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2006-1389: THE UNDERGRADUATE RESEARCH EXPERIENCE AS IT RELATES TO RESEARCH EFFICACY BELIEFS AND THE IMPOSTER PHENOMENON

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The Undergraduate Research Experience as It Relates to Research-Efficacy Beliefs and the Imposter Phenomenon

Abstract

Studies associating gender with self-efficacy beliefs and studies on the Imposter Phenomenon (IP) are great in number. This study seeks to further investigate the relationship between gender, self-efficacy, and IP by examining the research self-efficacy beliefs and imposter feelings of students in an eleven-week undergraduate summer research program. The results are from a voluntary survey offered in the ninth week of the program offered at a large Midwestern University. The qualitative/quantitative survey was designed to determine students' research-efficacy (i.e. their confidence in their abilities to succeed in the research program), their definitions of success in the research program, and their imposter status as measured by the Clance IP scale. Quantitative questions measured how successful students felt they were in the program, their efficacy for achieving success in the program, and the intensity of their imposter feelings. Qualitative, open-ended questions called for the participants' views of what it meant to be successful in the program and factors that influenced their definition of success. The results and conclusions presented here offer insight into the research experiences of both female and male students, as voiced by the students themselves.

Introduction

Studies have shown that the retention rate of women in STEM fields is significantly lower than that of their male counterparts¹. Moreover, research done by Seymour and Hewitt has shown that often there is no apparent difference in the achievement and attitudes of students who persist in the fields and those who leave². Many women who persist in STEM programs note a lack of assurance in their abilities, regardless of high grades earned and other commonly accepted indications of success, as a barrier to their overall success in the fields³.

This degree of certainty in one's ability to perform a designated task is called self-efficacy. Self-efficacy has been linked to student interest, achievement, and retention in STEM fields^{4,5}. Bandura's work on self-efficacy⁶ explains the sources of such beliefs by placing them in categories: mastery experiences, vicarious experiences, social persuasions, and physiological states. Mastery experiences involve the influence of people's self-evaluation of previous performances on similar tasks while vicarious experiences involve the influence of the outcomes achieved by others when performing comparable tasks. Social persuasions develop through verbal judgment and appraisal of others. Physiological states include stress, anxiety, fear, and emotions that impact confidence in one's abilities.

Clance and her colleagues discovered a psychological phenomenon that directly relates to the fear of success. The impostor phenomenon (IP) is a psychological syndrome that stems from intense feelings of fraudulent success and achievement⁷. Not to be confused with self-esteem, which "measures a broader domain of attitudes and feelings about the self than does the impostor phenomenon⁷," IP leads its victims to define their success by a single factor. Despite past performances and successes, it is this one factor that weighs heavily upon the mind of an IP sufferer. If this factor is achieved, they attribute their success to some external force, such as

charm, luck, or sexuality. Success is an ideal that cannot be internalized. Opportunities for achievements double as a chance to succeed and a chance to fail, or be exposed as a fraud.

The imposter syndrome was originally thought to be a women's issue⁷, however, more recent studies have proved otherwise⁹. Harvey notes that as many as 70% of all successful people have experienced imposter feelings¹⁰. Although IP is now known to affect both men and women alike, the diagnosis of female sufferers is greater due to the more frequent involvement of women in psychotherapy.

The Clance IP Scale and the Harvey IP Scale are numerical rankings used to diagnose and measure the intensity of the impostor phenomenon. The Clance scale includes a greater sensitivity to the phenomenon because it includes factors such as fear of evaluation (i.e., "I avoid evaluations if possible and have a dread of others evaluating me."), feelings that success cannot be repeated (i.e., "When I have succeeded at something and received recognition for my accomplishments, I have doubts that I can keep repeating that success.") and feelings of being less capable than one's peers (i.e., "I often compare my ability to those around me and think they may be more intelligent than I am.")⁸. The Clance IP Scale is a series of Likert-scale questions that yields a score from 0 to 100. Scores closer to 100 indicate more intense imposter feelings and greater success anxiety. Scores falling in the range of 0 to 40 correlate to "few" imposter feelings, 41 to 60 to "moderate," 61 to 80 to "frequent," and over 80 to "intense" feelings.

