

RESEARCH ARTICLES

Pharmacy Students' Participation in a Research Experience Culminating in Journal Publication

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Objectives. To examine factors that influenced doctor of pharmacy (PharmD) students to collaborate with faculty members, preceptors, or others on scholarly activities that resulted in publication of an article in a pharmacy journal, and whether this experience influenced their consideration of a career in academic pharmacy.

Methods. A 17-question survey instrument was e-mailed to student authors of papers published between 2004 and 2008 in 6 pharmacy journals. Responses were analyzed to determine factors influencing student participation in research and whether the experience led them to consider a career in academic pharmacy.

Results. Factors about their participation in the scholarly activity that respondents found valuable included personal fulfillment and making a contribution to the literature. Respondents indicated they were more interested in a career in academic pharmacy after their participation in the scholarly experience ($p < 0.001$).

Conclusions. Participation in scholarly activities and student authorship of a peer-reviewed journal manuscript during pharmacy school may lead to increased interest in a career in academic pharmacy.

Keywords: pharmacy student, publication, scholarship, faculty recruitment, journal

INTRODUCTION

Several studies have investigated the scholarly experiences and research-related coursework of PharmD students and the factors that motivated them to participate in research and scholarly writing (eg, elective opportunities, independent study, required projects, or working in a laboratory).¹⁻⁴ A 1988 study found considerable variation in the extent of research-related courses taken and experiences completed among different types of PharmD degree programs, eg, first-professional degree, post-bachelor of science, and nontraditional PharmD programs. A study by Murphy in 1999 found that most colleges required coursework in research methodology, biostatistics, drug information, and literature evaluation.² Students had opportunities to conduct research as an elective in 41% of the responding programs at that time, but only 12.9% of respondents were required to complete an extensive project with data collection, analysis, and write-up. In 2007, Murphy and colleagues reexamined the research-related

coursework and research experiences in first-professional degree PharmD programs and found that out of 20 programs (25% of respondents) requiring research experiences, 12 (15%) required an extensive project with data collection and analysis.

Original research helps students develop critical-thinking skills to understand the foundations of evidence-based medicine. Providing these opportunities for students is not easy and may not be considered of sufficient benefit to the individual faculty member or college of pharmacy to justify the time and other costs. Several barriers to requiring student-conducted research have been reported, including a lack of faculty members with appropriate expertise and sufficient time for mentoring.³ The logistics of managing research projects for a large number of students has been reported by some respondents to be difficult or impossible.³ Despite these difficulties, pharmacy students work with faculty members on research projects in many colleges and schools of pharmacy across the country. Allowing students to participate in research and teaching has been shown to stimulate interest in an academic pharmacy career.⁴ Other variables that motivated students to consider an academic career included: the academic

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environment, teaching, participating in professional writing and reviews, and course design and/or assessment.⁴ While variables such as prior participation in a teaching certificate program and completion of an academic advanced pharmacy practice experience (APPE) may also affect a decision to pursue an academic career, the impact of residency training on this decision should be explored.⁴

The primary goal of this study was to examine factors that influenced PharmD students to collaborate with faculty members, preceptors, or others in scholarly activities that resulted in publication of pharmacy practice-related original research, a case study or report, or a clinical review, and to determine what students liked and disliked about the process. Secondary goals were to determine whether pharmacy students who published these papers were interested in careers in academic pharmacy; whether participation in the scholarly activity impacted their interest; whether they considered themselves high achievers; whether they had pursued or planned to pursue other education; and whether they participated in experiential education or teaching certificate programs.

METHODS

Mercer University's Institutional Review Board approved this study. All manuscripts published in pharmacy practice-related journals from January 2004 through December 2008 were reviewed to identify student authors. Pharmacy journals considered for inclusion were those indexed in Medline and focused on pharmacy practice, that contained original research, reports, clinical reviews, case studies or case reports, and meta analyses. Also, to be included, a journal had to have published at least 10 student-authored papers from January 2004 and December 2008. The number of student-authored publications was determined by a review of a year of publications in each journal. If fewer than 2 papers by students were identified, no further effort was made to identify student authors in other journal years. Journals that met the inclusion criteria included: the *American Journal of Health-System Pharmacy*, *Annals of Pharmacotherapy*, *Journal of the American Pharmacists Association*, *American Journal of Pharmaceutical Education*, *Pharmacotherapy*, and the *Consultant Pharmacist*. Several other journals that were examined but not included either did not clearly identify authors as students, or there were too few articles by students. The number of student authors and number of publications authored were determined from the journals; one of the authors had to be named as a current student or as a student at the time the paper was developed, or have no degree listed (an indication that the author might be a student), with subsequent follow-up revealing that the author was a student.

