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FACULTY MENTORS' AND STUDENTS' PERCEPTIONS OF STUDENTS' RESEARCH SELF-EFFICACY

Elise L. Lev, Ed.D., RN¹, John Kolassa, PhD², and Lori L. Bakken, PhD³

¹ Rutgers, The State University of New Jersey, College of Nursing, Newark, NJ 07102.

² Rutgers, The State University of New Jersey, Department of Statistics, Piscataway, NJ. 08854

³ University of Wisconsin-Madison, Department of Medicine and Educational Leadership and Policy Analysis, Madison, WI. 53706

Abstract

Mentoring in nursing is an important process for socializing nurse researchers, developing a body of professional knowledge, and influencing career choices of students. Self-efficacy (Bandura, 1997) is concerned with one's perceived ability to perform tasks within a specific domain.

The purpose of this study was to compare undergraduate and graduate student's perceptions of their abilities to pursue research (research self-efficacy) with their mentors' perceptions. A cross-sectional design was used to study mentors in any academic discipline who received external funding and worked with an undergraduate or graduate student on the research study. Recruitment and data collection were completed using the Internet and included 21 faculty mentors and student dyads. The Clinical Research Appraisal Inventory was used to measure research self-efficacy. Differences between the faculty mentor's perception of the student's confidence in research and students' perception were significant at $p < 0.001$.

Misjudgment of efficacy appraisals can result in opportunities forsaken and careers not pursued. Assisting mentors to guide students' skill perfection may increase students' choice of research careers, promote the effectiveness of mentorship, aid in the development of a body of professional knowledge and benefit careers of both mentors and students.

Keywords

mentor; student, research career; self-efficacy

Introduction

Mentoring occurs when a senior person or mentor provides information, advice, and emotional support to a junior person or student over a period of time (Dorsey & Baker, 2004; National Academy of Sciences (NAS), 2008). Elements of formal mentorship programs include giving advice, psychosocial support, role modeling, career advising or counseling, cultivating the

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Corresponding author: Elise L. Lev, 78 Fox Hill Rd., Stamford, CT 06903 USA Telephone: 203 322-9905 Fax: 203 322-6274
eliselev@rutgers.edu.

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intellect of the student, and varying the help given to meet the needs of the mentee over time (Allen, Eby & Lentz, 2006; May, Meleis & Winstead-Fry, 1982, NAS, 2008).

Graduates of a doctoral program in nursing revealed that mentoring relationships were critically important to their research careers (Heinrich, 2005). A workgroup of the National Institute of Nursing Research (Sigmon & Grady, 2001) maintained that dedicated research mentors are needed to “provide socialization and support” to PhDs who are most likely to pursue research careers. Although mentorship has been shown to be a critical factor in students' choice of research career (Smedley, Stith, Colburn, & Evans, 2001), no actual evidence was found that illuminated the mentor's specific influence on the student's self-efficacy for research.

Background

Bandura (1997) hypothesized that most human behavior is learned through reciprocal interactions with others. Hence, efficacy expectations can be formed through information derived from four sources: performance accomplishments, vicarious experience (role modeling), verbal persuasion, and physiological states. Models provide guided skill perfection by modeling proficiency, providing corrective feedback, maintaining confidence in the abilities of the trainee, and providing informative feedback about how trainees are doing.

Congruence of self-efficacy appraisals between mentors and mentees is important to assure that mentees have the self-confidence to pursue independent research careers and that they do not forsake research opportunities. Bandura (1997) noted that although misjudgment of self-efficacy is rarely studied, it is believed that misjudgment of one's self-efficacy for a specific task produces dysfunction. Miscalculation of one's self-efficacy can result in either (1) overestimating one's ability to complete a task and lead to failure or (2) underestimating one's ability and passing up opportunities that shape one's life course. Similarly, although research on mentoring typically focuses on benefits, incompatible expectations for a mentor relationship may lead to problems (Allen, Eby & Lentz, 2006).

