

Mentor perceptions of the value of a fourth year research project for Doctor of Pharmacy students

MELANY P. PUGLISI^{1*}, CHARISSE L. JOHNSON², ROSALYN VELLURATTIL³, MICHAEL WILCOX¹, JOSEPH SLONEK², KUMAR MUKHERJEE^{2,4}, ELMER GENTRY¹

¹Department of Pharmaceutical Science, Chicago State University College of Pharmacy, Chicago, Illinois 60628, USA.

²Department of Pharmacy Practice, Chicago State University College of Pharmacy, Chicago, Illinois 60628, USA.

³University of Illinois at Chicago College of Pharmacy, Chicago, Illinois 60612, USA.

⁴Current address: Philadelphia College of Osteopathic Medicine, Georgia Campus, Suwanee, Georgia 30024, USA

Abstract

Chicago State University College of Pharmacy introduced the capstone project in 2011 as a requirement of the Doctor of Pharmacy degree. The objectives of this study were to assess faculty perceptions of: 1) the value of research in the students' success in a pharmacy degree programme; 2) the students' level of preparedness to complete the project requirements; and 3) the students' ability to complete research projects in their future career. A 35-item survey instrument was administered to 23 capstone mentors to elicit their perceptions regarding the programme and research as it relates to a pharmacy degree. Mentors agreed it was important for students to participate in (n = 15) and demonstrate excellence (n = 11) in research activities. Respondents (n = 12) indicated that students were not adequately prepared by the didactic curriculum and that additional preparation may be necessary to conduct research independently in the future.

Keywords: *Capstone Project, Pharmacy Education, Student Research, Faculty Mentors, Preceptor Mentors*

Introduction

According to the American Association of Colleges of Pharmacy (AACP), one of the goals of pharmacy colleges and schools is to produce pharmacists who are scientifically and technically proficient (AACPa, 1993). The Commission to Implement Change in Pharmacy Education (CICPE) stated "while most professionals prepared by pharmaceutical education are not scientists, all need to use scientific knowledge and scholarly principles in solving problems." (AACPb, 1993: p379; Draugalis & Slack, 1992). It is vital that pharmacy students are taught the importance of the various scientific methods and how to apply these tools to provide the highest level of pharmaceutical care. The CICPE also stated that constantly seeking to improve the level of pharmaceutical care is the way to ensure the advancement of the profession of pharmacy (AACPb, 1993). The CICPE concluded that research conducted by student pharmacists is one way to achieve advancement of the profession of pharmacy (AACPb, 1993). Identified areas for needed improvement include statistics, drug information, and the evaluation of scientific literature (Draugalis & Slack, 1992). The goal is to increase the ability of pharmacists to transmit new knowledge and improve their analytical, written, and verbal communication skills to produce healthcare professionals that are better equipped to serve the patients.

One way in which many colleges and schools of pharmacy throughout the United States of America have sought to achieve this goal is through the implementation of research projects in the Doctor of Pharmacy (Pharm.D.) curriculum (Murphy, 1997; Fuji & Galt, 2009; Kao, Hudmon & Corelli, 2011; Wuller, 2010; Vellurattil *et al.*, 2014; Assemi *et al.*, 2015). For many of these programmes, the research project is a graduation requirement for all student pharmacists. The research project requires students to prepare a project proposal, obtain the appropriate institutional approval if required (*i.e.* Institutional Review Board), participate in data collection and analysis, and prepare a final written report or presentation detailing research outcomes (Kao, Hudmon & Corelli, 2011). The capstone project is generally defined as a project that allows students to apply the knowledge they have learned throughout their didactic pharmacy education, select a topic of interest, and create a research project to examine or investigate a particular idea regarding their area of interest (Vellurattil *et al.*, 2014; Grad School Hub, 2016).