Though both self-efficacy and IP account for a great number of studies in education and psychology, we are unaware of any studies that have looked at both simultaneously. Interestingly, many of the factors measured by Clance's scale suggest strong ties to self-efficacy theory. Feelings that successes cannot be repeated, for example, may be tied to students' assessments of their mastery experiences when they are forming their efficacy beliefs. In addition, students' comparisons of their capabilities to those of their peers are vicarious experiences which are also significantly influential on efficacy beliefs. In the case of an IP sufferer, the negative feelings associated with these mastery and vicarious experiences suggest that susceptibility to the phenomenon may lead to a lack of efficacy in areas for which imposter feelings are associated.

To date, neither self-efficacy nor IP have been investigated in a summer program purposed to expose students to undergraduate research and the application of their studies. One study has, however, investigated IP in relation to new roles and environments. It found that 57 freshman and sophomore males and females who were not yet in an honors program scored higher on the Harvey IP scale than college juniors and seniors already in the program¹⁰. Also, Harvey found that first-year graduate students scored eight points higher than undergraduates¹⁰.

With the budding push in academia for participation in summer internships and co-operative programs comes the possibility of an added source of stress for students as they attempt to succeed in another aspect of the STEM experience. The increasing prevalence of these opportunities in the STEM fields may further contribute to the retention issues faced by the fields, however, the nature of this contribution is not yet known. Students may associate internships, co-operative programs, and other research experiences with the "real world," making failure or success in this environment influential in the formation of their research-efficacy

beliefs and thus their decision to stay in their respective programs. This study is designed to investigate how self-efficacy beliefs relate to the Impostor Phenomenon in a summer research program. Participants answered open-ended questions and listed factors affecting how they viewed and defined their confidence in their ability to succeed in the program.

Research Design

A phenomenographical research methodology, pioneered by Marton et al.¹¹, looks at the qualitatively different ways people interpret various experiences. In this study, understanding how participants perceived their experiences in the research program is crucial to explaining the program's role in both the potential development of IP feelings and the formation of efficacy beliefs. IP sufferers perceive success to be a function of fraudulent experiences; it is therefore important to recognize the various perceptions research program participants hold about success in the research enterprise. Moreover, the development of efficacy beliefs results from one's perceptions of his or her abilities in a given area. Participant's experiences in the summer research program are therefore the focus of this study, lending it to be investigated using a phenomenographical framework.

The participants in the research program were 161 students from various colleges and universities across the U.S. who attended an eleven-week summer research program at a large Midwestern university. Twenty-six percent (n=42) of the program participants were female and 73% (n=119) were male; 20% (n=33) were minorities (African American, Native American, and Hispanic American) and 80% (n=128) were Caucasian. While the majority of the participants (85%, n=137) were students enrolled at the host institution, fifteen percent (n=24) of the participants visited the program from other institutions. Table 1 depicts the demographics for the 40 students that made up the sample population for this study.

Table 1. Demographics of sample population.

	Men		Women	
	# in Sample	% of Sample	# in Sample	% of Sample
Caucasian	16	40.0%	0	0.0%
African-American	2	5.0%	5	12.5%
Hispanic	1	2.5%	2	5.0%
International	1	2.5%	0	0.0%
Asian/Pacific Islander	7	17.5%	3	7.5%
Other (Hindu)	1	2.5%	0	0.0%

The summer research program was structured such that students were required to meet several criteria. The students were to work at least 40 hours per week with a professor and/or graduate student on a project of choice that corresponded to his/her interests and major. At the culmination of the program, students were required to create a poster to be judged by university faculty, give an oral presentation, or write a final report.

Procedure

An online qualitative/quantitative survey was emailed to all students in the program. Students were given the opportunity to participate in the study on a voluntary basis and were informed that their survey responses were completely confidential and would not be linked to their individual identities. The survey was made available approximately two weeks before the end of the program, allowing participants to accurately reflect on their work and experiences without having completed the program requirements.

The survey was designed to probe program participants' efficacy beliefs, feelings of achieved success, and perceptions of success in the research program. On a Likert-scale, students were asked to rate, "your confidence in your ability to succeed in the research program," and "the degree to which you are currently succeeding in the research program." Following each of these items, open-ended questions prompted students to (1) explain "why did you choose this rating", and (2) list "what factors influence how you feel about your ability to succeed/current success?" Respondents were also asked to respond to the question, "What is your personal definition of success in the research program?" They were further asked how they thought their peers, family, professors, and graduate student mentors would define success, the results of which are not presented here. The Clance IP Scale¹² was incorporated in the survey to determine each participant's imposter status.

