Combining Engineering Fundamentals and Personality Indicators in a First-Year Retention Program

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Abstract

Personality markers have been shown to be predictors of success in engineering programs (Hall, 2015; Perez, 2014). The Indigo personality assessment has been used in high schools and universities to identify at risk students based on five distinct metrics – managing stress, self-confidence, self-esteem, sense of belonging, resiliency, self-direction, and feelings about future (Smith, 2015). However, retention programs based on personality assessments are not necessarily attractive to university students in engineering. In this program all students in the first-year, introductory engineering course were required to take the Indigo personality assessment and were invited to the program. Workshops were created to explore fundamental engineering concepts in combination with discussion questions that addressed the above metrics from a Christian worldview. For example, after a brief introduction to its material properties, clay was used to create models of heroes who inspire the students to succeed. A discussion to address the metric of self-direction then followed examining the connection between the traits of a good hero and the qualities to which they aspire. One student focused on Jesus as his hero stating "It is His love and compassion for others, not just in words but also actions, that I want to emulate in my life as an engineer by helping others." Many of the students involved expressed interest in continuing with similar programs during their entire four year program of study. Future plans include recruiting students from additional STEM programs so quantitative analysis investigating the relationship between retention and personality metrics can be pursued.

Introduction

The science, technology, engineering, and math (STEM) fields are growing quickly, even as high as three times that of other fields (Hall, 2015). This fact, combined with the concerning data that around 40% of engineering-specific college students either drop out or transition to other programs, calls for further exploration into the retention and persistence of college engineering students.

Previous engineering retention efforts have focused on students' financial concerns, math ability deficiencies, and a supportive culture, as well as course-related intensive projects outside of the classroom (Ricks, 2014; Ragusa, 2012). Additional programming targeted at retaining female engineering students has explored the benefits of pairing female engineering students with female mentors who graduated from the program previously (Poor, 2013). While intentional support of various kinds seems helpful, some studies have targeted personality traits specifically among engineering students (Hall, 2015; Haemmerlie, 2012). However, social-emotional statuses of concern in first-year engineering students has not yet been addressed.

The sciences behind the Indigo Assessment have been utilized in corporate America for over 30 years (Smith, 2015). The Indigo Project has applied the assessment to high school and college students in the hopes of helping students identify their career paths earlier and with more accuracy. The assessment identifies a student's Behavior Styles, Skills, Strengths, Motivators as well as Social-Emotional indicators. All freshman engineering students were required to take the assessment and were subsequently debriefed on how to read and understand their results in class. In hopes of addressing areas of concern in students, an engineering retention program was offered to provide additional assistance and guidance to first-year engineering students.

Method

All students in the first-year, introductory engineering course were required to take the Indigo personality assessment and were invited to the program. At risk students were not identified. Workshops were created to explore fundamental engineering concepts in combination with discussion questions that addressed the metrics for the at-risk students from a Christian worldview (CWV). An end of course survey was given to assess the students' experience. The surveys were anonymous.

Workshop 1: Resume/Portfolio Building
Students created a resume, a LinkedIn profile and a portfolio to demonstrate their work.
Engineering Principle(s): Technical Writing & Portfolio Creation
CWV Integration: Finding the balance between humility and pride in accomplishments.
Indigo Indicators: Feelings about the future, Self-Confidence, Self-Esteem, Self-Direction

Workshop 2: Working as a Team
Teams were given a challenge to build a tower using only uncooked spaghetti noodles and tape to meet given specifications.
Engineering Principle(s): Working with others, design, understanding and completing project requirements, fabrication
CWV Integration: Genesis 2:18
Indigo Indicators: Sense of Belonging, Resiliency

Methods (cont.)