As early as 1910, it was recognised that engaging professional students in scientific research could improve patient outcomes (Bandiera, 2013). Improving students' understanding and use of the scientific method, through improved research skills, could be important to improve

*Correspondence: Dr. Melany P. Puglisi, Associate Professor, Chicago State University College of Pharmacy, Department of Pharmaceutical Science, Douglas Hall 206, 9501 South King Drive, Chicago, IL 60628, USA. Tel: +1 773 821 2163; Fax: +1 773 821 2595. Email: mpuglisi@csu.edu

patient outcomes (Kao, Hudmon & Corelli, 2011). Because of this, pharmacy educators are developing and implementing new teaching methods to improve skills such as abstract critical thinking, critical analysis, and improved reading, writing, and communication (Fuji & Galt, 2009). However, limited research has been conducted to gauge the attitudes of the educators responsible for ensuring that current and future pharmacy students achieve these goals (Murphy, 1997; Kao, Hudmon & Corelli, 2011). Studies of college of pharmacy faculty member attitudes toward senior project experience at the University of Arizona and University of California at San Francisco report that the majority of preceptors suggest that a research project added value to the pharmacy profession for the students, faculty, and the programme (Murphy, 1997; Kao, Hudmon & Corelli, 2011; Assemi *et al.*, 2015). In these studies, preceptors agreed that courses to help students develop research, literature evaluation, analytical, and presentation skills were vital and should be a required part of the Pharm.D. curriculum.

Chicago State University College of Pharmacy implemented a capstone project in the 2011-2012 academic year. Students were matched with mentors (faculty or preceptors) to develop a research project, collect and analyse data and present the results in a poster and manuscript at the end of their fourth professional year just prior to graduation (Vellurattil *et al.*, 2014). Students were assessed (both formatively and summatively) by their faculty capstone mentors. Most students worked in pairs, while some students worked individually. Research projects included, but were not limited to, laboratory research, clinical research, educational research, business plan development, and drug utilisation review. Students were expected to work on their capstone projects throughout the fourth professional year outside of advanced pharmacy practice experiences. In some instances, the faculty mentor utilised an Advanced Pharmacy Practice Experience (APPE) module to work with students on their projects. In the 2011-2012 academic year, 65 (91.6%) of the students participating in May 2012 exit interviews completed an anonymous survey eliciting their attitudes and perceptions about various aspects of the capstone research programme and the value of research in their future careers (Vellurattil *et al.*, 2014).

The purpose of this parallel study was to assess mentor perceptions of the value of research to the student pharmacist and the capstone project as a graduation requirement for the pharmacy programme during academic year 2011-2012. The objectives of this study were to assess faculty perceptions of: 1) the value of research in the students' success in a pharmacy degree programme 2) the students' level of preparedness to complete the project requirements; and 3) the students' ability to complete research projects in their future career. Mentors completed a companion survey to the one administered to the students in the class of 2012 asking similar questions from the mentor's point of view.

Methods

The Capstone Director administered an anonymous survey to the 23 faculty members and preceptors who served as capstone mentors for the inaugural year of the capstone research programme (academic year 2011-2012). The survey was administered utilising Survey Monkey® (1999-2014 version) in May 2012. Subjects were contacted via e-mail and provided the Survey Monkey® web link requesting participation. Submission of a completed survey via Survey Monkey® implied consent to participate. Surveys were collected with no individual subject identifiers.

The 35-item survey consisted of closed-ended, open-ended and Likert-type items. The Likert-type items were assessed with the use of progressive scales offering ten response options. These options consisted of numerical descriptors (0 to 9), allowing subjects to select an appropriate number to denote their response. The scale descriptors represented a continuous scale ranging from 0 = minimal to 9 = significant and 0 = poor to 9 = very well. A 10 point scale was employed in this study in an attempt to tease out finer differences in responses (Dawes, 2008; Vellurattil *et al.*, 2014).

Items elicited the faculty perceptions about various aspects of the capstone research program and also research generally as it relates to a Pharm.D. programme. The survey was developed from an instrument used in a companion study to capture student attitudes toward the capstone research programme (Vellurattil *et al.*, 2014). Prior to administration, the survey was administered to faculty experts to review the content of the instrument. Data obtained from the completed surveys were reviewed and analysed employing quantitative descriptive statistical methods using PASW Version 18.0. University Institutional Review Board approval was obtained for this study (Protocol # 015-04-12). Mentor participation was voluntary.

