



Factors That Lead to Self-Efficacy in STEM Students: A Focused Literature Review

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Abstract

Social cognitive career theory was developed to explain how educational and career choices are made and is frequently used in studies of students' career-related outcomes (Lent et al., 2018). This theory states that self-efficacy beliefs and outcome expectations are related to students' academic interests, career choices, career success, and more (Lent et al., 2018). Self-efficacy is defined as the belief in one's abilities to perform specific activities or behaviors (Sheu et al., 2018).

While many studies examine the relationship between self-efficacy and student outcomes, less attention has been given to the factors that lead to self-efficacy. A recent review by Sheu et al. (2018) briefly mentions the four precursors to self-efficacy but largely focuses on the applications of self-efficacy. My review dives deeper into these predictive factors and discusses how self-efficacy builds in STEM students, in particular, with this question in mind: what factors lead to self-efficacy in STEM students?

I conducted a focused literature review by compiling recently published articles in five databases. My search was limited to peer reviewed articles published in English, after 2017. I also excluded dissertations. I narrowed my findings to 21 articles and used the following guiding question to determine relevance: Does this article address the factors that lead to self-efficacy itself or how self-efficacy is applied?

All four hypothesized precursors – mastery experience, verbal persuasion, vicarious learning, and affective state – have an overwhelmingly positive relationship with the development of self-efficacy. While all precursors play a role, mastery experience and verbal persuasion may be more effective in increasing self-efficacy, as they were more frequently mentioned throughout the literature.

The findings will be discussed in terms of their implications for practitioners (student advisors, career counselors) who work with STEM students as well as their relevance to social-cognitive career theory.

Introduction

- **General issue**
 - How to aid students in feeling confident in their abilities as they decide on a career path
- **Theoretical background**
 - Social cognitive career theory (SCCT; Lent et al, 2018) explains:
 - how career goals develop
 - how educational and career choices are made &
 - what factors play a role in academic and career success
 - Social cognitive career theory presents self-efficacy as one of the main factors in determining how career choices are made and success is attained
- **Definition of Self-efficacy**
 - Belief in one's ability to perform situation-specific actions (Lawrence & McLeroy, 1986)
- **Four main predictors of self-efficacy (Sheu et al, 2018)**
 - Mastery experience: experience gained from completing a task or action
 - Vicarious learning: learning from the experience of others
 - Verbal persuasion: verbal or written feedback that is indicative of another's abilities
 - Affective state: experiences of emotional state
- **Focus on STEM career development**
 - Stigma is commonly associated with the STEM field
 - For many students, especially women, pursuit of STEM careers can have negative consequences such as feelings of imposter syndrome and lower self-efficacy
- **Research question**
 - What do studies conducted on STEM students say about the factors that lead to self-efficacy?

Methods

Read an existing review (Sheu et al., 2018) and conducted my own literature review

- **Search Terms:**
 - (STEM or science or technology or engineering or mathematics) AND (college students or university students or undergraduates) AND ("social-cognitive-career-theory" or SCCT)
- **Constraints:**
 - Peer reviewed articles
 - Excluded dissertations
 - Published in English
 - Published in 2017 or later
- **Databases:**
 - PsycInfo (32 articles)
 - ERIC (13 articles)
 - Web of Science (21 articles)
 - Scopus (26 articles)
 - PubMed (22 articles)
- **Selection of articles to review:**
 - Skimmed 97 articles
 - Chose 21 articles for my review
 - Selected articles for inclusion using the following questions:
 - Does this article address the factors that lead to self-efficacy or does it align more with how self-efficacy leads to specific outcomes?
 - Does this article address students in the United States?
 - Does this article address college students?
 - Does this article address STEM students?

Results

- All four hypothesized precursors – mastery experience, verbal persuasion, vicarious learning, and affective state – have an overwhelmingly positive relationship with the development of both general as well as various types of specific STEM self-efficacy, including engineering, math, and science self-efficacy
- While all precursors play a role, mastery experience and verbal persuasion have the largest positive effects on self-efficacy
- 12 of the 21 articles cited either mastery experience and/or verbal persuasion as positive precursors of a form of STEM self-efficacy
- Six articles cited vicarious learning as a positive precursor to both general and engineering self-efficacy
- Two articles described affective state as a positive precursor to engineering self-efficacy
- Two articles cited verbal persuasion, in the form of discrimination/stigma, as a negative precursor to STEM self-efficacy, meaning that they dampened students' sense of self-efficacy
- In a few cases, mastery experience had a stronger effect on women than men