Analysis

Many survey submissions included partially answered questions and omitted responses. A total of 46 responses were received; however, only 40 responses (i.e. those in which >50% of the qualitative questions were answered) were included in the analysis, an overall response rate of 25% for men and 24% for women. At a 90% confidence level, this response rate corresponds to no more than 13% and 22% error in the data collected from men and women respectively.

Qualitative survey data was analyzed using ATLAS.ti, version 5.0¹³, a qualitative management program. Students' responses to open-ended questions asking why they selected the rankings of confidence in summer research program success and degree of current success that they did were reviewed. Responses that were similar in nature were given an enveloping "code-name." All student comments were then coded individually by two independent researchers. Upon completion of independent analysis the two researchers met to perform an interrater reliability exercise. Initial researcher agreement on factors placed in each category ranged from 85% to 90%, which is a reasonable level of agreement for this type of research¹¹. Factors not initially agreed upon were discussed until agreement was reached.

Results

Analysis of students' scores on the Clance IP scale revealed that 35% (9 men and 5 women) of the respondents suffered from IP, defined as a score of greater than 60 on the IP scale⁹. Three students were found to suffer from intense imposter feelings, two of whom were male. The majority of those suffering from IP experienced frequent imposter feelings (n=11).

Of those students who were not classified as IP sufferers, 23 (58%) experienced moderate imposter feelings and 3 experienced few such feelings.

Quantitative survey items incorporated in this study aimed to investigate the potential relationship between IP and students' efficacy beliefs. The results of the small scale study did not yield a large enough response rate to suggest whether statistical correlations or significant differences can be identified in the data. The degree to which students felt that they were achieving success or were able to achieve success in the program did reveal general trends, however, when analyzed based on gender and IP status. These trends are illustrated in Figures 1 and 2.

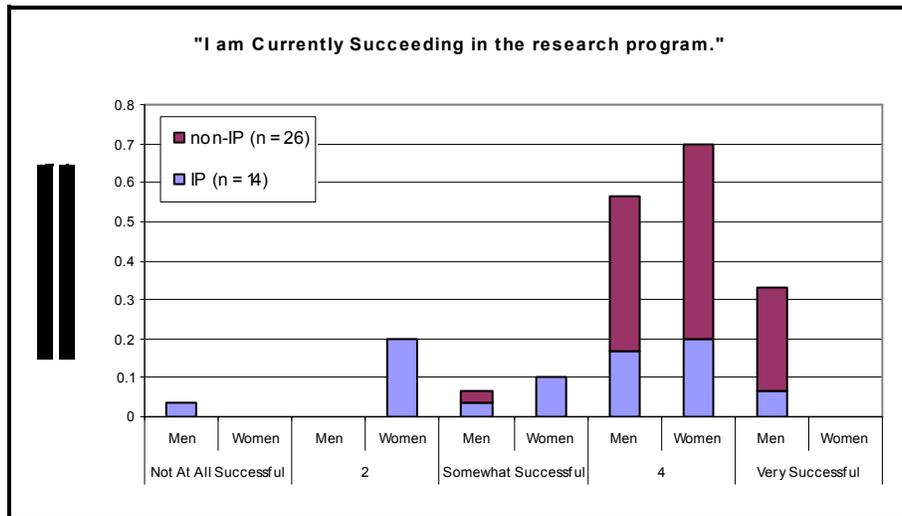


Figure 1. Student rankings of their current success in the research program based on gender and IP status (average ratings: Men = 4.2, Women = 3.5, IP = 3.5, and non-IP = 4.3).

