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Mary E. Kiersma
Purdue University

Nicholas E. Hagemeyer
East Tennessee State University, hagemeyer@etsu.edu

Aleda M.H. Chen
Cedarville University

Brittany Melton
Purdue University

Marwa Noureldin
Purdue University

See next page for additional authors

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A Graduate Student Mentoring Program to Develop Interest in Research

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Creator(s)

Mary E. Kiersma, Nicholas E. Hagemeyer, Aleda M.H. Chen, Brittany Melton, Marwa Noureldin, and Kimberly S. Plake

RESEARCH

A Graduate Student Mentoring Program to Develop Interest in Research

Mary E. Kiersma, PharmD, PhD,^{a,b*} Nicholas Hagemeyer, PharmD, PhD,^{a,c} Aleda M. H. Chen, PharmD, PhD,^{a,d} Brittany Melton, PharmD,^a Marwa Noureldin, PharmD, MS,^{a,e} and Kimberly S. Plake, PhD^{a,e}

^aPurdue University College of Pharmacy, West Lafayette, IN

^bManchester University College of Pharmacy, Fort Wayne, IN

^cEast Tennessee State University Gatton College of Pharmacy, Johnson City, TN

^dCedarville University School of Pharmacy, Cedarville, OH

^eCenter on Aging and the Life Course, West Lafayette, IN

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Objective. To assess the impact of a graduate student mentoring program on student interest in research and postgraduate education and on graduate student confidence in mentoring.

Methods. Undergraduate and pharmacy students (mentees) and graduate students (mentors) were matched and participated in the study, which required them to engage in at least 2 discussions regarding research and careers. Mentees completed a pre- and post-assessment of their perceptions of research, postgraduate training plans, and perceptions about mentors. Mentors completed a pre- and post-assessment of their perceptions about themselves as mentors and their confidence in mentoring.

Results. Although there were no significant differences among the mentees' perceptions of research or the mentors' confidence in mentoring, qualitative analysis indicated that the mentees' perceptions of research improved and that the mentors believed their mentoring skills improved.

Conclusions. Based on the results of the qualitative analysis, implementing a graduate student mentoring program may help improve students' perceptions of research and graduate students' confidence in mentoring, which could increase student interest in postgraduate education and prepare mentors for future leadership roles.

Keywords: mentoring, research, graduate students, pharmacy students

INTRODUCTION

Mentoring and research are often presented together in the pharmacy literature as they relate to promoting faculty development.¹⁻⁶ However, much of this literature stresses the need to foster research skills and student pharmacist interest in research.⁷⁻¹⁰ Mentoring is believed to be 1 method of increasing research interest among student pharmacists. The Accreditation Council for Pharmacy Education (ACPE) Guideline 23.4 states, "Colleges and schools should implement strategies and programs to broaden the professional horizons of students in areas such as scientific inquiry, scholarly concern for the profession, [and] the relevance and value of research."¹¹ Most student

pharmacists feel ambivalent about research and research-related careers.^{12,13} Moreover, relatively few pharmacy graduates pursue research-intensive postgraduate paths (eg, graduate school, fellowship training).^{14,15}

Methods of increasing student pharmacist interest in research have included developing research-intensive advanced pharmacy practice experiences (APPEs)¹⁶ and elective courses,¹⁷ increasing student exposure to research in the doctor of pharmacy (PharmD) curriculum,¹⁸ and requiring students to complete research projects prior to earning the PharmD degree.^{7,19} However, little has been reported in the literature about the impact of research requirements and other interventions to stimulate student interest in research and research-related careers.

A potential method of increasing student pharmacist interest in and exposure to research is through the development of mentoring relationships that focus on research. An essential characteristic of a mentor is an increased level of experience compared with that of the mentee or protégé,²⁰ allowing the mentee to learn from and be guided by the mentor's experiences. Pharmacy faculty members who conduct research are a potential mentor resource

Corresponding Author: Mary E. Kiersma, Manchester College, 10627 Diebold Rd, Fort Wayne, IN 46845. Tel: 260-470-2668. Fax 260-270-4418. E-mail: mekiersma@manchester.edu

*Drs. Kiersma, Hagemeyer, and Chen were PhD students at Purdue University at the time the study was conducted. Study analysis and the writing of this paper were completed after they graduated and relocated to the university with which each is currently affiliated.

for student pharmacists. Given the research-intensive nature of pharmacy graduate programs, individuals who are in the process of developing an expertise in conducting research, (ie, graduate students) might also be an effective research-specific mentor resource for student pharmacists.