Results

The instrument was administered to 23 mentors for the capstone research experience of whom 19 completed the survey (83%). The capstone mentors for the launch of the capstone research programme included faculty within the pharmaceutical sciences and pharmacy practice areas and one from outside the College, with the majority (68%) from the Pharmacy Practice department (Table I). The majority of the mentors in this new pharmacy programme were at the rank of assistant professor (58%) (Table I). Fifty-three percent of mentors reported that they had a minimum of 1-3 years of basic science research experience, while 79% reported that had a minimum of 1-3 years of clinical research experience (Table I). The mentors for the capstone research programme published an average of two peer reviewed publications in the five years leading up to the launch of the capstone research programme (Table I).

Table I: Demographics of the survey participants (N=19)

Item	Choices	No. Responses (%)
Your faculty appointment within the CSU College of Pharmacy is with the:	Department of Pharmaceutical Sciences	5 (26.3%)
	Department of Pharmacy Practice	13 (68.4%)
	I do not have a faculty appointment within the CSU College of Pharmacy	1 (5.3%)
Currently your academic title is:	Instructor	1 (5.3%)
	Assistant Professor	11 (57.9%)
	Associate Professor	6 (31.6%)
	Full Professor	
	I do not have a faculty appointment within the CSU College of Pharmacy	1 (5.3%)
The highest degree that you possess is a:	Bachelor's degree	
	Doctor of Pharmacy degree	11 (57.9%)
	Master's degree	1 (5.3%)
	Doctor of Philosophy degree	7 (36.8%)
How many years of "basic research" experience do you possess?	0	9 (47.4%)
	1-3	4 (21.1%)
	4-7	
	8 or more	6 (31.6%)
How many years of 'clinical research' experience do you possess?	0	4 (21.1%)
	1-3	9 (47.4%)
	4-7	5 (26.3%)
	8 or more	1 (5.3%)
In the past five years, how many scholarly works have you published in a peer reviewed journal?	0	2 (10.5%)
	1	5 (26.3%)
	2	2 (10.5%)
	3	5 (26.3%)
	4	1 (5.3%)
	5 or more	3 (15.8%)

When mentors were asked how important student participation in research related activities was during the Pharm.D. programme the mean response was 6.26 (SD=1.33). When asked how important student demonstration of excellence in research activities is during the Pharm.D. programme, the mean response was 5.48 (SD=1.78). When asked how important are the skills and experience of doing research during the Pharm.D. programme for the students, the mean response was 6.47 (SD=1.68). The mean responses was 5.16 (SD=1.68) when mentors were asked how important student participation in research activities are to students' ability to achieve their future goals. The mean response was 4.47 (SD=2.14) when mentors were asked how important is student participation in research activities for success in community or institutional pharmacy.

When capstone research mentors were asked, as a capstone research project mentor, what the level of

guidance did you need to generally provide to students to solve research-related problems, eight (42.1%) chose option (9) indicating significant guidance (Table II). When asked as a capstone research project mentor, what the level of guidance did you need to generally provide to students in completing the capstone project, seven (36.8%) chose (9) indicating that they provided significant guidance to the student (Table II). The mean response of 3.5 was at the lower end of the scale when asked what level of preparedness do you believe students received in the didactic curriculum for the capstone project at this college of pharmacy (Table II). Similarly, the mean response of 3.7 was at the lower end of the scale when asked based on your current experience with the capstone research project, how well do you think students would generally perform in a 'basic research setting' in the future (Table I). When asked, based on your current experience with the capstone research

Table II: Responses to survey items regarding role of the capstone mentor in the Doctor of Pharmacy curriculum