Literature

Both positive and negative aspects of mentoring have been reported (Records & Emerson, 2003). One mentoring program in nursing was unsuccessful because of misunderstandings between mentors and mentees (Burns, 2002). In addition, disincentives to mentoring in nursing have been reported (Turnbull & Roberts, 2005). More than 25% of nurse scholars reported they never had a mentor (Turnbull & Roberts, 2005). The current nursing shortage also causes a shortage of nurse researchers that may contribute to the availability of adequate numbers needed to mentor nursing students (Meleis, 2005).

Few studies on mentoring in nursing incorporate perspectives of both mentors and students. Mentors for some nurses may be from disciplines other than nursing (Bellack & Morjikian, 2005). Nurse researchers become involved in the research process early in their careers rather than waiting until they are doctorally educated (Buerhaus, 2006). Research conducted by nurses today is more generalizable to populations of patients with conditions that are also studied by researchers in areas other than nursing and sources of funding are likely to come from areas other than nursing research (Buerhaus, 2006). Therefore it is important to study mentors in academic settings who conduct clinical research and work with undergraduate and graduate students. Dyads in this study refer to the two people with different levels of experience in an academic setting who came together by participation in a relationship to achieve research outcomes. The purpose of this study was to compare the students' perceptions of confidence in their abilities to pursue research with their mentors' perceptions.

Methods

A cross-sectional design was used. In this study, the mentor was defined as a National Institutes of Health (NIH) funded faculty researcher who was a research role model to an undergraduate or first year masters students. Researchers in an academic setting were studied in order to provide a large pool of individuals experiencing a similar type of relationship. Eligibility requirements included that the funded NIH researcher in any academic discipline (1) study human subjects and (2) work with undergraduate or masters student on the funded study. Data were collected from a dyad consisting of a mentor and one student, who worked with the faculty mentor on an NIH funded research study.

A software program was designed to identify faculty researchers who received NIH research funding during the two years prior to the July, 2006, funding date by searching the NIH's CRISP database: <http://crisp.cit.nih.gov/>. The computer program was built to randomly select faculty researchers listed in CRISP as having current funding. A mass email was sent in 2007 from Rutgers University, Newark, NJ, USA, to identified faculty researchers. The email briefly described the study and stated that human subjects approval was granted by the sponsoring University. If the recipient of the email met the eligibility criteria listed and consented to participate in the study, the URL for the study web site was given.

The online study website gave specific directions for faculty mentors and students to complete separate surveys and identified data collection instruments by ID numbers only, thus keeping the identity of the online data files confidential. After logging onto the study website, mentors were asked (1) whether they worked with a student on the funded project and (2) whether the project included human subjects (eligibility criteria). Faculty mentors were asked to contact their student and, after obtaining consent, enter the student's e-mail address.

Directions were given for completing the Clinical Research Appraisal Inventory (CRAI) (Mullikin, Bakken & Betz, 2007), an instrument designed to assess clinical research self-efficacy. Faculty mentors were asked to rate what they believed to be their student's confidence in conducting research. The students were asked to complete the CRAI to rate their own confidence in their abilities to conduct clinical research. Instrument completion was done separately so neither could view the other person's responses (unless they violated the confidentiality request). The two sets of completed surveys were linked by ID number for data analysis. Although survey instruments were completed by faculty mentors and students, participants were able to view only their own instrument. The study website was available to participants for four months after the email was sent.

Instruments

Mentor demographic data—Mentor demographic data included information about the mentor's age, ethnic background (White, Hispanic, Asian, African-American), and gender.

Student demographic data—The students' demographic data included age, ethnic background (White, Hispanic, Asian, African-American), gender, whether the student was an undergraduate or graduate student, total time spent with the research mentor in both formal and informal settings, major area of study, setting in which the student worked, and an open ended question asking the student to list as many of their mentor's qualities as they believed to be important to the role of mentor.

Clinical Research Appraisal Inventory (CRAI)—The 92 item CRAI (Mullikin, Bakken, & Betz, 2007) assesses an individual's perceived ability to perform various research-related tasks measuring clinical research self-efficacy. For the purpose of this study we analyzed our data using the revised criteria (88 items, 8 factors) reported by the authors (Mullikin, Bakken

& Betz, 2007). Respondents rated the degree to which they were confident in their ability to perform each item on a scale of 0 (not confident) to 10 (completely confident).