Corresponding authors were contacted using the address listed on the manuscript to verify student authorship and obtain an e-mail address for the student author. If a corresponding author's address was not listed on the publication, a search was conducted to locate contact information. Missing e-mail addresses were obtained from professional organization membership records, school/college Web sites, or the editorial staff of the journal in which the author had published. If the student's contact information was unknown by the corresponding author, the Web site of the state board of pharmacy from the student's pharmacy school or the last known state of residence was searched for contact information. State boards of pharmacy Web sites were searched by cross referencing maiden names with married names or searching for first names only to locate female authors who had married and changed their names. Contact information was also obtained using Facebook⁵ and MySpace⁶ sites. White Pages⁷ and Zabba Search⁸ were used to locate postal addresses or phone numbers. In some instances, letters were sent to student authors asking them to contact the study authors by US mail or e-mail.

A 17-item online questionnaire was developed using SurveyMonkey.⁹ Prior to surveying the student authors, the questionnaire was reviewed by 5 pharmacy practice faculty members who made minor modifications. The questionnaire was then pilot tested by 15 pharmacy students who had authored a publication between 2004 and 2008. Minor refinements were made to clarify certain questions. Student authors from the pilot project were not included in the study.

The questionnaire was divided into 3 sections. In the first section, demographic information was collected including age, sex, professional degree(s) obtained, year of pharmacy school graduation, and any postgraduate training or graduate program experiences. Other background information collected included the respondents' description of the type of manuscript published, description of the primary author (faculty, non-faculty, or the student), and journal name. In addition, respondents were asked whether they had completed an academic APPE or teaching certificate program; whether the manuscript authored was associated with a didactic requirement, an APPE, or other type of project; and whether they had any plans for obtaining an additional advanced degree.

In the second section, respondents were asked to rate whether they considered various aspects of the scholarly process valuable (using a 5-point Likert scale with responses ranging from 1 = strongly disagree to 5 = strongly agree) along with a single item that addressed whether they had been encouraged by a mentor to conduct the research for publication. Three open-ended questions

asked why they wanted to publish a manuscript, and what they liked most and least about scholarly writing. Responses to these open-ended questions were grouped into general categories for reporting purposes.

The third section collected information on the respondent's interest in a career in academic pharmacy before and after involvement in the scholarly activity, and a self-rating of their achievements, ranging from not being an achiever to being an extremely high achiever. Also, information was collected on the respondent's current job/position.

E-mails were sent to the student authors asking them to complete the online survey instrument. They were allowed 2 weeks to complete and submit the questionnaire. Two reminder e-mails were sent at 2- and 3-week intervals after the initial e-mail. Nonresponders were contacted again after 4 weeks with a more personalized message that included the name of the journal they had published in and the name of the primary author. Two weeks later, any remaining nonresponders received a phone call asking them to complete the questionnaire.

Descriptive statistics were used to describe most of the data collected. A 2-tailed *t* test was calculated to compare respondents' interest in a career in academic pharmacy before and after participating in the scholarly activity. In addition, the following groups were compared to determine their interest in an academic career before after participating in the scholarly activity: (1) those who had completed a teaching certificate program or an academic APPE, and (2) those who had completed a residency. Alpha was set at 0.05 for significance.

RESULTS

Review of the 6 selected journals resulted in identification of 137 student-authored manuscripts by 187 students from 2004 through 2008. Of the 187 student authors, valid contact information was identified for 144, all of whom were contacted by e-mail or US mail. Questionnaires were completed by 109, for a response rate of 75.7%. Some respondents did not answer all of the items. Among the respondents providing information, 70 (65.4%) were female. The mean age was 28 ± 2.9 years and ranged from 21 to 36 years of age. Sixty (55%) out of the 109 respondents graduated from pharmacy school in 2007, 2008, 2009, or would graduate in 2010. The remainder graduated before 2007 or would graduate after 2010. Professional degrees and training as of spring 2009 were reported by 104 respondents, and included PharmD (99; 95.2%), bachelor of science (28; 26.9%), master of science (MS; 5; 4.8%) and doctor of philosophy (PhD; 4; 3.8%). Thirty-six of 104 respondents (34.6%) had completed a postgraduate year 1 (PGY1) residency; 10 (9.6%)

