

# Should I Stay or Should I Go? *Engineering Students' Persistence is Based on Little Experience or Data*

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“I see my dad, he’s an engineer. He sits in his cubicle, at his computer all day, typing up code and doing stuff. I don’t really want to be doing that but that’s engineering for you. I haven’t really thought about ‘Well, after school, what am I gonna be doing?’ I think it’s sit in a cubicle all day and I might be doing this, might be doing that, and I really don’t know.”

Roger, Mountain Tech, Freshman

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# Academic Pathways Study (APS)

an element of the Center for the Advancement of Engineering Education

- Exploratory longitudinal study of 160\* research participants at 4 institutions
- Participants: selected Fall term of freshman year; self-reported interest in engineering
- Goal: Identify and characterize the pathways of students pursuing engineering
- Data: Interviews (semi-structured & structured), online surveys, ethnographic observations, engineering performance tasks, academic courses & grades

# Research Questions

- Skills
- Identity
- Education
- Workplace

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# Research Questions

- How engineering **skills** develop
- How engineering **identity** evolves
- How engineering **education** contributes to skills and identity

# Institutions

## Coleman University

- Private institution
- Research extensive
- 6700 undergraduates, 2003-2004
- West Coast
- Comprehensive focus

## Mountain Technical Institute

- Public institution
- Research intensive
- 2700 undergraduates, 2003-2004
- Rocky Mountain West
- STEM focus



# Qualitative Inquiry

- Annual Semi-Structured Interviews (n=32)
  - Interest in engineering
  - Current academic experiences
  - Projections about future career pathways
- Supplemental Data (n=76)
  - Online surveys
  - Academic course & grade records

# Data Analysis

- Analysis of semi-structured interviews of 32 respondents (first two years of data)
- Open coding based on skills, identity and education research questions

# Code Book

<b>Academic Advice</b>	<b>Academic Assistance</b>	<b>Academic Courses</b>	<b>Academic Navigations</b>
<b>Academic Major Influences</b>	<b>Advice to Others</b>	<b>Pre-Professional Experiences</b>	<b>Career</b>
<b>College (Experience)</b>	<b>Concerns &amp; Priorities</b>	<b>Engineering Definitions</b>	<b>Faculty Interactions</b>
<b>High School</b>	<b>Identity</b>	<b>Interest &amp; Abilities</b>	<b>Professional Influences</b>
	<b>Projects</b>	<b>Non-Curricular Activities</b>	

# Code Book

Academic Advice	Academic Assistance	Academic Courses	<b>Academic Navigations</b>
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High School	Identity	Interest & Abilities	Professional Influences
	Projects	Non-Curricular Activities	

# Emergent Themes

- Students making academic major decisions based on little first hand knowledge and experience (about & in engineering)
- Students expressed varying levels of commitment towards their intention to major in engineering

# Emergent Themes

- Students making academic major decisions based on little **Exposure** knowledge and experience (about & in engineering)
- Students expressed varying levels of commitment towards their **Intention** to major in engineering

# Exposure

## *Exposure to engineering before entering college*

- **Low**: no direct engineering experiences
- **Moderate**: direct mentored experiences related to engineering activities
- **High**: in depth, broad and direct mentored experiences related to engineering activities

# Exposure

<b>Exposure</b>	<b>Coleman (n=15)</b>	<b>Mountain Tech (n=17)</b>	<b>Totals (n=32)</b>
Low	10 (67%)	10 (59%)	20 (63%)
Moderate	1 (7%)	5 (28%)	6 (19%)
High	4 (53%)	2 (11%)	6 (19%)



# Exposure Narratives

Low

Moderate

High

# Exposure Narratives

Low

Moderate

High

Mark, Mountain Tech

- Excelled in math and science in high school
- Strong interest in meteorology
- Applied to MT because of regional reputation
- Enrolled in MT because of Geophysics major

# Exposure Narratives

Low

Moderate

High

## Mark, Mountain Tech

- Excelled in math and science in high school
- Strong interest in meteorology
- Applied to MT because of regional reputation
- Enrolled in MT because of Geophysics major
- ➔ Majored in Meteorology and left MT

# Exposure Narratives

Low

**Moderate**

High

# Exposure Narratives

Low

Moderate

High

Emma, Coleman

- Excelled in math and science in high school
- 5-week summer program focused on engineering
- Childhood engineering projects with Grandfather (an engineer)
- Interested in civil engineering, architecture, & sustainability

# Exposure Narratives

Low

**Moderate**

High

Emma, Coleman

- Excelled in math and science in high school
  - 5-week summer program focused on engineering
  - Childhood engineering projects with Grandfather (an engineer)
  - Interested in civil engineering, architecture, & sustainability
- ➔ Majored in Civil Engineering

# Exposure Narratives

Low

Moderate

High

# Exposure Narratives

Low

Moderate

High

Joe, Mountain Tech

- Grandfather (an engineer) introduced him to metallurgical engineering
- Repeatedly enrolled in engineering laboratory course in high school
- Built trebuchet for high school English course
- Related blacksmithing hobby to his interests in metallurgical engineering