ITEM	0 Minimal	1	2	3	4	5	6	7	8	9 Significant	Overall Response Mean (SD)
As a capstone research project mentor, what level of guidance did you need to generally provide to students to solve research-related problems?	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (5.3%)	3 (15.8%)	5 (26.3%)	2 (10.5%)	0 (0%)	8 (42.1%)	7.11 (1.79)
As a capstone research project mentor, what level of guidance did you need to generally provide to students in completing the capstone research project?	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (5.3%)	3 (15.8%)	5 (26.3%)	3 (15.8%)	0 (0%)	7 (36.8%)	7.0 (1.73)
What level of preparedness do you believe students received in the didactic curriculum to prepare them for the capstone research project ?	2 (11.1%)	2 (11.1%)	3 (15.8%)	3 (15.8%)	2 (11.1%)	4 (21.1%)	2 (11.1%)	0 (0%)	0 (0%)	1 (5.6%)	3.47 (2.32)
Based on your current experience with the capstone research project, how well do you think students would generally perform in a "basic research setting" in the future?	1 (5.6%)	2 (11.1%)	2 (11.1%)	4 (22.2%)	3 (16.7%)	2 (11.1%)	3 (16.7%)	0 (0%)	0 (0%)	1 (5.6%)	3.72 (2.22) N = 18
Based on your current experience with the capstone research project, how well do you think students would generally perform in a "clinical research setting" in the future?	0 (0%)	0 (0%)	0 (0%)	4 (22.2%)	7 (38.9%)	2 (11.1%)	3 (16.7%)	0 (0%)	0 (0%)	2 (11.1%)	4.78 (1.83) N = 18

N=19 unless otherwise indicated; SD = Standard Deviation)

project, how well do you think students would generally perform in a 'clinical research setting' in the future, the mean response was 4.78 (Table I). Six (31.6%) of mentors chose option (9) when asked how prepared were you in overseeing a student project in terms of possessing the applicable knowledge and research experience.

Table III: Responses to survey items regarding student mentorship

ITEM	1	2	3	4	5 or more	N
As a capstone research project mentor how many "student projects" did you oversee?	9 (50%)	4 (22.2%)	2 (11.1%)	1 (5.6%)	2 (11.1%)	18
As a capstone research project mentor how many "student" did you oversee?	4 (21.1%)	4 (21.1%)	2 (10.5%)	4 (21.1%)	5 (26.3%)	19

The majority of mentors oversaw one student project (Table III). The majority of capstone mentors were assigned between one and four students, while five (26.3%) mentored five or more students in the

completion of their project (Table III). Nine (47.4%) mentors reported that students presented their capstone research project at a local or national conference outside of the university. In addition, students of four mentors (38.4%) won awards for their poster presentations (Table IV). Only one (6.3%) capstone project resulted in a publication at the time the survey was administered.

Only 16 of the 19 respondents in the instrument completed the remaining 11 items (Table IV). Generally, 12 (75.0%) of the respondents felt that their students are able to present a poster at a local or national conference in the future and nine (56.3%) generally felt that their students would be able to write a research manuscript in the future (Table IV). Only seven (43.8%) of mentors said that the college provided them with adequate resources and materials to serve as a capstone project mentor, while nine (56.3%) said that the capstone research provides them with assistance in furthering their own research initiatives (Table III). Only six (37.5%) of the respondents said that the capstone project has been successful in increasing the scholarly output of their department. Eight (50.0%) of those surveyed said that the capstone project, as organized by the college, was structured and they, as a capstone research mentor, had clear expectations about their roles and responsibilities. Twelve (75.0%) of the mentors agreed that the college should designate one APPE module for future students completing requirements for the capstone project (Table III). Ten mentors (62.5%) reported that their students had

Table IV: Responses to survey items regarding importance of research in the Doctor of Pharmacy curriculum

ITEM	YES	NO	N
Did your student(s) present their capstone research project at a local or national meeting (outside of this college)?	9 (47.4%)	10 (52.6%)	19
Did your student(s) capstone research project win an award (i.e. Best Poster, First Prize, Second Prize, etc.)?	4 (38.4%)	7 (63.6%)	11
Did your student(s) capstone research project result in a publication?	1 (6.3%)	15 (93.8%)	16
Generally, do you feel your student(s) are able to present a research poster to a local or national meeting in the future?	12 (75.0%)	4 (25.0%)	16
Generally, do you feel your student(s) are able to write a research manuscript in the future?	9 (56.3%)	7 (43.7%)	16
Did the college provide you with adequate resources and materials to serve as a capstone research project mentor?	7 (43.8%)	9 (56.3%)	16
Did the capstone research project provide you with assistance in furthering your own research initiatives?	9 (56.3%)	7 (43.7%)	16
Has the capstone research project been successful in increasing scholarly output of your department?	6 (37.5%)	10 (62.5%)	16
Was the capstone research project, as organized by the college, structured?	8 (50.0%)	8 (50.0%)	16
As a capstone research project mentor, did you have clear expectations about your roles and responsibilities?	8 (50.0%)	8 (50.0%)	16
Should the college designate one APPE module for future students completing requirements for the capstone research project?	12 (75.0%)	4 (25.0%)	16

adequate time to complete the capstone research project during the APPE year and thirteen (81.2%) of the twenty capstone project mentors believe that the capstone project should remain a requirement for graduation from the college.