Mean scores were computed by summing the item responses within each subscale and dividing by the number of items contained in the corresponding subscale. Mullikin, Bakken and Betz (2007) reported good internal consistency and test-retest reliability following a factor analysis ($\alpha = .89$ to $.97$ and $r = .82$ to $.95$, respectively, for eight factors) and a test-retest reliability of $.89$ to $.97$. The inventory has demonstrated some evidence of validity in that at least some of the self-efficacy subscale scores correlate with measures of outcome expectations, current research performance, level of research career interest (only some factors), and academic title (Mullikin, Bakken & Betz, 2007). Sample items are shown in Table 1.

Descriptive statistics were used to calculate demographic data and students' reports of their mentor's qualities. Reliability estimates were calculated for the factors of the CRAI. Mean CRAI scores for mentors and students were compared using t-tests.

Results

Forty-three faculty mentors and 29 students completed the CRAI. Of these 21 were mentor/student dyads. We excluded from the analysis any individual who was not paired with either a mentor or student. Mentors' average age was 46 and ranged in age from 34 to 59 years of age. Students' average age was 28 and ranged in age from 19 to 50 years of age. Students reported they spent from 1 to 40 hours per week with their mentor with an average amount of 7 hours per week in both formal and informal settings. Additional demographic data for mentors and students are shown in Table 2. Students' list of qualities that applied to their mentor is shown in Table 3.

Comparison of mentor and students perceptions of clinical research self-efficacy

We conducted a post hoc power analysis (Brown, Brauner, Chan, et al., 2000). Power for detecting a mean difference was $.978$. The mean score on the faculty mentors' assessment of students' clinical research self-efficacy was 8.4 ; the mean score students' clinical research self-efficacy was 6.8 . This difference was significant at $p = 0.0005$ ($t = -4.19$). Mentor and student ($n = 21$ dyads) scores on the CRAI are shown in Table 4. For the purposes of this study, we computed subscale scores based on 88 items and 8 subscales as suggested by Mullikin, Bakken & Betz (2007). Table 5 shows the range of inter-item correlations for individual items. Our analysis revealed coefficient alphas for students for seven of the eight subscales on the CRAI ranged from $.81$ to $.96$. The exception was the 'organizing' factor in which alphas ranged from $.51$ to $.79$.

Discussion

The purpose of this study was to compare students' perceptions of their confidence in their own abilities to do clinical research (i.e. their research self-efficacy) to that of their mentor's perceptions of the student's confidence to perform clinical research. In this study we used the CRAI (Mullikin, Bakken & Betz, 2007) to measure clinical research self-efficacy of undergraduate and graduate students. We found a significant difference between the means of the CRAI completed by mentors and students ($p = .0005$). Mentors in this study perceived their students to be much more self-confident in their ability to conduct research than the student's self-perceptions of their abilities. Scholars found that misaligned expectations between a mentor and mentee can result in less favorable mentoring experiences (Eby & McManus, 2004). Bandura (1997) asserted that misjudgment of efficacy appraisals can produce dysfunction and may include educational opportunities forsaken, careers not pursued and risks

not taken. It may be that a mentor who misjudges a student's efficacy appraisals is unable to provide informative feedback that would guide the student in making corrective adjustments.

Millikin and colleagues studied medical students, post-doctoral physician trainees, and M.D. or M.D./Ph.D. faculty and reported coefficient alphas ranging from .89 for 'organizing a study' to .97 for 'study design and data analysis' (Mullikin, Bakken & Betz, 2007). In the study reported in this paper undergraduate and graduate students were studied. The coefficient alphas for seven of the eight factors of the CRAI were consistent with previous reports (Mullikin, Bakken & Betz, 2007). The exception was the 'organizing' subscale scale. Bloom theorized that 'organizing' is an example of 'Synthesis,' one of the higher categories in the cognitive domain of the Taxonomy of Education Objectives (Bloom & Krathwohl, 1956). It may be that there was more variability in undergraduate and graduate students' preparation for creative behaviors included in 'organizing a study' than for behaviors that may have been emphasized in undergraduate and graduate research courses.