Self-efficacy theory posits that task-specific self-efficacy or self-confidence beliefs are formed, in part, as a result of internalizing and processing past experiences.²¹ As future academicians and/or research project managers, graduate students who have had positive experiences as mentors may see an increase in their self-efficacy beliefs regarding their mentoring abilities. Therefore, from a career-preparation perspective, a mentor/mentee relationship between a graduate student and a student pharmacist, respectively, may have the potential to benefit both cohorts. Graduate students could improve their mentoring skills, and student pharmacists could learn from and be guided by the graduate students' research experience.

The potential role of using pharmacy graduate students as mentors for student pharmacists and prepharmacy students has not been previously explored. The purpose of this project was to implement a graduate student mentoring program for undergraduate and professional student mentees at a research-intensive institution in an effort to increase prepharmacy and pharmacy student interest in research. The objectives of the study were to assess the impact of a pilot graduate student mentoring program on undergraduate student interest in research and postgraduate education and graduate student confidence in mentoring.

METHODS

The mentoring program was developed and initiated during the 2010-2011 academic year at Purdue University. Undergraduate students (prepharmacy and pharmaceutical sciences majors) and PharmD students who were enrolled in Purdue University's College of Pharmacy courses were given an opportunity to participate as mentees in this program, and graduate students in the College of Pharmacy were offered the opportunity to participate as mentors. A needs assessment of pharmacy faculty and graduate and undergraduate students as well as a review of pertinent literature were used in designing the mentoring program's structure and developing assessment instruments. Prior to administration, assessment instruments underwent peer review by faculty and graduate students in the Department of Pharmacy Practice. Institutional review board approval was obtained from Purdue University prior to program implementation.

Graduate student mentors were recruited from all College of Pharmacy graduate departments: Industrial

and Physical Pharmacy, Medicinal Chemistry and Molecular Pharmacology, and Pharmacy Practice by means of an e-mail announcement prior to the start of the spring 2011 semester. A mentor orientation meeting provided information regarding the program structure and expected program time commitments to interested graduate students. Those who elected to participate in the program completed a graduate student information sheet to assist coinvestigators in matching mentors to undergraduate and PharmD student mentees.

Following recruitment of graduate-student mentors, mentees were recruited by means of in-class announcements during undergraduate and PharmD courses offered by the college. A meeting for interested prepharmacy students, bachelor of science in pharmaceutical sciences (BSPS) degree students, and PharmD students provided information regarding program structure, expectations, and types of pharmacy research. This meeting also introduced graduate student mentors to the mentees. Mentees then completed an information sheet similar to that completed by the mentors to further assist co-investigators in matching graduate student mentors and undergraduate and PharmD student mentees based on similar research interests.

Graduate student mentors were asked to complete a 49-item mentor pre-experience survey instrument consisting of 3 sections: (1) 27 items assessing mentors' perceptions of the importance of certain mentoring qualities based on a 5-point scale (5=extremely important, 4=moderately important, 3=somewhat important, 2=not important, 1=not sure); (2) 17 items assessing mentors' confidence in their mentoring qualities using a 5-point Likert scale ranging from 5=extremely confident to 1=not at all confident; and (3) 5 demographic items including gender, graduate degree pursued, year in the graduate program, graduate department, and perceived mentoring experience relative to that of peers.

Interested undergraduate and PharmD students completed a 45-item mentee pre-experience survey instrument consisting of 4 sections: (1) 19 items regarding mentees' perceptions of research using a 5-point Likert scale ranging from 5=strongly agree to 1=strongly disagree; (2) 4 items related to mentees' postgraduate training plans using a 5-point Likert scale ranging from 5=extremely likely to 1=extremely unlikely; (3) 27 items concerning mentees' perceptions of the importance of certain mentoring qualities based on a 5-point scale (5=extremely important, 4=moderately important, 3=somewhat important, 2=not important, 1=not sure); and (4) 5 demographic items including gender, degree pursued (PharmD or BSPS), year in the prepharmacy, PharmD or BSPS program, and perceived relative research experience compared with that of peers.

