

# Relating Project Tasks to Engineering Confidence and Self-Efficacy

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## Motivation

**Confidence** = Self-assurance coming from appreciating one's abilities

**Self-Efficacy** = The belief in one's ability to succeed



Students' project experiences differ based on:

- Their background
- Interactions with teammates
- Mastery experiences they undertake

**How can we structure projects so all students experience an increase in confidence & self-efficacy?**

## Research Questions

1. How does confidence or self-efficacy change throughout the project course?
2. How are students spending their time in hands-on team projects?
3. Was there a difference in confidence levels between male and female students?
4. How does confidence relate to the project tasks students complete?

## Methodology

- **Participants**
  - 52 students from a small private engineering college
  - 25 students from three different large public universities

- **Data collection**
  1. Pre- and post-course surveys to assess demographics, personality, confidence & self-efficacy

Commitment to Completing Degree	Confidence in Completing Degree
Academic Self-Confidence	Problem-Solving
	Math & Science Skills
Self-Efficacy	Professional & Interpersonal Skills
	Engineering Tinkering

2. Weekly activity logs, including tasks later organized in 2 clusters:

Mastery Clusters	Activity Tasks
Problem-solving	Brainstorming
Math & science	Calculations
Professional & interpersonal	Communication
Engineering	Documentation
Tinkering	Hands-on Work
	Modeling/CAD
	Oral Presentation
	Project Management
	Research
	Sketching (2D/3D)
	Teamwork
	Written Report

3. Semi-structured interviews

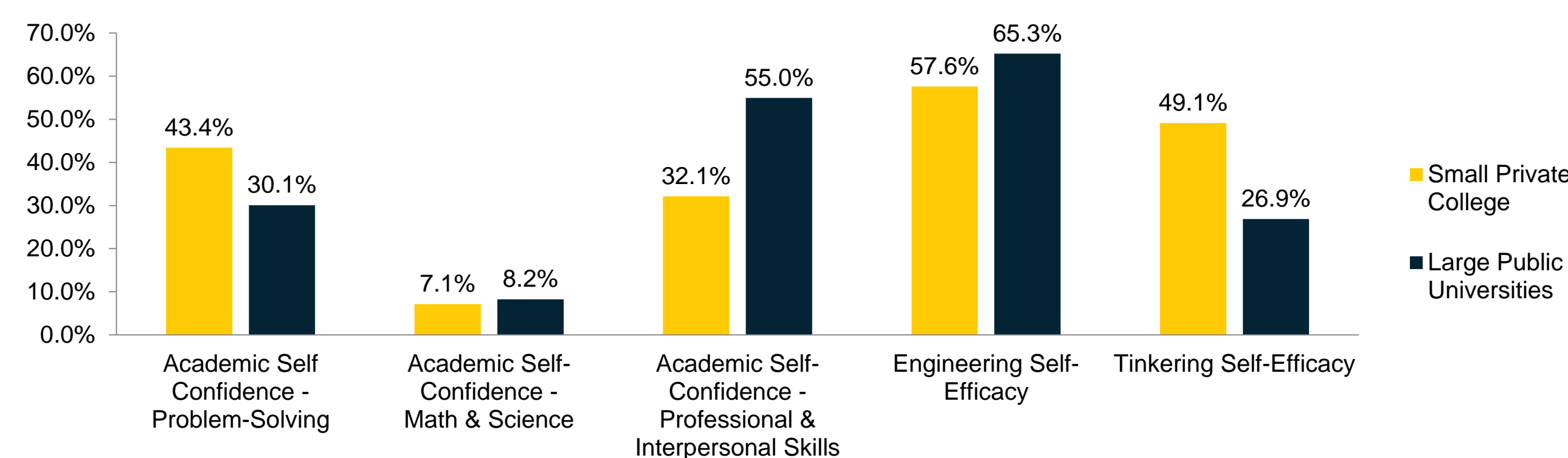
- **Data analysis**
  - Mixed-methods concurrent triangulation