Students list of qualities of their mentors referred to attributes believed to contribute to career success. No negative qualities were listed. Mentor characteristics and behaviors found to influence students' research careers in this study were congruent with previous reports (Strayhorn & Terrell, 2007; Webb & Shakespeare, 2008).

Due to the small sample size, there was no attempt in this study to analyze the effect of gender similarities in mentors and students. Although some previous researchers have found that gender of the dyad affects the mentor/student relationship (Bakken, 2005; Kahn & Scott, 1997), other researchers reported no support for the hypothesis that mentor and mentee differences in gender influence negative aspects of the relationship (Eby & McManus, 2004; Russell, Hancock & McCullough, 2007).

Limitations of the study

The small sample size was a limitation of this study. Recruitment of subjects was conducted by sending a mass email to NIH funded academic researchers derived from the CRISP website. Unsolicited emails are frequently rerouted to "spam" folders and may never reach the recipient's "inbox" without a corrective action by the recipient. Therefore it was not possible to estimate the number of researchers who actually received and read the email requesting participation. Hamilton and Bowers (2006) noted that response rates for Internet recruitment are based on the number of individuals who initially contact the researcher for information and agree to participate in the study. In this study some potential recipients logged onto the study web site (n=165) and other potential participants contacted the researcher by e-mail (n= 37). It is not known whether or not the potential participants who contacted the researcher by e-mail may or may not have also logged onto the study website. Future researchers could improve data accrual by sending letters to each faculty researcher by US mail rather than by sending email, by sending individual email messages, and by re-contacting potential participants including mentors and students who participated individually rather than paired with each other.

Another factor that may have contributed to the limited participation may have been the requirement that mentors study "human subjects" rather than conducting research in a lab. The focus on human subjects research limited the sample since many NIH-funded researchers do not work with human subjects. This study was focused on human-subjects research because many clinicians, including nurses, conduct human subjects research.

The study was conducted with funded NIH researchers in any academic discipline in order to provide a large pool of individuals experiencing a similar type of mentor relationship. Scores of graduate and undergraduate students on the CRAI were combined because of the lack of

sufficient power for analysis of the low number of participants who were undergraduate students. The results may not be generalizable to nurse mentors, mentors in any other academic discipline and their students.

Although the study design did not allow us to provide an explanation for the small sample size, we suggest that some faculty researchers may have believed they lacked sufficient time to participate. Other researchers may not have been comfortable asking a student to participate in research. Although some universities prohibit or severely limit student's participation in research, others cite safeguards such as informed consent, evaluation of protocol risks, and understanding the importance of research (Forester & McWhorter, 2005). Few differences were found between online informed consent and face-to-face paper informed consent (Varnhagen, Gushta, Daniels et al., 2005). Findings of a study investigating medical students' participation in faculty research supported the hypothesis that medical students did not feel coerced to participate in research because of a faculty member's position of authority (Forester & McWhorter, 2005). No literature was located investigating students in other disciplines who participated in research suggested by their mentor.

Qualitative research may yield additional data and/or interpretations. A qualitative study conducted to explore the mentor-mentee relationship (Straus, Chatur & Taylor, 2009) was conducted with 7 clinician scientists and 21 mentees. All participants reported that good mentorship was vital to their research career success. Mentors played a key role in mentee's grant application review before submission, established connections with research collaborators, provided networking opportunities, and facilitated decision-making.

Strengths and weaknesses of using the Internet for research were revealed. Although the Internet offers a quick way of reaching many people at no cost to the sender, low response rates occurred in this study as well as other studies (Im & Chee, 2004a, 2004b). The low response rate may threaten the generalizability of the study. In addition, generalizing beyond the actual participants is not possible due to the nonprobability method of their selection. Response speed and response completeness of Internet-based surveys was significantly higher than the speed and completeness of mail survey data (Im & Chee, 2004). Advantages to the researcher of using the Internet include cost effectiveness, increased pool of participants, increased access, decreased time, and methodological rigor controlled by the researcher. Disadvantages include the fact that the population may not represent the population profile, consequently threatening validity and generalizability of the study findings. Response rates may be decreased as studies are inconsistent, survey errors may occur due to complex designs of research, authenticity of respondents' data may be questionable, and data entry errors may occur (Ahern, 2005).

