Supporting student skill development in undergraduate research experiences through the development of a self-reflection guide

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Introduction

There has been an increased emphasis on documenting the benefits of participating in undergraduate research opportunities (URO) and developing an understanding of the factors that influence these benefits. While tools to effectively measure the behavior, attitude, skills, interest, and/or knowledge (BASIK) that result from UROs have matured, little focus has been placed on developing practical tools and instructional strategies to support students and mentors as they work to develop the BASIK being measured.

Viewed through the lens of constructivism, a URO can be examined as a cognitive apprenticeship (CA) where learning occurs through several key pedagogies described below (Collins et al., 1989). In a study of UROs as CA, Feldman et al., (2013) found modeling and reflection to be the least commonly initiated methods employed by interns and mentors, and concluded, "there is need for professors to be more proactive in helping their students gain intellectual proficiency". This work seeks to address this gap through the refinement of an intern Self-reflection Guide (SAMPLE NEXT TO POSTER) and implementation plan to further increase students' skill development.

Pedagogies of a Cognitive Apprenticeship

Modeling - An expert demonstrates a task explicitly so that novices can experience and build a conceptual model of the task at hand.

Coaching – An expert observes a novice's task performance and offers feedback to transition the novice's performance towards that of an expert's.

Scaffolding - The act of analyzing and assessing student abilities , and then invoking strategies and methods to support the student's learning.

Articulation - Getting students to articulate their knowledge, reasoning, or problem-solving process in a domain

Reflection – Allowing students to compare their own problem-solving processes with those of an expert, another student, and ultimately, an internal cognitive model of expertise The goal of reflection is for students to look back and analyze their performances with a desire for understanding and improvement towards the behavior of an expert.

Exploration - Giving students skills and room to problem solve on their own

Self-Reflection Guide Goals:

- Engender opportunities for mentors and interns to engage in Modeling and Reflection pedagogies
- Increase the extent to which the intern is satisfied with the mentoring relationship
- Increase the extent to which the mentoring relationship is centered on the intern.
- Enable mentors and interns to feel more effective in monitoring their own/intern's personal/professional growth

Implementation aligned with Cognitive Apprenticeship Pedagogies

Phase	Implementation	Modeling	Coaching	Scaffolding	Articulation	Reflection	Exploration
Orientation Week	Training and practice with metacognitive strategies	X			X	X	
	Self-Reflection Guide	X					
	Discussion of Self-Reflection Guide with peers/near-pears				X	X	
Beginning of Placement	Interns individually complete the self-reflection guide				X		
	Discussion of ratings with mentor	X		X		X	
Middle of Placement	Interns complete self-reflection guide together with the mentor and discuss	X	X	X	X	X	
End of Placement	Interns and their mentor each separately complete the self-reflection guide and discuss		X		X	X	
	OR interns complete self-reflection guide together with the mentor and discuss		X		X	X	

References:

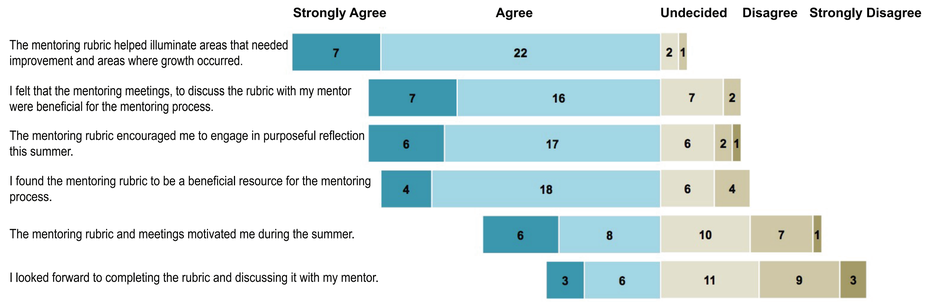
Collins, A. (2006). Cognitive Apprenticeship. In The Cambridge Handbook of The Learning Science (pp. 47–60). Cambridge: Cambridge University Press.

Feldman, A., Divoll, K. A., & Rogan-Klyve, A. (2013). Becoming Researchers: The Participation of Undergraduate and Graduate Students in Scientific Research Groups. Science Education, 97(2), 218–243.

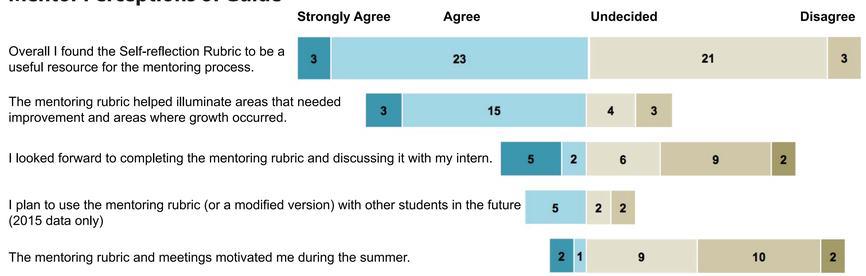
Results

Survey data was collected between 2011 and 2015. Average response rate for interns was 90% and 84% for mentors.