## Results

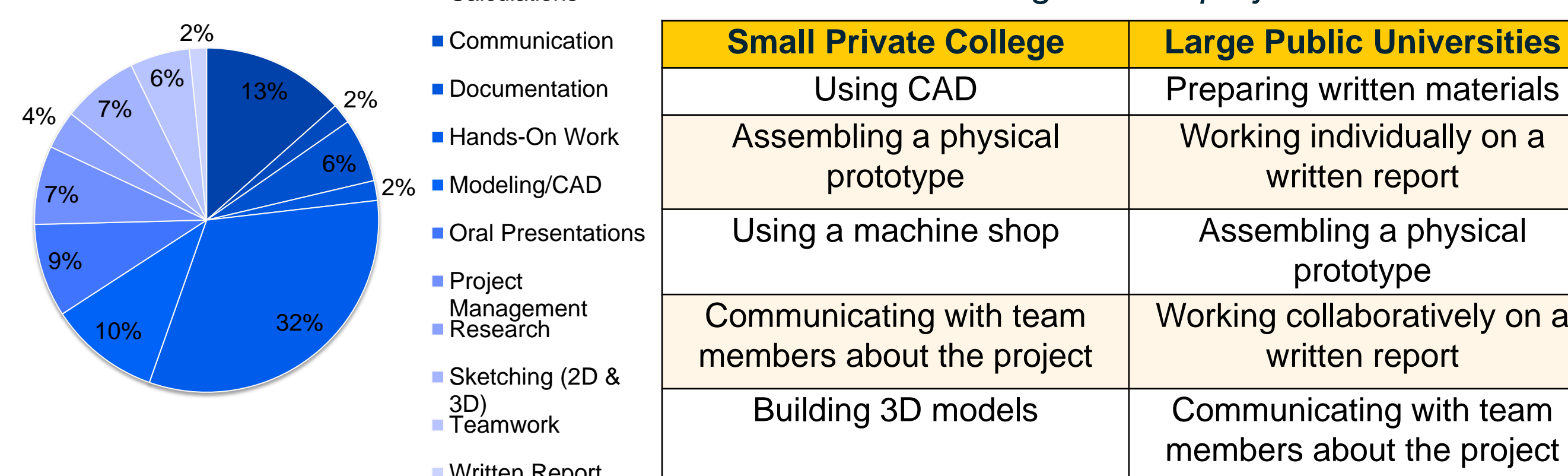
### Confidence & Self-Efficacy Changes Throughout the Course

		Small Private College				Large Public Universities			
		Incoming		Outgoing		Incoming		Outgoing	
		M	SD	M	SD	M	SD	M	SD
Commitment to Completing Degree	Confidence in Completing Degree	0.92	0.12	0.93	0.11	0.89	0.21	0.88	0.20
	Academic Self-Confidence	0.83	0.11	0.84	0.11	0.82*	0.08	0.87*	0.06
Self-Efficacy	Engineering	0.76	0.10	0.78	0.06	0.72	0.10	0.81	0.10
	Tinkering	0.76	0.10	0.78	0.07	0.74**	0.09	0.80**	0.09

### How Students Spend Their Time



The five tasks that students spend the most time on throughout the project



### Differences between Genders

		Small Private College				Large Public Universities											
		Female		Male		Female		Male									
		Incoming	Outgoing	Incoming	Outgoing	Incoming	Outgoing	Incoming	Outgoing								
Commitment to Completing Degree	Confidence in Completing Degree	0.88*	0.14	0.92	0.12	0.97*	0.08	0.95	0.09	0.95	0.09	0.95	0.09	0.84	0.26	0.82	0.24
	Academic Self-Confidence	0.82*	0.21	0.88	0.14	0.95*	0.09	0.97	0.08	0.84	0.15	0.90	0.15	0.81	0.23	0.90	0.14
Self-Efficacy	Engineering	0.80*	0.12	0.81	0.12	0.88*	0.08	0.88	0.08	0.82	0.10	0.88	0.08	0.82	0.06	0.86	0.05
	Tinkering	0.80*	0.12	0.75*	0.12	0.89*	0.06	0.84*	0.13	0.81	0.10	0.88	0.08	0.79	0.12	0.79	0.10

### Correlations between Tasks and Confidence & Self-Efficacy

Measure Change	Correlated Tasks	Small Private College		Large Public Universities	
		Positively Correlated	Negatively Correlated	Positively Correlated	Negatively Correlated
Commitment to Completing Degree	Research	--	--	--	--
Confidence in Completing Degree	Brainstorming	--	Tinkering Tasks	--	Engineering Tasks
Academic Self-Confidence	Open-Ended Problem-Solving	--	--	Calculations	Oral Presentation
	Math & Science	--	--	Calculations	Communication
	Professional & Interpersonal Skills	--	Calculations	Research	--
Self-Efficacy	Engineering	Brainstorming	Average Time on Task	--	--
	Tinkering	Brainstorming	Average Time on Task	--	--

## Future Directions

1. How do students choose which tasks they complete?
2. Do team dynamics affect student confidence & self-efficacy?
3. Does the assignment of team roles affect students' confidence and development of skills?
4. How do other contributors to self-efficacy affect students:
  - Social affirmation
  - Role models
5. Can projects be structured to improve confidence & self-efficacy in all areas?

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