Mentors and mentees were matched using data collected on the information sheets. Matches were based on preference for a specific mentor or rank of interest in a specific department. Mentors were asked to specify the number of mentees they would agree to mentor. During the semester-long pilot program, mentor/mentee pairs participated in a minimum of 2 structured discussions regarding research and pharmacy-related research careers. Because of undergraduate and PharmD student interest in the program, graduate student mentors were assigned, on average, 2 to 3 mentees. Based on scheduling and preferences, individual or group meetings were held between the mentors and mentees. To assist mentors in their discussions with mentees while maintaining program flexibility, mentors were provided with a list of possible discussion topics, including mentees' strengths and weaknesses, level of interest in assisting/conducting research, career path/development, and course selection. Mentors were encouraged to seek out additional resources to aid in their discussions with mentees as they deemed appropriate.

At the end of the semester, a group meeting was conducted in which mentors and mentees discussed the positives and negatives of the program to assist in determining what changes, if any, should be made for the next year. Graduate student mentors completed the 49-item mentor postsurvey instrument to assess changes in their perceptions of mentors and their confidence in mentoring. Undergraduate and PharmD students completed the 45-item mentee postexperience survey instrument to assess changes in their perceptions of research, postgraduate training plans, and perceptions of mentors. An identifier was used to match pre- and post-experience survey instruments while maintaining anonymity. In addition to the postexperience survey instruments, mentors and mentees also completed a 6-item qualitative survey instrument assessing program utility, barriers to the mentoring relationship, the program's impact on mentees' perceptions of research, willingness to continue the program or recommend it to others, and overall opinions on how the program could be improved.

All data were analyzed using SPSS, v.19.0, software system (IBM, Armonk, New York). An *a priori* level of 0.05 was used for significance, and descriptive statistics were calculated for demographic items. Changes in mentee and mentor perceptions of mentoring qualities were assessed using a Wilcoxon rank sum test because the data were ordinal and contained a response option of "not sure." Prior to performing analyses to determine the changes in graduate student confidence in mentoring and undergraduate-student perceptions of research, the distribution of the data was analyzed, and the data were found to be normally distributed and presented using parametric

tests.^{22,23} Data were also analyzed using both parametric and nonparametric tests, and the results were identical. Therefore, parametric tests are reported for all tests other than those regarding perceptions of mentoring qualities. Paired *t* tests were used to determine changes between the pre- and post-experience test responses for graduate student confidence in mentoring and undergraduate student perceptions of research.

Content analysis of the qualitative items was performed to find themes grounded in the responses.²⁴ Two of the researchers independently identified themes present in the responses. The themes were then discussed to reach consensus on which ones were the predominant themes from the qualitative survey instrument. Themes were considered predominant if mentioned by at least 50% of mentees or mentors who completed the postexperience qualitative survey instrument.

RESULTS

Fifty-seven undergraduate and PharmD students and 22 graduate students expressed interest in the mentoring program. Of the 79 interested individuals, 47 students (59.5%) completed both the pre- and post-program assessments. Demographic information is presented for 26 mentees and 21 mentors who completed both assessments. The majority of the 21 graduate student mentors were in the pharmacy practice department (66.7%), were female (57.1%), and were pursuing a PhD (85.7%). Most of the 26 mentees (96.2%) were pursuing a PharmD degree (prepharmacy or pharmacy) and were female (88.5%). One student was enrolled in the BSPS and PharmD programs simultaneously. Among the undergraduate and PharmD students at baseline, 19.2% felt that they had less research experience than did their peers, 38.5% stated they had about the same amount of experience, and 42.3% felt they had more research experience than did their peers prior to beginning the program (Table 1).

Graduate students were asked to indicate their perceptions of mentors and the importance of a mentor possessing specific mentoring qualities/skills. Wilcoxon rank sum tests were used to assess differences in pre-and post-experience survey responses and to evaluate the impact of the mentoring program on graduate students' perceptions. Graduate students considered the majority of the mentoring qualities/skills as important for a mentor to possess, with most items being scored either 4 or 5 on a 5-point scale (Table 2). There were no significant differences in graduate students' importance ratings before and after program completion.

