



College of Education

Who Belongs in STEM?

Ty White, Freeport McMoRan, Az G&T, Texas Instruments

High School Chemistry, Biology and Mathematics

College of Education, University of Arizona; Willcox High School, Willcox Unified School District



Introduction to Problem

Students are typically unable to relate to STEM classes, even when they show talent.

Connection to Industry

Multiple summer employers noted that there is a shortage of qualified or experienced applicants for positions.

Resolved:

There is a need to deliver STEM content in a manner that enables students to perceive themselves as participants or career seekers.

Research shows that most students have determined that they are either very interested or not at all interested in STEM before they reach High School. The current economy modelled on supply and demand is not sufficient to draw students to STEM, and status quo educational practices aren't meeting the needs of industry either.

Investigation

I intend to create a literacy project that shows the "normalcy" of scientists, technologists, engineers and mathematicians.

The participants in this study were volunteers from 2 sections of first year chemistry students in Willcox, Az. As the novel literacy activities arose, they were presented with pre-and post-surveys intended to assess how they perceive themselves, their school, and their future identity to determine if changes were effected. The surveys consisted of 9 forced choice items with 1 open ended item.



All shared pictures have a Creative Commons license

Question 2:

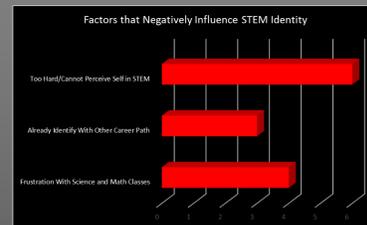
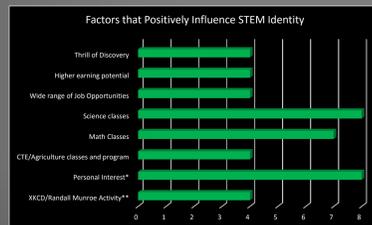
What strategies will students advise or describe that affect their own sense of how identity develops? An identity of belonging in STEM careers?

- Most students don't see school as having much effect on their sense of identity (note exception to the right). [Strong trend]
- Most students related experiences they have outside of school in connection with their families or close friends as where they developed their perception of self. [Strong trend]
- Some students have indicated that they like the challenge inherent in STEM [Weak trend]
- Students have developed interest after learning about the opportunities and higher pay related to STEM careers. [Weak trend]
- Some students stated an interest in STEM due to parental encouragement. Supporting data from selected interviews are shared to the right.

Question 3:

What factors do students recognize that affect their interest in terms of potential careers and interests?

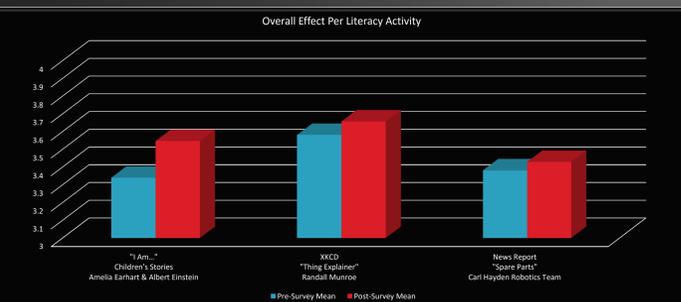
- Most students related experiences they had as young kids. [Strong trend during interviews]
- Some mentioned High School CTE programs – However, it is worth noting that in a ranching and farming town like Willcox, these programs and lifestyles have been a part of their lives all along – see previous bullet.
- Specific classes – effective classrooms influence students' identities.
- Students responded with specific interests, which were sometimes identified and sometimes left vague.



Question 1:

Will literacy activities that represent people in STEM careers influence a student's ability to personally identify with STEM opportunities?

The following graphs show the pre (blue)-post (red) results on a per student basis. Overall, most students did not indicate a strong change one way or another. Most students that did change their selections changed for the positive, indicating that this was not "harmful", but not groundbreaking beneficial either.



Conclusions

While these activities weren't a sweeping success, the larger trends show that they also didn't harm or negatively influence students perception. Some students indicated that they felt the selections were inspirational, but that they just didn't really affect how they viewed themselves. In the surveys, students regularly felt that school was not an effective motivator of identity. They develop their dreams and goals through experiences they have outside of school as kids. Any effective program looking to influence the way students see themselves and impact their desire to pursue STEM will have to find a way to create these experiences, and to reach out to students at younger ages.

References

Aschbacher, P. R., Li, E., & Roth, E. J. (2009). Is Science Me? High School Students' Identities, Participation and Aspirations in Science, Engineering, and Medicine. *Journal of Research in Science Teaching*, 564-582.

Xue, Y., & Larson, R. C. (2015, May). *STEM crisis or STEM surplus? Yes and yes: Monthly Labor Review: U.S. Bureau of Labor Statistics*. Retrieved from U.S. Department of Labor - Bureau of Labor Statistics: <http://www.bls.gov/opub/mlr/2015/article/stem-crisis-or-stem-surplus-yes-and-yes.htm>

Identity: Elementary Teacher



- EXPERIENCES:** When I first went to school in Kindergarten I knew I liked it. I didn't speak English but I knew I wanted to learn. My Kindergarten teacher, Mrs. Franklin, helped me a lot. I mastered the language around 1st grade so I could speak and I could communicate with my classmates and my teachers, I knew I wanted to help others so they wouldn't be in a horrible position like I was. It's a horrible feeling not being able to understand what's going on.
- CAN A TEACHER AFFECT IDENTITY:** Yes, on a person to person basis. Some people have a strong sense of identity, they are set in their ways and you can't change it. It takes a lot to persuade them to choose something else when they really want something.

Identity: Anesthesiologist



- FAMILY:** I started because the majority of my family, my uncles and my dad, they are in like science related or engineering related fields. And they tell me that like it's not only worthwhile, but its enjoyable. I have been thinking of going into Anesthesiology.
- WHAT CAUSES INTEREST:** My experiences have made me interested in this field. I've been around the medical field for the past 4 or 5 years, and they seem real laid back, and calming.... And then science, I have always enjoyed science, I have always enjoyed and understood my science and math classes.
- EXPERIENCES:** I had surgery at 13 on my back for a tumor I had to get removed, and ever since then I have had MRIs, nurses, and every 6 months now I get MRIs.

Identity: Oncology Nurse/PA



- FAMILY:** My dad had a full time job but whenever I'd get home from school, and he'd get home from work, we'd be outside with each other with our animals. He trains animals for everyone, so I was always really interested in how he can manipulate an animal to be from like wild to tame and nice. So that always interested me and he always knew what to do with animals, like if they had cuts. So I thought as a kid I would I would get an actual degree in it and be a vet.
- WHAT CAUSES INTEREST:** My mom started getting sick, and we started taking her to the hospital and just being there and seeing what they did to my mom and how they would help her made me be more interested in that. Since I couldn't handle animals, I thought nursing would be a good field.
- Experiences:** Like in chemistry, learning about how the color we see is just like the energy that reflects in the eye, and like learning about all these discoveries is something that is really interesting. So if I were to continue into the oncology field, and I could discover stuff of my own, and help others by that, I think that would be a great achievement.
- The stories [I Am Albert Einstein and I Am Amelia Earhart] made me more interested...They showed how someone can start so low, and can do something so great.**

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the funders or partners. Teachers in Industry is administered by University of Arizona's College of Education. Teachers in Industry operates in partnership with Tucson Values Teachers through 100Kin10 and is supported by funding provided by the Thomas R. Brown Family Foundation.