An additional concern was whether the significant differences between the mentor and student perceptions of the student's confidence in his or her ability to do clinical research could be due to mentors reporting their own research self-efficacy as opposed to their student's research self-efficacy. Because we did not assess mentors' levels of expertise or academic rank we could not test whether significant differences in the CRAI were based on levels of expertise or academic rank. Although we bring this limitation to the reader, we believe the mentors clearly understood the directions given to them and reported on their perceptions of the student's confidence in their ability to do clinical research.

The sample of mentors was homogeneous in terms of race (mostly Caucasian). Negative experiences that may face non-Caucasians were not investigated. Minorities comprise 25% of the US population; however they remain underrepresented in health and research professions (Smedley, Stith, Colburn & Evans, 2001).

Implications for future research

The experiences that may face non-Caucasians in a mentor/mentee relationship needs further investigation (Strayhorn & Terrell, 2007). Universities have involved magnet science high schools to stimulate science talent early and recognized the importance of establishing mentoring relationships to assist minority students in preparation for research careers (Smedley, Stith, Colburn & Evans, 2001).

Responses from students in this study identified only mentors' positive characteristics possibly due to the fact that students were asked to list qualities believed to be important to the role of mentor. Because previous studies revealed that mentors may have both positive and negative characteristics and behaviors (Eby, McManus, Simon & Russell, 2000), future researchers should include questions about positive as well as negative behavior characteristics of the mentor.

Additional studies are needed to understand the reciprocal relationship between mentors and students. Given the dearth of literature in nursing examining mentor and student pairs, this represents a high priority for future research because perceptions may influence the course of the relationship (Eby & McManus, 2004). This study focuses on congruence in perceptions of confidence of research mentors and students. The next steps might include investigation of not only a sense of confidence but also actual competence in the research process. In addition, the mentor-mentee relationship needs further study (Eby & McManus, 2004; Johnson-Bailey & Cervero, 2002; Scandura & Williams, 2001; Strayhorn & Terrell, 2007; Parise & Forret, 2007). Qualitative study of mentor-student dyads may reveal additional data about the mentor's specific influence on the student's development of skills deemed important for success as a scientist or on their decision to pursue a career as a health researcher.

Conclusions and implications

This study was conducted with faculty mentors who were recipients of NIH funding in any academic discipline and undergraduate or graduate students. Inconsistencies were found between mentor's and students perceptions of student's research self-efficacy. Given the significant challenges in nursing in recruiting, training and retaining skilled nurse researchers, mentoring students early in their career is critical (Morrison-Beedy, Aronowitz, Dyne & Mkandawire, 2001).

Faculty research mentors and their students need to establish a shared understanding of the mentor relationship and evaluate the quality of the relationship. Although the extent to which mentors and students agree about the level of psychosocial support being provided in the relationship has been shown to be an important factor, research has shown that agreement in this area is not easily achieved (Waters, 2004). Mentees may assess the quality of the relationship in terms of its ability of the relationship to enhance their personal and professional competence (Allen, Eby, Lentz, 2006). Future research could be conducted to design and test efficacy enhancing interventions given mentors to enhance student's research self-efficacy. Offering training for mentors and students may make mentorship more rewarding to both (Allen, Eby & Lentz, 2006).

Nursing faculty who mentor students may benefit their own careers by enhancing their research productivity as well as by strengthening their school's reputation and resources (Morrison-Beedy, Aronowitz, Dyne, & Mkandawire, 2001). Assisting mentors and students to develop realistic expectations of the relationship may increase students choice of research careers, promote the effectiveness of mentorship, aid in the development of a body of professional knowledge and benefit both careers of both mentors and students. Research on mentoring is

continuing in a current study investigating an “Efficacy intervention to promote research careers (Lev, 2008).”