Workshop 3: Managing Stress
Students were tasked with performing a mock "assembly line" activity under time constraints and with distractions introduced randomly.
Engineering Principle(s): Working with others, DMAIC, ability to work under changing circumstances
CWV Integration: Philippians 4:6
Indigo Indicators: Managing Stress, Resiliency

Workshop 4: Sketching/Drawing
Students were tasked with a sketch/drawing of something they would like to make one day.
Engineering Principle(s): Communicating Ideas, Technical Drawing, Ideation
CWV Integration: Genesis 1:27
Indigo Indicators: Self-Esteem, Self-Confidence

Workshop 5: Looking at Our Heroes
Students were tasked with using modeling clay to create a sculpture that represented someone they look up to or that inspires them.
Engineering Principle(s): Model Making, Materials
CWV Integration: Lives of David and Daniel used as examples.
Indigo Indicators: Feelings About the Future, Self-Direction

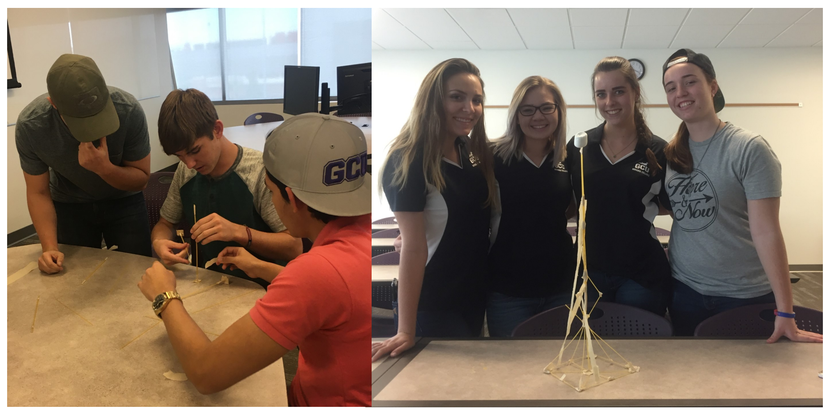
Workshop 6: Public Speaking
Students were then asked to present themselves in an "elevator pitch" format. Each student was given a topic at random and had to share their opinions on the topic for one minute.
Engineering Principle(s): Presentations, public speaking, elevator pitches
CWV Integration: Jeremiah 1:4-10
Indigo Indicators: Self-Esteem, Self-Confidence, Self-Direction

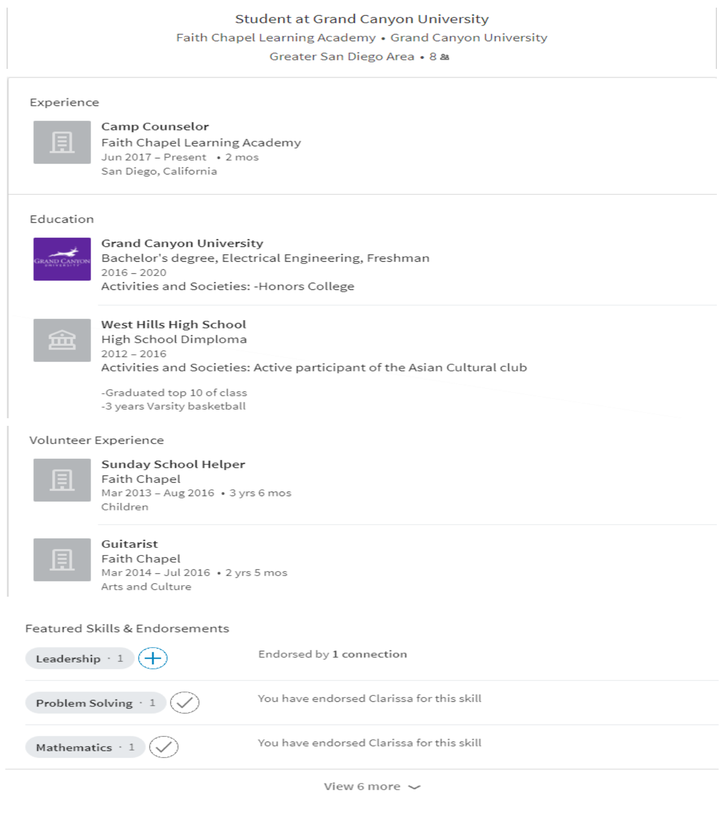
Workshop 7: Perfectionism and Failure
All students were tasked with standing on one side of a tarp and flipping it without stepping off. Additional restrictions were imposed until the task became impossible. Students were tasked with building small catapults with no instructions and (unknown to the students) a missing component.
Engineering Principle(s): Critical Thinking, Working as a Team, Adapting to Changing Circumstances

Results

A very small number of students participated (n=8).

