested in teaching prior to participating the summer camp 67% stated Yes, 17% stated Maybe and 17% stated No.

Would you consider being a high school teacher, after working with the camp?

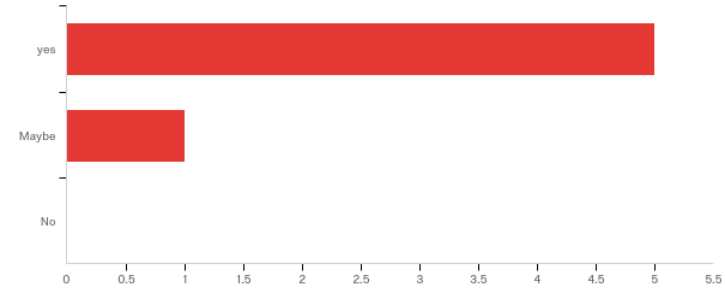

Figure 4. EBTIC interest in Teaching, after summer camp

The EBTIC ambassadors were questioned if they would be interested in teaching after volunteering for the summer camp 83% stated Yes, 17% stated Maybe and 0% stated No.

What is your overall satisfaction rating of the camp?

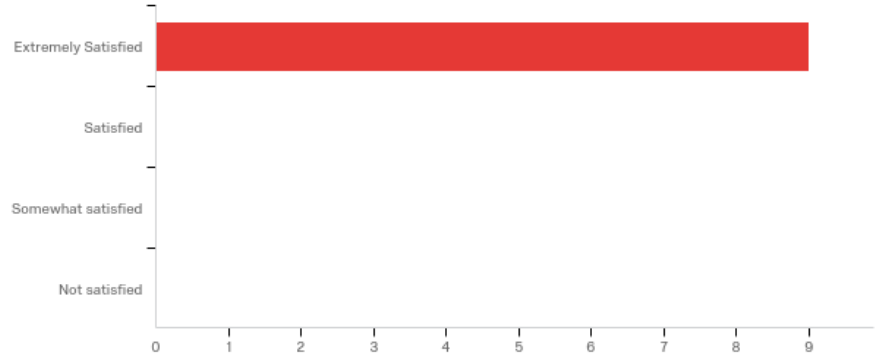

Figure 5 Parents Overall Satisfaction with the Summer Camp

The EBTIC parents were questioned if they were satisfied with the summer camp 100% were extremely satisfies. They provided their observation of their student's participation in the summer camp. (Table 1).

Table 1. Did the camp meet you and your child's expectation? Why or why not
Yes, student was truly motivating
Yes. He would like the camp to be longer.
Yes, my daughter came home daily excited about the things she learned. She was excited about the level of content and depth of the instruction.
Yes. Very engaging.
My son really enjoyed learning about the different topics presented and the hands on activities.
The camp exceeded our expectations because the students were exposed to STEM topics in an exciting, hands-on method.
Yes. You received enrichment and had lots to tell her friends.
Yes. He would like the camp to be longer.
Yes, she came away informed and interested in science
Yes, student was truly motivating
Yes, she came away informed and interested in science
Yes, my daughter came home daily excited about the things she learned. She was excited about the level of content and depth of the instruction.
Yes. Very engaging.
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Yes. You received enrichment and had lots to tell her friends.

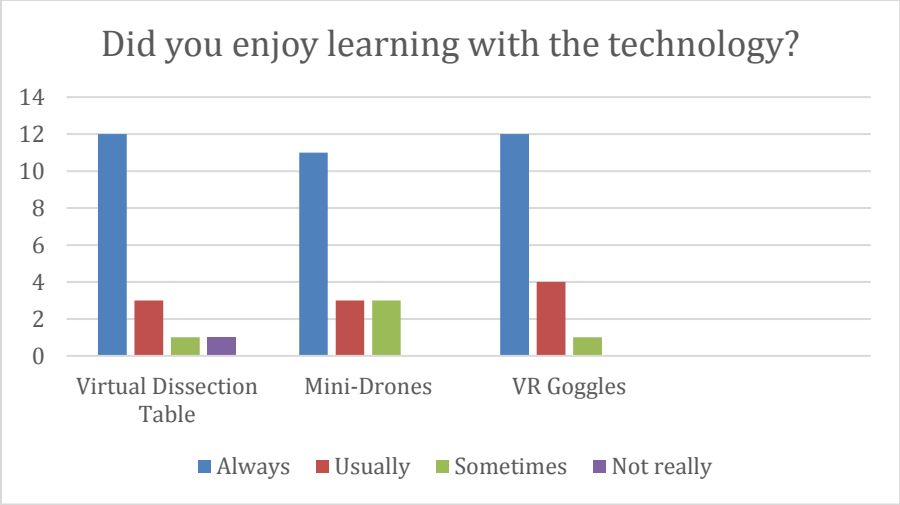

Figure 6. Participants View of using the Technology to Learn Science

The graph shows that students enjoyed learning while using the various forms of technology. 75% of the participants answered Always, 18% Usually, 1 % Sometimes for learning with the Virtual dissection table. The participants answered 64% Always, 18% Usually and 18% Sometimes for learning with the mini-drones. The participants answered 70% Always, 24% Usually and 7% sometimes for using VR googles.

Summary and Discussion

The data showed that majority of the students saw themselves working in a STEM career. They also enjoyed learning scientific concepts with the innovative technology. The parents noted the engagement and motivation of their children in the EBTIC. It was also noted that the EBTIC ambassador's participation in the camp motivated them to consider teaching STEM in middle school or High School. This preliminary data seems positive but we look forward to a larger test group.

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