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Increasing STEM Career Awareness and Identity Exploration in a Space Summer Camp

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Abstract

The need to prepare students for success in STEM fields begins with getting students to develop STEM identities which can be changed through educational programs and interventions (Kim, Sinatra, & Seyranian, 2018). This paper showcases the preliminary findings of a summer space camp designed to increase STEM career awareness and change the commonly accepted stereotypes for racial minorities. Projective Reflection (Foster, 2014) was used as a theoretical framework to assess learning as identity change over time in four areas: knowledge, interest and valuing, self-organization and self-control, and self-perception and self-definition.

Aims

The aims of running this camp and conducting this study were to increase STEM career awareness among minority students, provide an opportunity for them to explore different roles in these positions, and bridge students' interests with future careers in STEM. To this end, the students had the opportunity to choose among three different STEM-related projects: (1) astrobiology, (2) astrophysics and (3) astroengineering and work with their peers on a Mission to Mars project.

Background and Problem Statement

Increasing STEM careers in the United States demands recruiting capable individuals with STEM backgrounds regardless of their gender or ethnicity to strengthen a diverse workforce in the 21st century (Hill, Corbett, & St Rose, 2010). While a significant number of initiatives have tried to provide educational programs for racial minorities and females, these groups are still experiencing social and emotional barriers that are preventing them from choosing STEM careers (Fowler & Schreiber, 2017). Perceived masculinity or anticipated stereotypes in STEM careers shape these students' decisions and motivations (Gottfredson, 2002) which in turn can shape their identities and their imagined future (Elmore & Oyserman, 2012). Research has shown that identity change leads to academic motivation and makes students interested in

content (Kaplan & Flum, 2012; Oyserman, Bybee, Terry, & Hart-Johnson, 2004). This study aims to assess if and how students' identities change after an immersive one-week summer space camp designed for racial minorities. Students were assessed for STEM career content knowledge, interest and value in STEM, self-perception and self-definitions about STEM careers, and self-organization and self-control toward STEM activities.

Methodology

To pursue the aims of this study, the following research questions were posed:

1. To what extent and in what ways does participating in the Easley Summer Space Camp positively change students' STEM career identity?
 - a. STEM career content knowledge
 - b. Valuing and interest in STEM
 - c. Self-organization and self-control towards STEM activities
 - d. Self-perceptions and self-definitions about STEM careers
2. To what extent and how have the students' STEM career awareness changed during the camp?

Nineteen participants consented to be part of the study 7 females and 12 males; most of whom (n = 18) self-identified themselves as African-American. The program lasted one week and the students were involved in three different projects that they initially picked based on their interests: astrobiology, astrophysics, and astroengineering. The mission was to make rovers and send rockets to Mars and collect soil samples and return them to the Earth using small-scale models and hands-on activities. They also visited a science museum, watched stars with a telescope and had a movie night to gain experience from all aspects of real-life STEM careers in an immersive environment.

This study enjoyed a concurrent transformative mixed method design with a survey constructed from the four constructs of Projective Reflection 1) knowledge, 2) interest and value, 3) self-perception and self-definition, 4) self-organization and self-control (Foster & Shah, 2016) for the quantitative part, and focus group interviews, self-reflective journals and observational notes for the qualitative aspect. The *STEM Career Awareness and Identity Change* survey was piloted for the first time as a pre and post-assessment instrument for tracing the students' identity change.

Preliminary Findings

Since the data analysis was not complete at the time of this representation, this paper focuses on the preliminary findings of one student's interview results. The analysis of Alex's (pseudonym) interview transcripts showed that the two constructs of (a) knowledge, and (d) self-perception and self-definition were more evident in this student's utterances in comparison with the constructs of (b) interest and valuing and (c) self-organization and self-control. As to knowledge, this student demonstrated many instances of foundational content knowledge around his astroengineering project by using technical language such as "The project I was doing was building a robot that could pick up tire stacks and beat a scorpion, a robot scorpion, but in the end the robot scorpion beat us because we didn't have enough tork ...". He also demonstrated problem solving as a type of metaknowledge by talking about the rovers' features: "Our robot is built to pick up rocks, destroy rocks, to collect little samples of it, and its legs are built to dig in the ground to like stick their feet on the ground to have good grip to stick on the surface". Also, he had a clear understanding of his skills and his capabilities: "I'm going to build a company – raise it from one small bottom to the top and start engineering stuff" which were coded under self-perceptions and self-definition. Also, he demonstrated his interest and valuing toward mechanical engineering by saying: "I wanna be a mechanical engineer". Self-organization and self-control construct which show types of regulated learnings were really hard to be demonstrated and coded in one focus-group interview. However, Alex was always referring to his group and their group work for building different rovers with different capabilities for collecting samples which were coded as socially-shared regulated learning when the learners are following a common goal.

Conclusion and Research Implications

The primary goal of this space camp was to increase STEM awareness among under-represented minority students. To a great extent, this goal was accomplished as students -regardless of their interests in STEM careers- left the camp with a clear understanding of these occupations. Early evidence suggests that the duration of future STEM camps should be longer so that the students have some time to further experience new roles and develop a better understanding of STEM

careers. This will allow researchers to trace and study their identity exploration and change trajectories better.

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Author's Information and Biography

Hamideh Talafian is a third year PhD candidate in Educational Leadership and Learning Technologies (STEM concentration) at Drexel University. Her research interests focus on students' motivation in STEM, educational simulations and games, and experiential learning. Since she entered the program, Hamideh has been working with Interim Dean, Dr. Penny Hammrich on two NSF-funded projects on "Experiential Learning" and "Hypothesis-Driven Computational Genomics" which focused on engaging and motivating students in STEM disciplines. She is also working in Games and Learning in Interactive Digital Environments (GLIDE) lab, on an NSF-funded CAREER project with Interim Associate Dean, Dr. Aroutis Foster on designing and implementing educational games.

Hamideh received her Master's degree in Teaching English as a Foreign Language and her Bachelor's Degree in English Literature from the top-ranked universities in Iran and has over seven years of teaching experience in a number of schools and English institutes in Iran. She is currently working on a newly funded project aiming to develop STEM career awareness identity

exploration among middle school under-representative minorities. As a part of her professional services, she is in the editorial board of the Emerging Voices in Education Journal based in the School of Education which is only for graduate students and is run by graduate students. She is also the reviewer of a number of journals and conferences including but not limited to JXE, NSTA, AERA, SITE, etc.