Graduate students were asked to evaluate their confidence in displaying mentoring qualities. Paired *t* tests were used to evaluate the impact of the mentoring program

Table 1. Demographics of Participants in a Mentoring Program

Variable	Graduate Students (Mentors), No. (%)	Undergraduate/PharmD Students (Mentees), No. (%)
Gender		
Male	9 (42.9)	3 (11.5)
Female	12 (57.1)	23 (88.5)
Degree currently pursuing		
Masters	3 (14.3)	N/A
PhD	18 (85.7)	N/A
BSPS	N/A	1 (3.8)
PharmD	N/A	25 (96.2)
Graduate department (N=21) ^a		
IPPH	5 (23.8)	N/A
MCMP	2 (9.5)	N/A
PHPR	14 (66.7)	N/A
Year in the program (N=21)		
<1 year	5 (23.8)	N/A
1-4 years	12 (57.2)	N/A
≥ 5 years	4 (19.0)	N/A
Perceived mentoring experience compared to peers (N=21)		
A lot	6 (28.6)	N/A
Some	9 (42.9)	N/A
None	6 (28.6)	N/A
Year in the PharmD program (N=26)		
Pre-pharmacy	N/A	10 (38.5)
1 st Professional	N/A	6 (23.1) ^b
2 nd Professional	N/A	5 (19.2)
3 rd Professional	N/A	4 (15.4)
N/A	N/A	1 (3.8)
Year in the BSPS program (N=26)		
3 rd Year	N/A	3 (11.5)
N/A	N/A	23 (88.5)
Perceived prior research experience compared to peers (N=26)		
More than peers	N/A	11 (42.3)
Same as peers	N/A	10 (38.5)
Less than peers	N/A	5 (19.2)

Abbreviations: BSPS= prepharmacy and pharmaceutical sciences; IPPH=industrial and physical pharmacy; MCMP=medicinal chemistry and molecular pharmacology; PHPR=pharmacy practice
^a 1 student in the first year of PharmD program was also a BSPS student in the third year.

on graduate students' mentoring self-confidence. Overall, graduate students felt confident in their ability to display mentoring qualities, with mean scores in self-confidence ranging between "somewhat confident" to "extremely confident" (Table 3). Mentoring qualities with the lowest mean self-confidence scores included "being knowledgeable" (3.7 ± 0.7) and "being available" (3.7 ± 0.7). There were no significant differences in graduate students' self-confidence ratings before and after completing the program. Paired *t* tests were used to assess differences in pre-and post-survey responses and to evaluate the impact of the mentoring program on students' perceptions of research in pharmacy. There were no significant differences in pre-and post-experience responses for the students' perceptions about research. In general, students held neutral to moderately positive views of research, with mean scores ranging between 2.9 ± 0.9 and 4.4 ± 0.6 (Table 4).

Undergraduate and PharmD students were asked to rate qualities displayed by their ideal mentor. The mentoring qualities on this assessment were similar to those on the graduate student confidence section. Wilcoxon rank sum tests were used to assess differences in pre-and post-program responses. Only 1 mentoring quality, availability, was found to be significant ($p < 0.01$) (Table 5). Mentees felt that availability was more important after completing the program.

Several predominant themes were identified through the qualitative survey analysis (Table 6). The first theme that emerged was that both mentors ($n = 14$) and mentees ($n = 23$) felt that they would recommend this program to others. Most mentors and mentees felt that the program was beneficial. For example, mentees mentioned that they learned about research techniques as well as career opportunities in research. Mentors also stated that their experience in the program improved their communication skills and helped them better understand their own goals and perceptions about research.