Mentors offered many suggestions for improving the capstone project experience. One concern is that students do not have the time to complete their project and respondents suggested that students can begin earlier (*i.e.* P1 or P2 year) to identify a project, receive training in manuscript and poster preparation, and provided opportunities to learn the skills required to complete the work, especially in the basic science laboratory. Earlier involvement was suggested as also able to give the student a sense of ownership and encourage them to meet deadlines. Mentors also requested more support from the college in software training (*i.e.* PASW Version 18.0) for themselves and their students.

Discussion

Results from this study reveal that most faculty mentors felt that a capstone research project is an important tool that should be used to help students develop better research skills. At the time of the study, however, faculty members also felt that students are not as prepared as they should be to conduct quality research on their own. The capstone students in the class of 2012 agreed that the didactic curriculum minimally (fairly) prepared them to complete their capstone project (Vellurattil *et al.*, 2014). These results are different from those expressed in other studies at two larger research institutions (Murphy, 1997; Kao, Hudmon & Corelli, 2011). These differences in opinion may be a reflection of the relative sizes of the academic institutions, different missions, and the length

of time that the programme has been in existence. This College is in a university with an overall enrolment of less than 7,000 students per year with the main focus on teaching and the Pharm.D. programme began in 2008 and has approximately 90 pharmacy students enrolled per year, whereas the other two institutions have been in existence since 1872 and 1947, respectively, and have thus had more time to develop a stronger research base (Murphy, 1997; Kao, Hudmon & Corelli, 2011; Assemi *et al.*, 2015).

While the first cohort of mentors in the capstone research project at this College of Pharmacy suggested that student participation in research related activities is important, students reported that they felt research activities are not important for their Pharm.D. education (Vellurattil *et al.*, 2014). However, most of the mentors and students at this institution agree with studies at other institutions that the capstone project is a useful skill building tool and positive learning experience in which students were able to practically apply the knowledge that they attained during their pharmacy education (Murphy, 1997; Vaidean *et al.*, 2013; McClendon *et al.*, 2015).

Mentors generally felt there is moderate to significant importance to demonstrate excellence in research related activities during the Pharm.D. programme and for achieving their future goals. Interestingly, fewer respondents felt it was important to demonstrate excellence in research related activities when specifically considering the community or institutional pharmacy setting (Table II). Since most of the mentors are academicians, this finding has greater relevance for those students desiring to pursue careers where research is now commonly done, *i.e.* in academia or in advanced clinical settings, rather than traditional pharmacist practice environments (Fagan *et al.*, 2006).

About one half of the responding mentors said their capstone students presented their projects at a local or national meeting outside of the University, and about a third of them had a project that received an award. This finding shows that students are gaining valuable experience in presenting original research. However, only about one third of the mentors reported that the programme was successful in increasing scholarly output of their department. Peer-reviewed publications and invited oral presentations at national conferences are generally more highly valued for promotion and tenure decisions in academic institutions than poster presentations at local conferences (Gross-Schaefer *et al.*, 2015; Tanaomi & Asaadi, 2017). With that being true, student engagement in research is considered an important aspect of the teaching duties of faculty at this institution (Assemi *et al.*, 2015).

The results from this study are in agreement with the findings reported with regard to mentor experiences with student research projects at Samford University (Nelson, Cates & Woolley, 2008), Touru College of Pharmacy and Farleigh Dickenson University (Vaidean *et al.*, 2013). Mentors reported that some students were minimally prepared by the didactic curriculum to complete the requirements for the capstone project without fairly significant guidance from capstone mentors in both solving research related problems and completing the project. The capstone students in the class of 2012 agree that the didactic curriculum minimally (fairly) prepared them to complete their capstone project, however, they reported that they received minimal guidance from their mentors in the completion of their research projects (Vellurattil *et al.*, 2014). Furthermore, the curriculum at this college meets the Accreditation Council of Pharmacy Education standards providing students with an advanced practitioner degree. However, while many courses at the research institution address laboratory techniques and scientific understanding, the curriculum does not put emphasis on research training for students during the initial years.