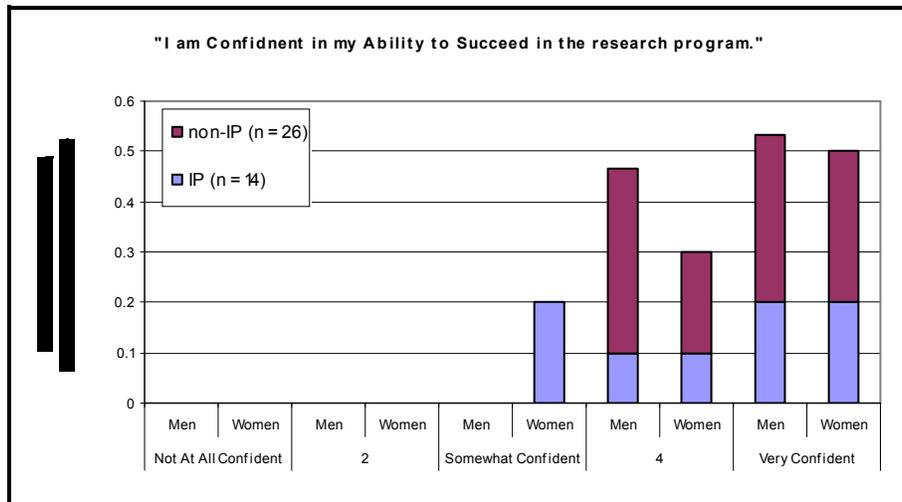


Figure 2. Student rankings of their ability to succeed in the research program based on gender and IP status (average ratings: Men = 4.5, Women = 4.3, IP = 4.4, and non-IP = 4.5).

Analysis of (1) students' definitions of success in the program and (2) the factors cited as explanations for their confidence in overall program success and their assessment of their current success in the program, revealed seven overarching categories. A description and example of each category are presented in Table 2.

Table 2. Categories developed to describe students' responses to open-ended survey items.

Category Title	Description	Example
Completion	Student discussion of completion of or an attempt to complete assigned tasks	"Finishing the project." "Completing the goals set for me by my mentor."
Current Status	Student discussion of current results, current project status, and doing well on projects now as a determinant of future success	"Because of how far I have gotten on my project."
Drive & Motivation	Student report of possessing or lacking personal attributes such as hard work	"I am a hard worker." "I put forth my best effort."
(Research) Environment	Student discussion of the nature of the research and learning environment including degree of satisfaction with graduate mentors, professors and other researchers in the labs	"Working well with my professors and grad mentors." "The professor was helpful and supportive."
(Research) Experience	Student discussion of acceptance into the program, the stipend associated with the program, and gaining new experience from the program	"Just being here." "Getting paid." "Learning what research is all about." "Gaining new experiences."
Growth & Development	Student discussion of personal growth and development while in the program including the progression of knowledge and skills beyond what they were before program participation and the ability to network	"To publish a paper." "Apply knowledge here to future endeavors." "To feel prepared for grad school after the program."
Understanding	Student discussion of understanding or learning theories and concepts involved in research projects	"Learning and being able to apply the concepts I need to do my research." "New knowledge in the field of _____."

Students' survey responses have been analyzed such that comparisons can be made based on IP status as well as gender. Here, the variation in responses given by IP and non-IP students is presented first, followed by a contrast of men and women. Tables 3 and 4 illustrate the difference in the numbers of IP sufferers and non-IP sufferers (and men and women: Table 4) citing factors that fell into each of the developed categories.

Table 3. Number of IP and non-IP (percent of IP and non-IP sample populations) citing the influence of each identified influential category.

Category	What factors influence how you feel about your ability to succeed in the research program?		Why did you rank your current success in the research program as you did?		What is your personal definition of success in the research program?	
	IP	Non-IP	IP	Non-IP	IP	Non-IP
Research Environment	4 (29%)	8 (31%)	1 (7%)	1 (10%)	1 (17%)	--
Drive & Motivation	2 (14%)	3 (12%)	2 (14%)	2 (8%)	--	--
Understanding	1 (7%)	5 (19%)	2 (14%)	2 (8%)	2 (14%)	10(28%)
Research Experience	1 (7%)	3 (12%)	1 (7%)	2 (8%)	4 (29%)	5 (19%)
Growth & Development	--	--	3 (21%)	3 (12%)	4 (29%)	8 (31%)
Completion	--	--	--	--	4 (29%)	5 (19%)
Current Status	--	--	5 (36%)	3 (12%)	--	--

Table 4. Number of men and women (percent of female and male sample populations) citing the influence of each identified influential category.