Another predominant theme was that mentees felt that the mentoring program positively influenced their perceptions of research, allowed for greater networking and development of relationships, and provided an abundance of information about research and research-related careers. The majority of mentees ($n=22$) felt the program improved their perceptions of research. Moreover, many students ($n=14$) indicated a desire to continue in research after completing the program. Three students stated that the program had a positive impact on how they viewed graduate school. The third predominant theme that emerged was that mentors believed the program improved their mentoring skills, positively influenced their willingness to continue mentoring others, and helped mentees make informed decisions. Many graduate students

Table 2. Perceptions of Graduate Student Mentors (N=20) Regarding the Importance of Mentoring Qualities Prior to and Upon Completion of the Mentoring Program

Mentor Perceptions of Mentoring Qualities^a	Preprogram Frequency, (%)^b	Postprogram Frequency, (%)^b	P
Selects projects that are realistic and make unique contributions to the discipline	12 (60)	8 (40)	0.48
Provides information to help mentee's understanding of subject matter	15 (75)	9 (45)	0.24
Explains relevant research techniques	11 (55)	10 (50)	0.56
Provides specific assignments related to objectives	3 (15)	7 (35)	0.25
Provides a clear focus on research objectives	5 (25)	6 (30)	0.61
Is intelligent	6 (30)	8 (40)	0.55
Teaches students about ethical considerations	9 (45)	13 (65)	0.18
Respects the intellectual property rights of others	18 (90)	15 (75)	0.53
Acts professionally	14 (70)	14 (70)	0.78
Is patient	14 (70)	11 (55)	0.56
Is approachable	16 (80)	15 (75)	0.71
Provides timely feedback	13 (65)	14 (70)	0.71
Displays thoughtfulness and consideration	13 (65)	11 (55)	0.28
Is friendly	7 (35)	5 (25)	0.69
Sets high standards for performance by his/her own behavior	13 (65)	11 (55)	0.81
Leads by example	16 (80)	14 (70)	0.80
Works hard to accomplish his/her goals	15 (75)	11 (55)	0.48
Encourages a mentee to express ideas/suggestions	14 (70)	13 (65)	1.00
Listens to mentee's ideas and suggestions	16 (80)	15 (75)	0.53
Allows mentee an opportunity to voice opinions	14 (70)	15 (75)	0.71
Considers mentee's ideas even when in disagreement	15 (75)	14 (70)	0.71
Suggests ways to improve mentee's performance	15 (75)	15 (75)	0.74
Encourages cooperation to solve problems together	6 (30)	7 (35)	0.41
Encourages exchange of information	11 (55)	10 (50)	0.53
Provides positive support regarding mentee's success	15 (75)	15 (75)	1.00
Is available	11 (55)	8 (40)	1.00
Teaches students about safety considerations	6 (30)	8 (40)	0.37

^a 5-point scale: 5=extremely important, 4= moderately important, 3= somewhat important, 2= not important, 1=not sure.

^b Frequency based on score of 5=extremely important.

expressed a desire to continue mentoring students in some capacity in the future. Graduate students also mentioned that the program was a good way for students to receive information needed to make informed decisions about postgraduate training, with some stating they would have appreciated a similar program when they were undergraduates.

Both mentors and mentees stated that their single largest criticism of the program was a lack of time, which was the fourth predominant theme. Time constraints included finding common times for mentors and mentees to meet, and many felt that 1 semester was not long enough to develop a strong relationship between the mentor and mentee. Another criticism mentioned by graduate students, although not predominant, was that the mentees were not involved and/or motivated or that the mentors'

and mentees' research interests did not align, making it difficult for mentees to become interested.

Mentors and mentees were asked how they thought the program could be improved. While no predominant themes emerged, the groups had similar suggestions for improving the program. Many wanted more program structure. Mentors wanted more training or topics to discuss with their mentees as well as a more defined timeline for activities with mentees. Mentees also wanted more defined activities and more meetings and also stated that it would be beneficial to have multiple mentors in different departments or to have an opportunity to talk with mentors and/or mentees in various departments to learn about research in other areas. Graduate students felt it would be beneficial to have a process to determine research interests prior to matching, and both mentors and

Table 3. Confidence of Graduate Student Mentors in Their Mentoring Qualities Prior to and Upon Completion of a Mentoring Program (N=20)