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Table 1

CRAI scales and sample items

Scale	Sample Item
Conceptualizing a study	Select a suitable topic area for study.
	Articulate a clear purpose for the research.
Designing a study	State the purpose, strengths and limitations of each study design.
	Determine an adequate number of subjects.
Collaborating with others	Initiate research collaborations with others.
	Consult senior researchers for ideas.
Funding a study	Identify appropriate funding sources.
	Establish a sufficient timeline for a grant application.
Planning and managing	Adhere to timeline for a research project.
	Recruit and screen project staff.
Protecting research subjects	Write a human subjects consent form.
Organizing a study	Maintain a log of your research process.
	Construct a plan for managing data files.
Reporting a study	Select a journal for a manuscript submission. Prevent authorship disputes.

Table 2

Demographic characteristics of mentors (n=21)

	N	%
Ethnic background		
White	19	90
Asian	2	10
Gender		
Female	12	57
Male	9	43
Demographic characteristics of students (n=21)		
	N	%
Ethnic background		
White	12	60
Hispanic	4	20
Asian	3	15
African American	1	5
Gender		
Female	15	71
Male	5	23
Missing	1	1
Educational background		
Undergraduate student	5	24
Graduate student	15	71
Missing	1	5
Major area of study*		
Nursing	3	15
Public Health	2	10
Biochemistry	1	5
Biomedicine	1	5
Computation	1	5
Communication	1	5
Epidemiology	1	5
Genetics	1	5
Hearing	1	5
Immunology	1	5
Medicine	1	5
Neurobiology	1	5
Neuroscience	1	5
Pharmacy	1	5
Psychology	1	5
Public Health	1	5
Rehabilitation	1	5
Social work	1	5

Setting in which student worked

Office	11	52
Lab	5	24
Other	4	19
Missing	1	5

* rounding % causes total to exceed 100%

Table 3

Qualities of mentors listed by students N=21

Has knowledge (of scientific discipline)	21
Supportive to student	20
Author of multiple publications	20
Many years of experience	18
PI of multiple NIH grants	17
Excellent problem solving abilities	16
Resourceful	15
Excellent teaching abilities	15
National reputation in the discipline	14
Creative	14

Many students listed more than 1 important quality

Table 4

Means, Standard Deviation, and Significance of scores on CRAI of Mentors and Students: Perceptions of student's research self-efficacy N=21 dyads

Factor	Mentor's perception			Student's perception			t value	p
	M	SD	M	SD	DF			
Conceptualizing a study	8.47	1.16	7.15	1.55	20		-3.11	0.006**
Designing a study	8.23	1.39	6.71	1.54	20		-3.37	0.003**
Collaborating with others	8.19	1.37	7.36	1.41	20		-1.94	0.067
Funding a study	8.59	1.61	6.02	1.89	20		-4.73	0.000***
Planning & managing study	7.99	1.48	6.75	1.64	20		-2.80	0.011*
Organizing a study	8.33	1.82	7.33	1.32	20		-1.87	0.077
Responsible conduct of research	8.00	1.84	6.61	1.69	20		-3.48	0.002***
Reporting and presenting study	8.93	0.90	6.90	1.70	20		-4.99	0.000***
Total CRAI	8.39	1.11	6.78	1.37	20		-4.19	0.0009***

* p < .05;

** p < .01;

*** p < .001

Table 5

Factor name, number of items, value of coefficient alpha for the eight factors of the Clinical Research Appraisal Inventory

Factor name	No. of items	Coefficient Alpha Student (n=21)		Coefficient Alpha Mentor (n=21)	
		Minimum	Maximum	Minimum	Maximum
Conceptualizing a study	9	0.93	0.94	0.91	0.93
Designing a study	22	0.96	0.97	0.96	0.97
Collaborating with others	9	0.91	0.94	0.87	0.92
Funding a study	13	0.95	0.96	0.95	0.97
Planning & managing study	5	0.815	0.85	0.84	0.91
Organizing a study	4	0.51	0.80	0.87	0.91
Responsible conduct of research	11	0.86	0.90	0.92	0.93
Reporting and Presenting a study	15	0.94	0.96	0.94	0.95