The majority of mentors felt students had adequate time for project completion, yet most suggested that students should take one APPE module that will be devoted to completion of work for the project. When students were asked the same questions, the majority of the students surveyed responded that they did not have adequate time to complete the project and two-thirds of those surveyed requested that an APPE rotation should be designated for the completion of the project (Vellurattil *et al.*, 2014). At Southern Illinois University Edwardsville School of Pharmacy, the capstone project is incorporated into the fourth year APPE curriculum (Wuller, 2010). Mentors and students likely see the benefit of APPE module as a time to make progress towards completion of the project without distraction. This could seemingly increase productivity and improve mentor and student interactions.

Interestingly, mentors reported students would perform better in a clinical research setting than students reported for themselves (Vellurattil *et al.*, 2014). The data

suggests that students who participated in the first year of the capstone research programme are less confident in their own abilities than mentors are in them; additionally mentors may feel that students get more out of the experience than they perceive (Vaidean *et al.*, 2013). It should also be noted that for many students, the capstone project is the first opportunity to participate actively in a clinical research endeavour, although there are students who enter the programme with advanced science degrees. In addition, some students engage in research in their first, second and third year of pharmacy school. As a part of their learning experience, students may need to make independent decisions to complete their research that challenge their knowledge and capabilities (Kritikos *et al.*, 2013; Vaidean *et al.*, 2013).

Mentors and students agreed that the capstone research programme should continue at this College of Pharmacy (Vellurattil *et al.*, 2014). However, it was clear from the results that the mentors felt that in order for the capstone research project to be a success, the programme warrants more structure and clarity with regard to expectations about their role and responsibilities (Wuller, 2010; Vaidean *et al.*, 2013). When the capstone research project was launched in June 2011, mentors were supplied with a handbook that provided the objectives and milestones of the project. The programme allowed the mentors to determine how much time they would dedicate to the students during the project and to set their own expectations of student output. While providing academic freedom to the mentors, these aspects also created some frustration in advising students. The capstone programme will be greatly improved through the development of uniform expectations for mentors and students. Other beneficial changes to the programme can include: completion of a required APPE module devoted to capstone work to provide the students time to focus and make considerable progress on their project, increasing communication between mentors and programme administrators to help mentors feel better-informed on matters of importance; and providing additional resources to mentors would ease the burden of mentors. As this college moves forward with the capstone research programme in the future, steps to resolve the disparate perceptions of the value of the programme between mentors and student pharmacists also need to be taken to promote its' overall success.

Limitations

The descriptive nature of the present study and small sample size limits any causal interpretation of the findings from the survey. It should also be noted that this study did not ask faculty/mentors to define the type of scholarly work produced limiting the interpretation of the above findings. Efforts to improve the teaching methods used to prepare pharmacy students for real-world success might be better served by further surveying and understanding the thoughts and attitudes of those entrusted with their education. Other studies need to be carried out by surveying mentors from similar pharmacy student research programmes at similar/peer institutions.

Conclusion

In this study, the first cohort of capstone mentors suggest that student participation in research is an important component of the Pharm.D. curriculum at this college of pharmacy. However, they also suggest that the demonstration of excellence during the project and the skills and experience gained in doing research and participation in such activities as it relates to achieving future goals is less important. Furthermore, the relationship between success in community and institutional pharmacy practice and student participation in research activities is perceived to be fairly minimal. As this college moves forward in the development of a rigorous capstone research programme, it will be important to put in place measures of faculty and student success, that demonstrate that this programme is a valuable educational experience that promotes the success of students after graduation. Mentor experiences should be used to develop clear, attainable goals for all of the students involved in the programme. In addition, this college should explore opportunities within the curriculum to better prepare students to complete the requirements of the capstone research project.

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