Category	What factors influence how you feel about your ability to succeed in the research program?		Why did you rank your current success in the research program as you did?		What is your personal definition of success in the research program?	
	Men	Women	Men	Women	Men	Women
Research Environment	11 (37%)	2 (20%)	3 (10%)	--	2 (7%)	--
Understanding	5 (17%)	2 (20%)	5 (17%)	2 (20%)	6 (20%)	4 (40%)
Drive & Motivation	4 (13%)	1 (10%)	1 (3%)	1 (10%)	2 (7%)	1 (10%)
Research Experience	3 (10%)	2 (20%)	1 (3%)	1 (10%)	8 (27%)	1 (10%)
Growth & Development	--	--	5 (17%)	2 (20%)	9 (30%)	2 (20%)
Completion	--	--	--	--	8 (27%)	3 (30%)
Current Status	--	--	8 (27%)	4 (40%)	1 (3%)	--

Discussion

The results of this study confirm the findings of many others in suggesting the susceptibility of students in new roles to IP¹⁰. Here, it was found that 35% of summer research program participants who completed the Clance IP scale scored in a range that classified them as IP sufferers. One implication of having IP feelings is the likelihood that those suffering from IP will shy away from situations in which they may be exposed as an imposter. It is therefore interesting to consider the number of IP sufferers who took the initiative to participate in this summer program. This may, however, be explained by the high efficacy displayed by all respondents when rating their confidence in their ability to succeed in the program (average ratings: IP = 4.4, and non-IP = 4.5.). These results suggest that the single factor defined as success by the identified IP sufferers is not their overall success in the summer research program. Rather, the difference in the responses of IP and non-IP sufferers to the item, "I am *currently* succeeding in the summer research program" (Figure 1; average IP rating = 3.5 versus non-IP =

4.4) suggests that there is a much more specific aspect of the experience on which IP sufferers define success and fear failure. Further, the fact that students suffering from IP demonstrate confidence in overall program success, yet are more hesitant when assessing their current success, suggests that they may either feel they can overcome the difficulties hampering their current success or that they do not believe that their overall program success will be dictated by the problems with which they are currently struggling. Alternatively, the difference in ratings between current and future success may indicate that although IP victims believe that they have the ability to achieve future success, they may begin to view this success as fraudulent when forced to make a current self-assessment.

When asked to define success in the research program, the responses provided by IP victims were varied (Table 3). The single factor on which students with imposter feelings define their success is, however, quite personal, therefore this finding is not surprising. To better understand the components of a summer research program experience upon which IP sufferers define their success and how their efficacy beliefs are related, a more extensive study looking at a larger population of students is required. Moreover, individual interviews with program participants can best reveal how such a program is perceived by all participants, IP and non-IP sufferers as well as men and women. Exploratory qualitative interviews would further elucidate how imposter feelings are cognitively processed and developed and provide insights into how such feelings are impacted through curricular and extra-curricular activities.

Tables 3 and 4 illustrate the significant distribution of students' responses to the factors that they used to evaluate their confidence in research program success, their current success in the program, and their definition of program success. This distribution, as well as the small number of participants in the study, provide little insight in determining whether differences exist in the factors cited by IP sufferers and non-IP sufferers or those cited by men and women. What is apparent from this data, however, is the strong degree to which all students in the research program drew on mastery experiences as the primary evaluator of their success and confidence in achieving future success. Mastering an understanding of research projects and the research experience, growing and developing as a researcher, completing a project, and current project status are all factors that fall under Bandura's⁶ defined efficacy source of mastery experiences. Many students also cited the consideration of the research environment, an influence that includes student interaction with faculty advisors and graduate mentors. This category describes the influence of vicarious experiences and social persuasions. A deeper understanding of how these efficacy sources relate to imposter feelings in the mind of the student could be also be achieved through interviews with program participants.

Conclusions

This study is a first step toward understanding the potential relationship between IP and self-efficacy beliefs. Results revealed that IP sufferers and non sufferers alike appear to be quite efficacious about overall summer research program success; the same was found to be true for men and women. IP sufferers, however, rated their degree to which they were currently achieving success in the program lower than non sufferers. These findings are useful in the development of further studies investigating the efficacy – IP relationship on a larger scale and incorporating exploratory interviews with students. Future studies that can better elucidate this

relationship can help inform curricular and extra-curricular practices in how best to promote efficacy and help students struggling with IP.

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