Table 1. Student-Authored Papers Published in Pharmacy Journals From 2004-2008

Journal	Publications (n = 137)	Student Authors (n = 187)
<i>American Journal of Pharmaceutical Education</i>	8	9
<i>The Annals of Pharmacotherapy</i>	31	46
<i>American Journal of Health-System Pharmacy</i>	40	51
<i>Journal of the American Pharmacists Association</i>	31	46
<i>Pharmacotherapy</i>	17	24
<i>The Consultant Pharmacist</i>	10	11

had completed a PGY2 residency; 1 (1.9%), a fellowship; and 1 (1.9%), a master of business administration (MBA) program. There were 186 responses to this item from 104 respondents because some had earned more than 1 degree. When asked about future plans for higher education, 35 of 103 (34%) individuals indicated they intended to continue their education, planning to complete or obtain a PhD, MBA, MS, master of public health (MPH), doctor of medicine (MD), or juris doctorate (JD) degree, or a fellowship. A teaching certificate was completed by 12 of 109 (11%) of the former student authors, and 40 of 109 (36.7%) had completed an academic APPE before graduating.

Table 1 lists the journal name, number of student-authored publications, and number of student authors for each journal. Table 2 lists the type of manuscript published. The classification of the primary author by the responding student authors is listed in Table 3. Various opinions of the respondents about participating in a scholarly activity are listed in Table 4, and the respondents' thematically grouped comments on the 3 open-ended questions about writing for publication and their primary reason for publishing a manuscript are shown in Table 5. Table 6 lists employment of respondents.

Table 2. Categories of Papers Published by Student Authors in Pharmacy Journals^{a,b}

Type of Publication	No. (%)
Original research ^c	47 (40.8)
Review	33 (28.7)
Case study/report	22 (19.1)
Report	5 (4.4)
Other ^d	8 (6.9)

^a Categories were self-reported by student authors.

^b Number of publications is greater than the number of student authors because some authors had more than 1 publication.

^c Includes 2 meta-analysis papers.

^d Drug Information Rounds (2), Experiences (2), Letter, Note, Opinion, Student Forum (1 each).

Table 3. Classification of Primary (First) Author (N = 106)

Title of Author	No. (%)^a
Self	46 (43.4)
Pharmacy faculty	43 (40.6)
Pharmacist preceptor	14 (13.2)
Clinical pharmacist	10 (9.4)
Research pharmacist	7 (6.6)
Student colleague	5 (4.7)
Ambulatory care pharmacist	2 (1.9)
Community pharmacist	2 (1.9)
Graduate student	2 (1.9)
Other	3 (2.8)

^a Total greater than 106 because some respondents selected more than 1 term to describe the primary author.

When asked if their scholarly activity that led to publication was related to coursework, practice experiences, or some other project, 39 of the 95 respondents (41.1%) completing this item indicated that the manuscript was associated with a special project linked to a didactic requirement or experiential setting. In some cases, respondents reported that the initial requirement was only for a project, but that the student was encouraged later to publish the findings. Findings from research completed during an APPE made up 33 (34.7%) publications; 10 (10.5%) were for a graduation requirement and 5 (5.3%) were the result of a required course (the latter 2 categories could be the same).

Respondents overall (n = 109) had a mean rating of 3 ± 1.4 for their interest in an academic career before

participating in the scholarly activity that led to the publication, and 4 ± 1.2 after. The scale was 0 = absolutely not interested to 5 = extremely interested. The difference was significant p < 0.001, CI 95% = -0.90 to -0.18). When individuals with residencies were compared to those without residencies, there was not a significant difference in their interest in a career in academic pharmacy. However, after the project the interest of both groups improved significantly. Of all those somewhat interested to extremely interested in a career in academic pharmacy (n = 80), 6 were in academia at the time of this study.

Respondents (n = 108) rated their achiever status at a mean of 4.1 ± 1. The scale was 0 = absolutely not an achiever to 5 = extremely high achiever. Students completing an academic APPE elective (n = 40) or teaching certificate program (n = 12) did not show a significant difference in interest in an academic career as a result of scholarly activity, though interest did increase (before = 3.3 ± 1.3; after = 3.7 ± 1.2).