Findings

Amount of Citations as Precursor to Self-Efficacy

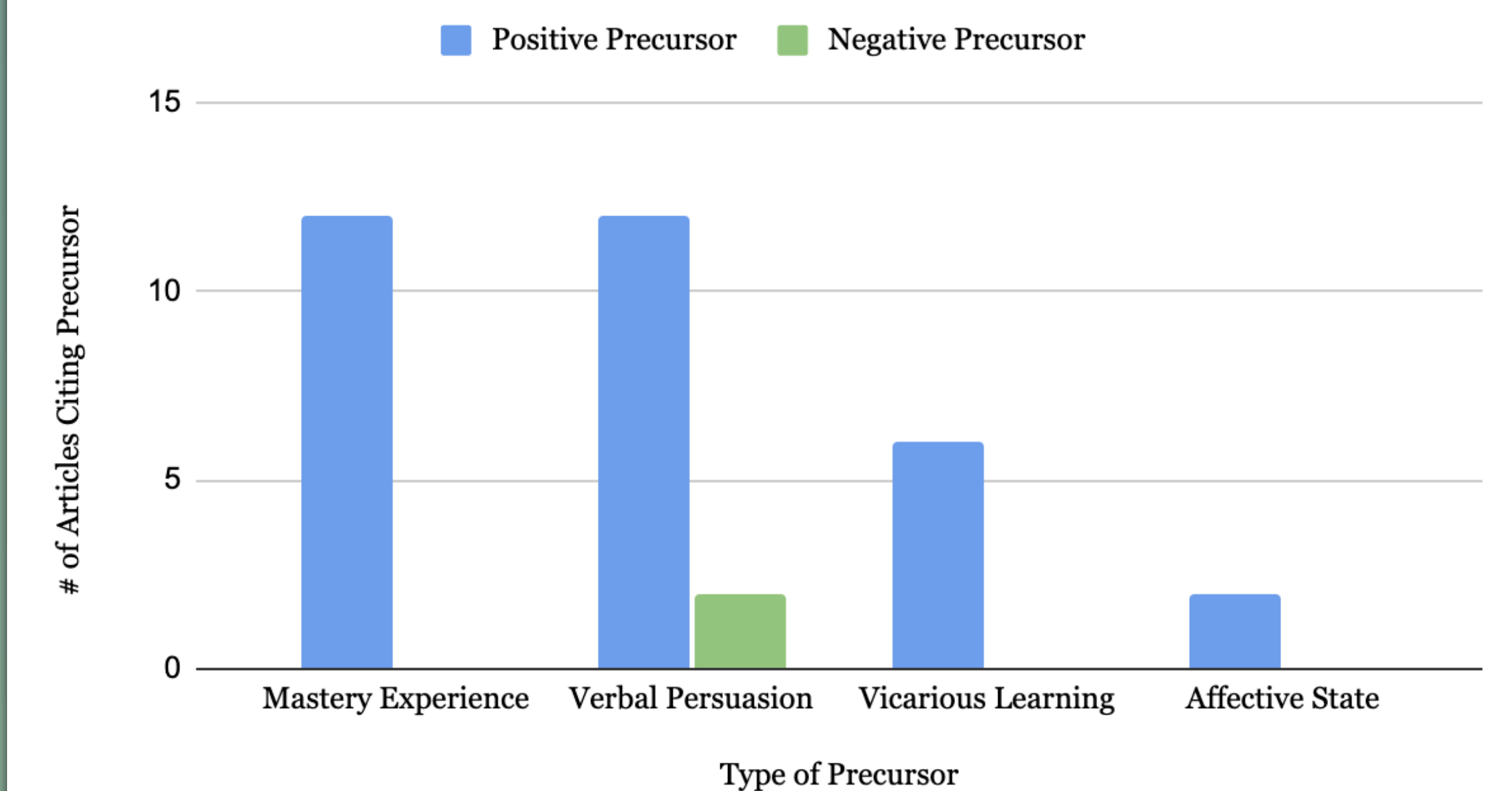


Figure 1. Amount of Citations as Precursor to Self-Efficacy. Displays the amount of references made to each precursor throughout the 21 articles that were analyzed and distinguishes between positive and negative precursors

Discussion

- **Existing literature is sparse**
 - Majority of current literature looks into how self-efficacy leads to certain outcomes
 - Very few articles look into what leads to self-efficacy itself
 - In general, my review indicates that the four hypothesized four precursors were positively related to self-efficacy
- **Implications**
 - Factors that lead to self-efficacy can inform interventions, programming, curriculum changes, and more
 - For example, a university may choose to implement a STEM mentoring program that increases positive verbal messages given to students by mentors
 - Similarly, experiential mastery programs, such as UROP, could be offered to give students the chance to gain mastery experience and in turn, increase feelings of self-efficacy
 - These changes in educational practice can help:
 - increase feelings of self-efficacy among students
 - allow them to feel more confident in their academic & professional endeavors
 - Changes like these are especially important in STEM fields due to their inherently competitive, high-stakes, and high-stress nature
 - Incidental increases in feelings of self-efficacy may lead to students achieving higher success in their academics and/or careers, as per social cognitive career theory

Acknowledgements

I would like to thank Dr. Angela Ebreo and Jordan Peyton for their guidance and support throughout working on this project. Their help was invaluable each step of the way, from initial drafting of research questions, to article collection, to final edits. Thank you for giving me the opportunity to immerse myself in the research process and learn about how literature reviews are written.