Mentoring Qualities	Preprogram	Postprogram	P
	Confidence	Confidence	
	Mean (SD) ^a	Mean (SD) ^a	
Available	3.7 (0.7)	3.7 (0.7)	1.00
Provides consistently, honest feedback	4.2 (0.7)	4.0 (0.7)	0.38
Good listener	4.4 (0.7)	4.3 (0.8)	0.77
Team player	4.3 (0.7)	4.0 (0.8)	0.26
Good role model	4.0 (0.9)	4.1 (0.8)	0.83
Positive	4.6 (0.7)	4.3 (0.8)	0.10
Intelligent	3.9 (0.8)	3.9 (0.8)	1.00
Integrity	4.5 (0.6)	4.6 (0.7)	0.43
Knowledgeable	3.7 (0.7)	3.8 (0.8)	0.42
Friendly	4.6 (0.6)	4.4 (0.6)	0.06
Organized	3.9 (1.0)	3.6 (0.9)	0.11
Open to feedback	4.3 (0.6)	4.3 (0.6)	0.75
Professional	4.3 (0.7)	4.2 (0.6)	0.54
Strong work ethic	4.2 (0.6)	4.3 (0.7)	0.33
Empathetic	4.4 (0.7)	4.6 (0.5)	0.38
Mature	4.4 (0.7)	4.4 (0.7)	1.00
Patient	4.3 (0.8)	4.5 (0.61)	0.33

^a Scores based on a 5-point Likert scale ranging from 5=extremely confident to 1= not at all confident.

mentees suggested that matching should be based on the level of involvement each is willing to provide.

DISCUSSION

The pilot graduate student mentoring program implemented in the Purdue University College of Pharmacy presented information to undergraduate/professional students regarding areas of research as well as postgraduate and career opportunities. The program also allowed graduate students the opportunity to gain skills and confidence in mentoring undergraduate and PharmD students. The matching of mentors and mentees was based upon mentees' perceptions of interest area and included selection of a specific mentor, if desired.

Perceptions of input into the matching process are important for both mentors and mentees, as participants who perceived greater input in the matching process had counterparts who reported higher scores in mentor qualities and role modeling compared with those who did not.²⁵ Given the opportunity to participate in the selection of their mentors, mentees may perceive a stronger involvement and increased motivation to maximize the relationship. Qualitative results in the current study indicating positive mentee perceptions of the program

may be, in part, a result to the choices the mentee was allowed to make in the program, including the selection of a specific mentor. By implementing a graduate student mentoring program, mentees felt that the program positively influenced their perceptions of research, presented the opportunity to network and develop new relationships, and provided information regarding research and potential career options in research.

The mentors also had positive comments regarding the program. A majority of mentors perceived that the program resulted in an improvement in their mentoring skills, that it positively influenced their willingness to continue mentoring, and that it allowed them to assist students in making informed decisions. These positive perceptions corroborate the high scores shown in sections of the assessment instrument related to mentoring confidence and qualities.

In the quantitative analyses, there were no significant differences in perceptions of mentoring qualities, perceptions of research, and future postgraduate plans among undergraduate/PharmD students from before and after the program. Based on feedback from both mentees and mentors, however, participants felt that the program was beneficial overall and indicated that they would recommend it to other students. Mentees in this program felt that it increased their confidence in research skills and provided useful experiences, networking opportunities, and helpful advice and direction for future careers. After participating in a graduate student mentoring program, undergraduate/PharmD students may gain valuable experience in conducting a research project and disseminating the results, which are skills often used in residencies, fellowships, and postgraduate training.

Additionally, implementing a graduate student mentoring program may improve graduate student mentoring skills, which could aid in future leadership roles and/or career development. Based on graduate students' qualitative feedback, the program improved their mentoring and communication skills, although the quantitative assessment did not find a significant improvement. Many graduate students in pharmacy become employed in academia, industry, government, or consulting. Regardless of the role they pursue after graduation, individuals completing graduate school will likely be in positions where they will become mentors of students, staff members, or junior colleagues. Programs that allow graduate students the opportunity to transition into a mentoring role can help prepare them for what will be expected of them in their future careers.

