

# “Will I be more certain about my future if I’m doing research?”: Examining Research and Academic Self-Efficacy and SE-related outcomes among undergraduates with and without research experience

Yuxi Xie<sup>a</sup>, Minso Choi<sup>b</sup>, M.A., Angela Ebreo<sup>c</sup>, PhD

<sup>a</sup> Department of Mathematics, University of Michigan; <sup>b</sup> Department of Educational Studies, The Ohio State University; <sup>c</sup> Center for the Study of Higher and Postsecondary Education, University of Michigan

## Abstract

During their college careers, some students may begin questioning their futures. For students unsure about their academic and professional trajectories, engaging in research helps them gain clarity toward future careers.

But does participation in research increase students' self-efficacy(SE) and certainty about their futures? This study examines possible differences in research SE, academic SE, and academic and career aspirations among Undergraduate Research Experiences(URE) participants and non-participants (51.1% STEM students). I analyzed **longitudinal survey data** from 567 first-year and transfer students enrolled during the 2011-2013 (60% participated in URE, 40% did not) from three time points: **October 2011, March 2012, and January 2013.**

## Introduction

By Social Cognitive Theory, While both involve a belief in one's abilities, **self-efficacy (SE)** is a more specific and theoretically grounded construct, whereas self-confidence is a broader, more general concept (Bandura, 2001). For example, a student might have strong overall self-confidence but low mathematics SE.



This study examines both undergraduate research participants and non-research students simultaneously, with a majority being STEM students. Addressing a gap in existing research—which predominantly focuses on students within UREs without a direct comparison group—this study explores how research participation influences SE and academic aspirations using survey data from the Undergraduate Research Opportunity Program (UROP) at the University of Michigan (UMich).

### Purpose of the Study

This study aims to compare academic and research self-efficacy between **UROP participants and non-UROP students** and to explore how these factors influence academic and career-related outcomes.

### Research Questions

- Do UROP participants and non-UROP students differ in their academic SE and research SE at Time 1 and Time 4?
- Does academic SE and research SE of UROP participants and non-UROP participants change from Time 1 to Time 4?
- Do UROP participants and non-UROP students differ in SE-related outcomes (e.g., term GPA, certainty of pursuing PhD or research career in STEM) after the first semester?
- To what extent are academic SE & research SE related to short-term outcomes?

Table 4: Outcomes difference between UROP and non-UROP students at Time 2

## Method

### Participants & Data Collection

- **First-year & transfer students (2011 to 2013)**
- **Survey time points:** T1 (N = 567), T4 (N = 210)

### Group distribution:

- **T1:** 290 UROP (51.1%), 204 non-UROP (36.0%), 73 missing
- **T4:** 124 UROP (59%), 86 non-UROP (41%)

Data analyzed in SPSS

### Measures

- **SE:** Academic & research SE at T1 & T4 (measured on a 4-point Likert scale)
- **SE-Related Outcomes:** Term GPA, cumulative GPA, certainty in Ph.D. & STEM research career (T2)
- **UROP Participation:** Binary (1 = UROP, 0 = non-UROP)

### Analyses

- **Independent t-tests** → UROP vs. non-UROP differences
- **Paired t-tests** → Changes in SE over time
- **Pearson correlations** → SE, GPAs, & career aspirations

## Result

Independent Samples T-Test

Variable	UROP		non-UROP		t	p
	Mean	SD	Mean	SD		
Academic SE-T1	3.78	0.55	3.70	0.53	-1.62	0.11
Research SE-T1	3.65	0.67	3.46	0.64	-3.146*	0.002*
Academic SE-T4	3.70	0.57	3.66	0.68	-0.46	0.65
Research SE-T4	3.52	0.77	3.37	0.76	-1.37	0.17

Note: SD = Standard Deviation; \*p<0.05.

		UROP		Mean	SD	t	p
T1	T4	Academic SE	Research SE				
T1	T4	Academic SE	Research SE	0.02	0.69	0.28	0.78
T1	T4	Academic SE	Research SE	.006	0.82	0.07	0.94

		non-UROP		Mean	SD	t	p
T1	T4	Academic SE	Research SE				
T1	T4	Academic SE	Research SE	0.12	0.67	1.68	0.10
T1	T4	Academic SE	Research SE	0.11	0.80	1.22	0.23

Independent Samples t-Test Comparing SE-Related Outcomes at T2

Variable	UROP		non-UROP		t	p
	Mean	SD	Mean	SD		
Term GPA	3.66	2.06	3.39	0.57	-1.40	0.16
Cumulative College GPA	3.51	0.40	3.50	0.46	-0.32	0.75
Certainty in STEM Research Career	2.69	0.99	2.53	1.07	-1.36	0.17
Pursuing a PhD	3.17	0.90	2.91	0.97	-2.56	.011*

Table 1: Differences in academic and research self-efficacy for UROP and non-UROP students at Times 1 & 4