# Exposure Narratives

Low

Moderate

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## Joe, Mountain Tech

- Grandfather (an engineer) introduced him to metallurgical engineering
  - Repeatedly enrolled in engineering laboratory course in high school
  - Built trebuchet for high school English course
  - Related blacksmithing hobby to his interests in metallurgical engineering
- ➔ Majored in Materials and Metallurgy

# Intention

*Intention to declare or pursue a major in engineering*

- **Unsure**: express several reservations about engineering; likely explore outside of engineering
- **Mostly Sure**: profess a lack of exposure to the engineering profession or coursework
- **Positive**: express minimal reservations about majoring in engineering

# Intention

<b>Intention</b>	<b>Coleman (n=15)</b>	<b>Mountain Tech (n=17)</b>	<b>Totals (n=32)</b>
Unsure	3 (20%)	8 (47%)	11 (34%)
Mostly Sure	4 (27%)	2 (12%)	6 (19%)
Positive	8 (53%)	7 (41%)	15 (47%)

# Intention Narratives

Unsure

Mostly Sure

Positive

# Intention Narratives

Unsure

Mostly Sure

Positive

“Honestly, no, I had no idea what engineering was, I was just like, ‘Okay, math and science school; we got it,’ and then like somehow that just kind of became synonymous with engineer-, with that definition. They’re like, ‘Oh you can be an engineer,’ I’m like, ‘Okay, I guess so?’ And I only really got a feel for what I’d be doing [after I got] up here....I don’t know what it [engineering] is.”

Jane, Mountain Tech (Freshman)

# Intention Narratives

Unsure

Mostly Sure

Positive

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Jane, Mountain Tech (Freshman)

# Intention Narratives

Unsure

Mostly Sure

Positive

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Jane, Mountain Tech (Majored in Physics)

2007 ASEE Annual Conference & Exposition Honolulu, Hawaii

June 25, 2007

# Intention Narratives

Unsure

Mostly Sure

Positive



# Intention Narratives

Unsure

Mostly Sure

Positive

“This quarter I’m taking (statics) in the engineering [college], so it’s-, I’m kind of struggling with that class a little bit. It’s pretty tough and I think that has something to do with me like really trying to figure out if I really want to be an ME. I’ll see how it goes next quarter.”

Grace, Coleman (Freshman)

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Grace, Coleman (Majored in Product Design)

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# Intention Narratives

Unsure

Mostly Sure

Positive

# Intention Narratives

Unsure

**Mostly Sure**

Positive

“I think we’re all for the most part pretty serious about school, and we’re pretty sure we want to be engineers.”

Christina, Mountain Tech (Freshman)

2007 ASEE Annual Conference & Exposition Honolulu, Hawaii

June 25, 2007

# Intention Narratives

Unsure

**Mostly Sure**

Positive

“I think we’re all for the most part pretty serious about school, and we’re pretty sure we want to be engineers.”

Christina, Mountain Tech **(Majored in Electrical)**

2007 ASEE Annual Conference & Exposition Honolulu, Hawaii

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# Intention Narratives

Unsure

Mostly Sure

Positive

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Unsure

Mostly Sure

Positive

“I’m rather odd in that I already am pretty sure what I want to do, cause everyone else seems to not be so sure....I think it’s very standard to wait until like the end of your sophomore before you declare, [but] I’m almost 99 percent sure that I want to do it, so I figure I might as well just do it [declare the major] now.”

Rudy, Coleman (Freshman)



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Rudy, Coleman (Undeclared - Computer Science)

# Intention

Exposure

	Unsure	Mostly Sure	Positive
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	<input type="checkbox"/> Emma, Civil <input checked="" type="checkbox"/> Bill, Mechanical <input checked="" type="checkbox"/> Roger, Mechanical	<input checked="" type="checkbox"/> Christina, Electrical <input checked="" type="checkbox"/> Marilyn, Environmental	<input checked="" type="checkbox"/> Max, Petroleum
		<input type="checkbox"/> Steve, Physics	<input type="checkbox"/> Nate, Chemical <input type="checkbox"/> Oscar, Electrical <input type="checkbox"/> Rudy, Undeclared* <input checked="" type="checkbox"/> Hilary, Chemical <input checked="" type="checkbox"/> Joe, Mat'I & Metallurgy

Key:  = Coleman Students     = Mountain Tech Students  
 \* = Students who have left either Coleman or Mountain Tech

# Intention

Exposure

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# Implications for Engineering Education

- Description of initial pathways into engineering
- Description of the **range** of exposure and commitment of engineering majors
- Students at **both institutions** had **low exposure** to engineering and **varying strength of intention** to pursue engineering
- Exposure based on formal, structured experiences beyond coursework
- Future analysis - contrast informal, unstructured experiences

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