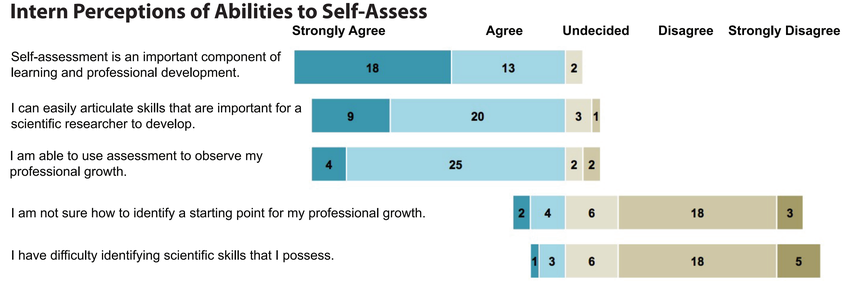
Intern Perceptions of Guide



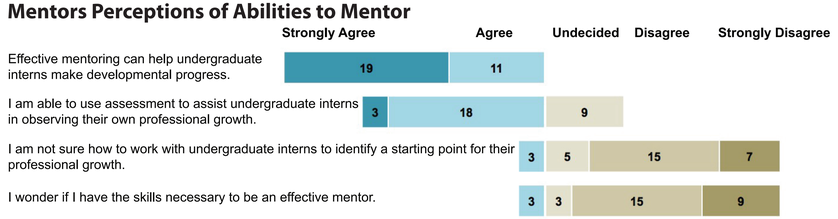
Mentor Perceptions of Guide



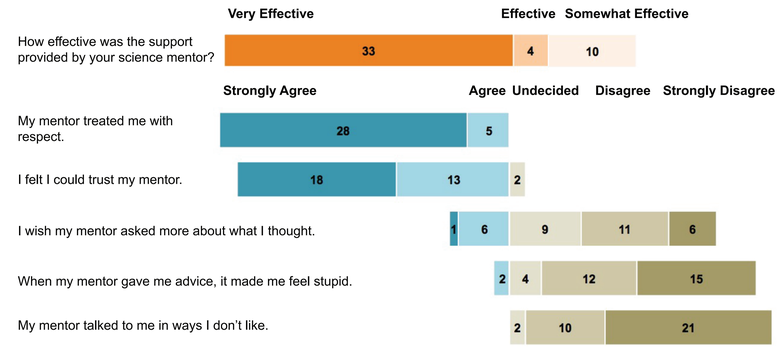
Intern Perceptions of Abilities to Self-Assess



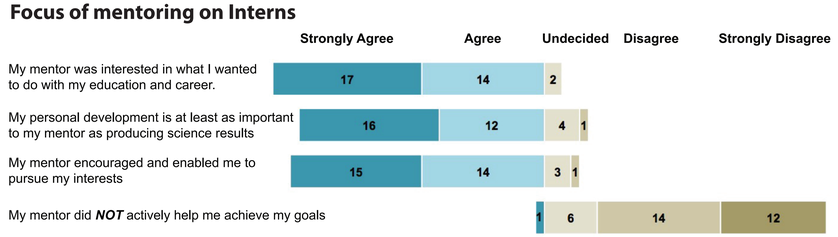
Mentors Perceptions of Abilities to Mentor



Intern Satisfaction with Mentoring

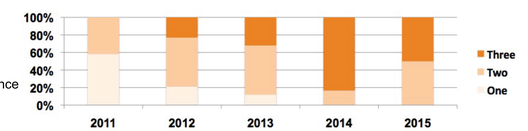


Focus of mentoring on Interns



Use of Self-Reflection Guide

The self-refleciton guide was intended to be used three times each summer as described in the Introduction. The results of the evaluation have been shared with mentors and interns each year. Overtime, this appears to have increased adherence to the protocol as designed.



Number of times the self-reflection guide was used each summer by percentage of mentor/intern pairings

Conclusions and Future Work

- Initial analysis warrants continued use and evaluation of the self-reflection guide.
- The self-reflection guide appears successful at achieving its goals despite both mentor and intern reticence.
  - Interns and mentors both described the self-reflection guide as useful for illuminating areas needing improvement and where growth occurred. Interns generally reported the guide to be a beneficial resource to a greater degree than did mentors.
  - Interns report satisfaction in the mentoring relationship and the degree to which it is centered on the them
  - Interns report confidence in monitoring their personal/professional growth
- Mentors indicate confidence in their abilities to mentor interns and use tools, such as the self-reflection guide, as part of the process.
- Adherence to the implementation of the self-reflection guide has generally increased over time.

Moving forward we intend to

- Incorporate remaining survey and qualitative data from 2011 – 2015 to gain additional insight into the impact and use of the self-reflection guide
- Leverage the URSSA tool to help measure the degree to which students made gains in skills in 2017.
- Recruit REU site(s) to administer similar survey items to better measure impact of guide.
- Develop online system to directly monitor and further encourage use of the guide.