Table 2 & 3: Changes within UROP and non-UROP students at T1 and T4

Pearson Correlations Between Academic SE, Research SE, GPA, and Career Aspirations

Variable	1	2	3	4	5	6
1. Academic SE	-					
2. Research SE	.634**	-				
3. Term GPA	-.031	-.026	-			
4. Cumulative GPA	.212**	.079	.086	-		
5. Pursuing a PhD	.054	.064	.063	.030	-	
6. Pursuing a STEM research career	.042	.045	-.006	-.106*	.364**	-

Note: \*\*. Correlation is significant at the 0.01 level (2-tailed).  
\*. Correlation is significant at the 0.05 level (2-tailed).  
N values vary per correlation due to missing data.

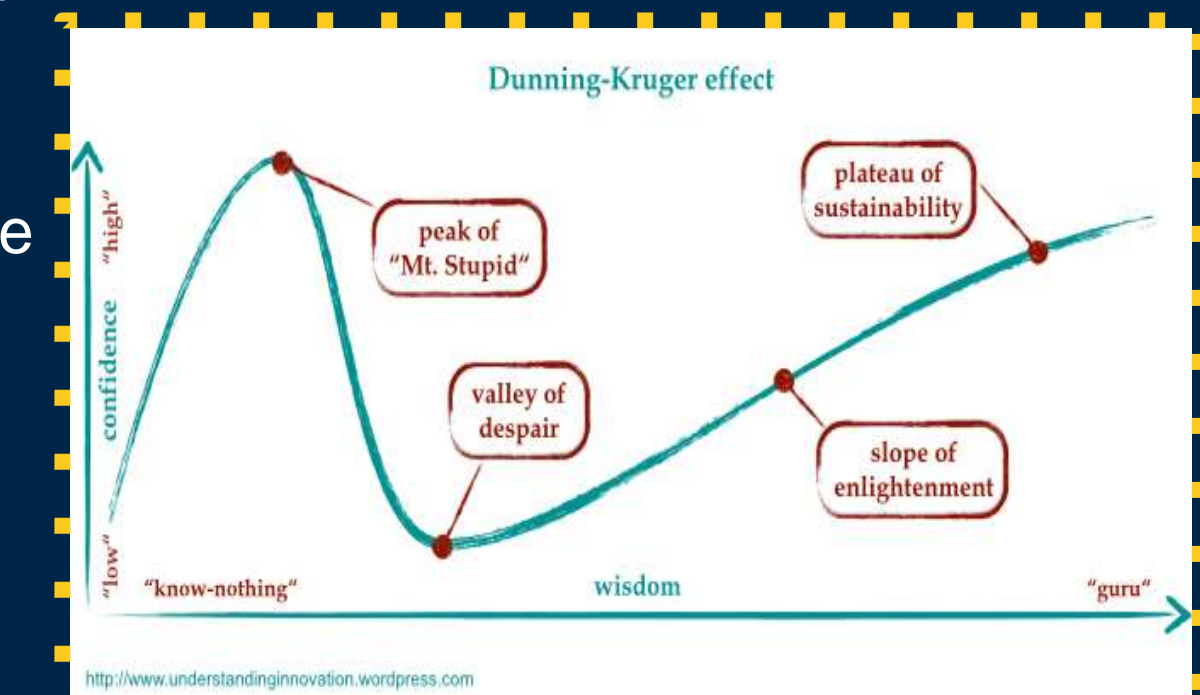
## Discussion

### 1. Decline in Research SE Over Time

a. **Dunning-Kruger Effect:** As students gained more research experience, they may have become increasingly aware of the complexities of research, leading to a decline in perceived competence (Dunning, 2011).

b. **Imposter Phenomenon:** Exposure to experienced researchers and advanced research environments may have led some students to feel inadequate despite their growing skills (Clance & Imes, 1978).

c. Research Challenges & Setbacks



### 2. Ph.D. Aspirations vs. STEM Career Certainty

a. While UROP provides students with exposure to research environments and methodologies, **the mentorship structure** may contribute to differing perceptions of research careers.

b. **Exploratory Nature of UROP:** Many students may enter UROP to explore research rather than commit to a career in STEM as its their first time research experience

### 3. Lack of Correlation Between SEs, Academic Performance, and Career Certainty

- **Future research:** Future research should explore which specific research skills (e.g., programming, experimentation, data collection, literature review, academic writing) most effectively enhance students' research self-efficacy.
- **Limitations:** Between T1 and T4, a significant number of participants were lost due to the extended timeframe.

## Acknowledgement

The data analyzed in this paper were collected as part of a larger longitudinal study that was supported by a grant from the National Institute of General Medical Sciences, National Institutes of Health (Award Number R01GM088750, Phillip J. Bowman, P.I). The opinions and recommendations presented here are solely those of the author(s) and do not represent the views of the National Institutes of Health.