DISCUSSION

According to the results of the study, personal fulfillment and contributing to the literature were the 2 highest rated factors that student authors considered valuable about publishing, although all statements had high ratings (Table 4). However, only 15 out of 95 (15.8%) respondents published their findings as part of required coursework. Thus, the individuals who published findings were more likely to have sought the opportunity, or were

Table 4. Opinions of Respondents About the Value of Publishing and Mentor Influence (N=108)

Questionnaire Item	Stongly Disagree^a	Disagree	Neutral	Agree	Strongly Agree	Mean
Publishing as a student provided me with personal fulfillment	-	-	5 (4.6)	27 (25)	76 (70.4)	4.7
Contribution to the literature as a student was a valuable experience	-	-	6 (5.6)	29 (26.9)	73 (67.6)	4.6
Publishing is an excellent source of recognition for a student	-	1 (0.9)	8 (7.4)	35 (32.4)	64 (59.3)	4.5
Publishing as a student provided me with formative training experience	-	1 (0.9)	6 (5.6)	44 (40.7)	57 (52.8)	4.5
My publication set me apart from my peers	-	3 (2.8)	7 (6.5)	39 (36.1)	59 (54.6)	4.4
I would like to publish another manuscript	-	1 (0.9)	11 (10.2)	26 (24.1)	70 (64.8)	4.5
I would recommend publishing to other pharmacy students	-	-	5 (4.6)	38 (35.2)	65 (60.2)	4.6
Overall, writing for publication was good experience ^b	-	-	2 (1.9)	38 (35.2)	67 (62.6)	4.6
I received encouragement from a mentor to conduct the research for publication.	2 (1.9)	1 (0.9)	3 (2.8)	31 (28.7)	71 (65.7)	4.6

^a Responses were based on a Likert scale from 1 to 5 on which 1 = strongly disagree and 5 = strongly agree.

^b n = 107

Table 5. Descriptive Responses to Open-Ended Questions (Thematically Grouped)

Questions	No. (%)
Why did you want to publish a manuscript? (n = 95) ^a	
Advance research/share findings	19 (20)
Interesting/good experience	18 (18.9)
Was encouraged or asked	17 (17.9)
Good achievement/goal	9 (9.5)
Set me apart from peers	8 (8.4)
Career advancement	8 (8.4)
Improve writing/research skills	6 (6.3)
Better chance of residency position	5 (5.3)
To have a relationship with or gain respect of faculty member	5 (5.3)
What did you like the most about writing for publication? (n = 95) ^a	
Review/literature search, analyzing data, interpretation, data collecting, and writing	20 (21.1)
Collaboration with others or with faculty	18 (18.9)
The learning experience	14 (14.7)
Sense of accomplishment/satisfaction/achievement	10 (10.5)
Publication process	6 (6.3)
Actually having a publication	6 (6.3)
Recognition	5 (5.3)
Sharing ideas/adding to literature/advancing research	5 (5.3)
A unique experience that is available to only a few	3 (3.2)
Presentation of findings at meetings	2 (2.1)
Other: hands on experience, name in print, graduation requirement, feed-back from peer-reviewers, subject to talk about during interviews, and working at own time/pace.	6 (6.3)
What did you like the least about writing for publication? ^a	
Editing and revising	25 (28.7)
Amount of time it takes	20 (23.0)
The amount of work required after peer review	15 (17.2)
Lack of collaboration	6 (6.9)
Nothing	6 (6.9)
Writing process	5 (5.7)
Data analysis	3 (3.4)
Data collection	3 (3.4)
Process is too long	2 (2.3)
Other ^b	2 (2.3)

^a n = 87 for this item. Remaining respondents did not answer.

^b Other responses included: not knowing when to stop the review process (1), and have not been able to continue (1).

specifically recruited by faculty members, suggesting that they may have been high achievers.

Ratings and comments on the value of the projects tended to be altruistic, related to self-fulfillment or to enhancing potential for obtaining a job or residency. Approximately a third of the respondents were still in formal training as a student, resident, or graduate student. More than 90% of this group reported that they strongly agreed that publication provided them with an excellent source of recognition and set them apart from others. These findings indicate that participation in scholarly endeavors has potential to be a motivator for students preparing themselves to compete for jobs where publication, teamwork on projects, and analytical skills are desired.