Mentoring programs also can have positive benefits for colleges and schools of pharmacy. Offering undergraduate students the opportunity to become involved in

Table 4. Perceptions of Undergraduate Students (N=26) Regarding Research Prior to and Upon Completion of a Mentoring Program

Mentee Perceptions of Research	Preprogram Mean^a, (SD)	Postprogram Mean^a, (SD)	P
I am interested in conducting research.	4.0 (0.7)	4.0 (0.5)	0.60
Classes I have taken have sparked my interest in conducting research.	3.6 (0.9)	3.7 (1.0)	0.70
The PharmD curriculum provides sufficient exposure to research-related career opportunities.	3.0 (0.8)	3.0 (1.1)	0.83
Professors in my classes make research-related careers sound interesting.	3.5 (1.0)	3.4 (1.0)	0.74
I think conducting research would be too difficult for me.	2.8 (0.9)	2.6 (0.7)	0.11
I find the idea of conducting research appealing.	3.9 (0.8)	4.0 (0.6)	0.80
I am interested in learning about opportunities that research-related careers offer.	4.4 (0.6)	4.1 (0.7)	0.11
Graduate school would help me decide what to do with my life.	3.3 (0.8)	3.3 (0.9)	0.70
The challenge of conducting research is exciting to me.	3.8 (1.0)	3.8 (0.9)	1.00
I need research skills to fulfill my potential.	3.6 (1.0)	3.5 (1.0)	0.48
I worry that spending time in a residency/fellowship will take time away from other activities I want to pursue while still young.	3.1 (1.1)	3.1 (1.2)	0.88
Professors in my classes make research sound interesting.	3.5 (1.0)	3.4 (1.0)	0.23
I have the knowledge necessary to make an informed decision whether or not to consider graduate school as a post-PharmD option.	2.9 (1.0)	3.2 (1.0)	0.37
I am concerned that pursuing a research-related career will prevent me from being able to focus on marriage and family as soon as I would like.	3.2 (1.2)	3.0 (1.1)	0.20
I am aware of the skills required to succeed in conducting research.	3.1 (1.0)	3.5 (0.8)	0.05
I do not want to take time away from a job and earning money by pursuing a postgraduate education after I graduate from pharmacy school.	2.9 (0.9)	2.9 (1.1)	0.70
Gaining research skills will allow me to make more money.	3.2 (0.9)	3.3 (0.9)	0.4
I am concerned about the impact postgraduate training would have on repayment of school loans and/or other debts.	3.4 (1.1)	3.0 (1.3)	0.15
I feel that learning how to conduct research is a necessary part of what will make me feel good about myself.	3.3 (1.0)	3.4 (0.9)	0.75

^a Based on a 5-point Likert scale ranging from 5=strongly agree to 1= strongly disagree.

research creates the potential to increase research productivity, thereby increasing the number of publications and presentations submitted by members of the college or school of pharmacy. Based on qualitative analysis, many of the undergraduate students who participated in this study (N=17) plan to continue research, which has the potential to increase faculty productivity.

There were some limitations to this program and its assessment. Post-hoc power analyses indicated that the small mentor and mentee sample sizes did not provide sufficient power to detect significant differences, assuming an effect size of 0.3 for a majority of items included in the survey instruments. A sample size of 70 would be needed to detect differences at the 80% power level. Unfortunately, samples of this size are unlikely, especially given the size of a majority of pharmacy graduate programs. Future research could aggregate data from similar programs at multiple institutions to adequately power such research.

The length of the pilot program was short, encompassing only 1 semester. Future program iterations should be longer, at least 1 year, to better assess the impact on student interest in research. Since the impact of research requirements and other programs to stimulate student interest in research and research-related careers is relatively unknown, it is difficult to examine the results of this program without comparable research regarding mentoring and research.

Mentors and mentees also indicated several areas for improvement associated with the pilot graduate student mentoring program. Most participants felt that insufficient time was allocated for the program, resulting in difficulty scheduling mentor-mentee meetings. As there was greater student interest than originally anticipated, resulting in multiple mentees per mentor, additional iterations of this program should increase mentor recruitment to decrease mentor burden. A lack of defined structure

Table 5. Perceptions of Undergraduate Students (N=26) Regarding Mentor Qualities Prior to and Upon Completion of the Mentoring Program