Engineering Activity/Professional Skill Development





Results (cont.)

CWV Integration

One student focused on Jesus as his hero stating "It is His love and compassion for others, not just in words but also actions, that I want to emulate in my life as an engineer by helping others."

When asked about the sculpture he made to represent his hero, the student said "I chose to make a cross to represent Christ. Beyond being my savior, Jesus is a man that I aspire to be like. I want to use my degree to help others and what better example do we have of what it means to love and help other people than Jesus?"

Referencing the task of acting as a team "It's really cool to work in a team. It makes us be humble and admit that we don't always know the best answer. None of us is going to be working alone, nor are we supposed to, and being willing and able to ask for help is a crucial skill to have in our personal lives and our future jobs."

End of Course Survey

Question 1: Students came to the sessions because of announcements in their Introduction to Engineering course (3/8) and referrals by friends (3/8).

Question 2: All students agreed that they learned new skills to use inside and outside the classroom.

Question 3: Students rankings of each session are below (x indicates no priority was given)

Question 4: Most students indicated making a connection with other students (6-Y, 1-N, 1-U).

Resume	Team	Stress	Draw	Heroes	Speak	Perfect
1,1	1,3,3,1	2,1,x,2	3,3,2 ,2	2,1,1	3,x	2,x,2,3,3

Question 5: Most students would recommend the program to incoming freshmen (6-Y, 1-N, 1-U).

Question 6: Eight reasons were cited for coming back with "Food" and "Learning" as the top reasons given.

Question 7: There were four suggestions for facilitator, but no top suggestion.

Question 8: Other comments included "Fun" and "Do it again next year".

Discussion

Many of the students involved expressed interest in continuing with similar programs during their entire four year program of study.

Rename Course from Surviving Engineering to ...

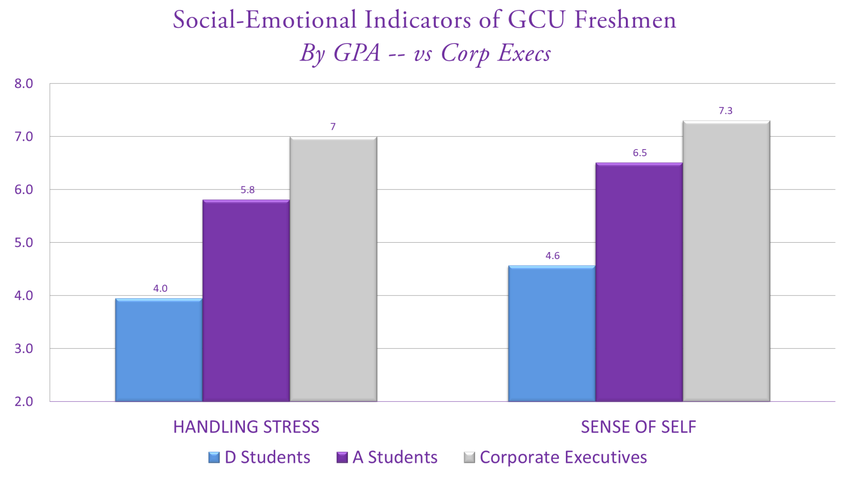
Mandatory for blue list?? Some type of incentive to attract blue list??

Conclusion about facilitators

{add discussion about retention & Indigo metrics}

Conclusion

Future plans include recruiting students from additional STEM programs so quantitative analysis investigating the relationship between retention and personality metrics can be pursued.



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