Students identified themselves as the primary author in 43% of the publications. This finding suggests that students who are encouraged by a mentor or seek out research projects are given the opportunity to see the project through to completion. A number of respondents indicated that they participated in scholarly work because they were asked to write the paper or were encouraged to participate by a faculty member. Faculty members obviously have influence in encouraging students to become scholars, while advancing their own academic careers through coauthoring publications with students. Several students reported that the activity permitted them to work with a faculty member, and they enjoyed the collaboration.

Table 6. Current Pharmacy Positions of Respondents (N = 107)

Position	No. (%)
Student, resident, or graduate student	30 (28.0)
Clinical pharmacist	30 (28.0)
Community pharmacist	14 (13.0)
Hospital-staff pharmacist	12 (11.2)
Pharmacy faculty	6 (5.6)
Administrator	6 (5.6)
Industry	2 (1.9)
Military	2 (1.9)
Other ^a	5 (4.7)

^a Other positions included research scientist, nuclear pharmacist, pharmaceutical scientist, not practicing pharmacy, and manager of a non-pharmacy retail outlet.

One report indicated that student participation in research and teaching may stimulate an interest in a career in academic pharmacy.⁴ While many pharmacy students may be comfortable in a teaching setting, they may be somewhat intimidated about participating in research-related activities. The respondents in this survey reported a good learning experience as well as a sense of achievement and satisfaction, when given the opportunity to participate in scholarly activities.

Also reported was the need to investigate whether students were more likely to consider an academic appointment after the completion of 1 or more residencies.⁴ In this study, students who did and did not complete a residency had a significant increase in interest in academia, though there was no difference in final interest level between the groups. This study was not designed to determine whether a residency increased interest in academia, but the results indicate that the project positively impacted interest, whether or not a student eventually completed a residency.

Of importance to colleges and schools of pharmacy seeking new faculty members, a significant difference in interest in a career in academic pharmacy developed after the respondents had authored a publication, even though only 6 of the total respondents were in academic pharmacy at the time of the study. Of the remaining respondents, however, 30 were in school and 35 others suggested they were going to continue their education. Thus, there is a reasonable chance that some of these respondents will eventually enter academic positions. Colleges and schools should take advantage of any opportunity to stimulate more interest in academia for their own vested interest, including providing more scholarly opportunities to their students.

The importance of student exposure and involvement in teaching certificate programs and academic experiences has been reported^{4,10-12} In this study, students having com-

pleted an experiential elective or teaching certificate program did not show a significant difference in interest in an academic career as the result of scholarly activity, though interest was shown to increase and was slightly higher than that of the overall group (3.6). The lack of a significant difference might suggest that this subset previously had considered an academic position, so the scholarly activity did not influence their opinion as much. Since these activities (participation in an academic rotation or teaching certificate program) may have occurred before, during, or after the scholarly activity project, and information on the timing of the activities was not collected, it is not appropriate to draw conclusions about the relationship of these programs to the respondents' interest in academia.

There were several limitations to this study. First, some students who authored papers during the collection years may not have been identified because the publications did not label them as students, or they had a previously earned degree listed that precluded investigating them as possible student authors. Using only the targeted pharmacy practice journals also resulted in omitting publications by students in other journals during the study period. Though this would not have impacted the study outcomes necessarily, the approach used was biased toward clinically and educationally related scholarly work. There may have been differences in outcomes for students who participated in other types of research. In addition, there was no attempt to determine whether students (1) who participated in a research project but did not publish a paper; (2) who did not participate in a research project, or (3) who participated in other activities during their PharmD program would have had similar attitudes toward pursuing an academic career. Additionally, this group already may have been more interested in an academic career because so many of them had completed an academic APPE. The change in attitude toward an academic career may have been impacted by the stage of the student's education (ie, would a recent graduate think more about an academic career than a second-year student?). Furthermore, student authors were allowed to self-report the category of their publication (Table 2). Because there may have been inaccuracies in this reporting, these results should not be considered exact, even though this would not have affected the targeted purposes of the study.

CONCLUSIONS

A variety of factors influence pharmacy students' participation in scholarly activities, including advancing research, participating in an interesting project, collaborating with and receiving feedback and encouragement from faculty members, and expanding their career opportunities. In addition, various factors affected students' perceptions of

the value of the process, including personal fulfillment, receiving mentoring, and career potential. Student participation in research that led to authoring a peer-reviewed manuscript appears to increase interest in a career in academic pharmacy.

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