Qualities ^a	Preprogram Frequency (%) ^b	Postprogram Frequency (%) ^b	P
Available	10 (38.5)	16 (61.5)	<0.01
Provides consistently, honest feedback	17 (65.4)	20 (76.9)	0.16
Good listener	14 (53.8)	17 (65.4)	0.07
Team player	9 (34.6)	10 (38.5)	1.00
Good role model	17 (65.4)	17 (65.4)	0.53
Positive	16 (61.5)	16 (61.5)	0.74
Intelligent	17 (65.4)	12 (46.2)	0.16
Integrity	18 (69.2)	14 (53.8)	0.60
Knowledgeable	17 (65.4)	15 (57.7)	1.00
Friendly	16 (69.2)	19 (73.1)	0.74
Organized	16 (61.5)	9 (34.6)	0.14
Open to feedback	13 (50.0)	10 (38.5)	0.59
Professional	10 (38.4)	13 (50.0)	0.52
Strong work ethic	17 (65.4)	14 (53.8)	0.07
Empathetic	12 (46.2)	14 (53.8)	0.83
Mature	14 (53.8)	13 (50.0)	0.80
Patient	18 (69.2)	13 (50.0)	0.10

^a 5-point scale: 5=extremely important, 4= moderately important, 3= somewhat important, 2= not important, 1=not sure.

^b Frequency based on score of 5=extremely important.

limited the productivity of these meetings when they were scheduled, which may have had a negative impact on the quantitative assessment and may explain why the qualitative analyses indicated that the program was beneficial, while the quantitative assessment did not indicate

significant changes. Another concern was a lack of mentee interest/motivation to fully engage in the program, a barrier that has been experienced by other researchers as well.²³ Future iterations of the program will use feedback received from the qualitative questionnaires to improve the program.

Additionally, the psychometric properties of the quantitative questionnaires used in this program should be assessed in future research. Given that the qualitative and quantitative results do not match, 1 or both of the questionnaires may not adequately assess either of the objectives of the study. Because it allows in-depth responses, the qualitative portion can be used to generate a quantitative questionnaire based on the themes identified as a means to probe whether the program met its objectives. As this program was conducted solely at Purdue University, a research-intensive institution, the results have limited generalizability to other colleges and schools of pharmacy and other health professions. Implementation of this program at other colleges and schools may allow for further assessment of the implications of a graduate student mentoring program.

Based on comments provided by the mentors and mentees in their postprogram qualitative survey instruments, future graduate student mentoring programs should include a formal program structure. There should be more training for interested graduate students regarding mentoring as well as more defined timelines for meeting with mentees. In future iterations, more detailed preprogram questionnaires or interviews will be used to match mentors and mentees based upon: (1) interest in the program, (2) time available, (3) desired involvement

Table 6. Predominant Themes That Emerged From Comments of Participants in a Mentoring Program (N=26 Mentees, N=21 Mentors)

Theme	No. (%) ^a
Theme 1: Both mentors and mentees felt that they would recommend this program to others.	
Mentors	14 (63.6)
Mentees	23 (82.1)
Theme 2: Mentees felt that the mentoring program:	
(1) positively influenced their perceptions of research	22 (78.6)
(2) allowed greater networking and development of relationships	18 (64.3)
(3) provided a great deal of information about research and research-related careers.	17 (60.7)
Theme 3: Mentors felt that the mentoring program:	
(1) improved their mentoring skills	15 (68.2)
(2) positively influenced their willingness to continue mentoring others	12 (54.5)
(3) helped students make informed decisions	11 (50.0)
Theme 4: Both mentors and mentees felt that a lack of time to meet was a major barrier to the program.	
Mentors	12 (54.5)
Mentees	20 (71.4)

^a Refers to the number of individuals who expressed the particular theme on the survey instruments assessed.

level, and (4) research interests. Future programs also should include a longitudinal interaction component (1 year or longer) between mentors and mentees and evaluate the long-term implications of a mentoring program on graduate student mentoring and undergraduate and PharmD student interest in postgraduate careers in research. This program also could be integrated within the curriculum as a research elective, allowing more time for both graduate students and undergraduate/PharmD students to interact while removing some of the time constraints, which were cited as barriers to program involvement. Identifying research projects prior to beginning the program or elective course has the potential to encourage active participation of undergraduate and PharmD student in research. The influence of participation in research projects on future career choices related to research also could be assessed.

CONCLUSION

Implementing a pilot graduate student mentoring program for undergraduate and PharmD students within a college or school of pharmacy may foster student interest in research and research-related careers and assist graduate students in developing mentoring skills. Further research is warranted to determine whether mentoring programs have a significant impact on both graduate student mentoring and undergraduate and PharmD student interest in research and research-related careers.

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