

Research Report Template
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PROJECT TITLE & AUTHORS

Project Title:	Student pharmacists' perspectives of a virtually-delivered research proposal course in the PharmD curriculum	
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PROPOSAL CHECKLIST

Completed (Y)	Checklist item
Y	Project title is clear and concise.
Y	Names and emails for project advisor(s) and up to five students per group are provided.
Y	Abstract is no more than 250 words and retains headings
Y	Introduction provides a definition of the topic under study, importance of the topic, and the issue addressed by the study and is no more than one single-spaced page.
Y	There is NO literature review section
Y	Purpose of project is clearly and concisely stated
Y	Methods section uses headings and represents a summary of the methods used. (Actual methods used should be described if they were modified from the proposal.)
Y	Data analysis described is appropriate and responds to the purpose.
Y	Appropriate tables are included in the results section.
Y	Text of results section interprets the findings reported in the tables, not repeating them.
Y	The discussion section includes a description of the most important findings, and relates findings to the literature.
Y	The final section of the discussion is the limitations section.
Y	The conclusions respond to the purpose statement.
Y	Reference list is complete and contains appropriate references, and reference style is applied correctly and consistently.
Y	Data collection/recording form(s) and/or questionnaire(s) are included in the appendix.
Y	Information is placed in the appropriate section—introduction, methods, results, etc.
Y	Template structure is maintained and all required sections are included. Red text instructions/examples are removed. Proposal is written in Times New Roman 12-point font and does not exceed 10 single-spaced pages (excluding appendices). Proposal has been spell-checked and grammar-checked.

ABSTRACT

Introduction: This study aimed to assess third-year student pharmacists' perspectives of a virtually delivered research proposal course.

Methods: A 23-item questionnaire was distributed to third-year student pharmacists enrolled in a research proposal course over three weeks in April 2021. The questionnaire consisted of 15 Likert-scale items (how well the course: facilitated student-instructor communication, prepared students for their career, and met expected Doctor of Pharmacy learning outcomes), seven descriptive items, and a free-text item for additional comments about the course. Items were summarized using descriptive statistics.

Results: Fifty-four student pharmacists (response rate=40.9%) participated in the survey. Student pharmacists surveyed generally had a positive perception of the virtually delivered research proposal course with median scores ≥ 4 (i.e., indicating agreement) for the majority (13/15) of survey items. Students did not agree that there was no difference in their motivation to succeed in the virtual course versus an in-person course and did not agree that they were more likely to pursue a career that involves undertaking a research project.

Conclusion: This study found student pharmacists generally had a positive perception of a virtually delivered research proposal writing course. These findings offer some support for the provision of an online, virtually delivered research proposal writing course for student pharmacists. Further research with a larger sample of students from multiple pharmacy schools is needed to improve the generalizability of the results.

INTRODUCTION

The abrupt global entrance of the severe acute respiratory coronavirus-2 in 2019 (commonly known as COVID-19), and associated physical distancing requirements, necessitated a prompt transition to alternative methods of teaching and learning. During this pandemic, the next generation of health professionals, including pharmacists, have been learning in a virtual setting rather than the traditional in-person setting. This environment has challenged pharmacy instructors to revise didactic courses, as well as Introductory Pharmacy Practice Experiences

(IPPEs) and Advanced Pharmacy Practice Experiences (APPEs), for virtual learning.¹ The Accreditation Council for Pharmacy Education (ACPE) Accreditation Standards broadly requires students to be exposed to research skills such as the evaluation of scientific literature, implementing solutions, and advancing creative thinking to reach professional goals, yet the methods employed to give student pharmacists a research-focused education vary across accredited institutions.² Research courses grant student pharmacists the skills to apply new evidence to pharmacy practice and boost their confidence in research.³ Doctor of Pharmacy (PharmD) programs are encouraged to cultivate self-directed students that can assimilate and apply vast amounts of research. These skills are important because pharmacists are responsible for synthesizing reliable and valid healthcare research and providing it to the patients and communities they serve. This is all the more important during a pandemic when there is rapidly evolving and sometimes contrasting information.⁴⁻⁶

Student pharmacists enrolled at The University of [blinded] College of Pharmacy accomplish these ACPE domains by designing and then conducting their own pharmacy research project through a required research course series. The University of [blinded] College of Pharmacy has a primary campus in [blinded city], [blinded state], and a satellite campus in [blinded city], [blinded state]. This dual campus model of pharmacy education has become commonplace alongside the advancement of live video conferencing software.⁷⁻⁸ In general, an instructor at the main campus ([blinded]) teaches in-person while sending a live video-stream to the satellite campus ([blinded]). Occasionally, the roles are reversed when an instructor at the satellite campus sends a live video-stream to the main campus. Briefly, students form teams or work independently, choose a project advisor, and develop a project to pursue. In the spring semester of the third year of the PharmD program, students take a required two-credit course where they

are taught how to develop a research proposal. After this proposal is approved by all necessary parties (course coordinator, project advisor, institutional review board, etc.), they may begin their project. Students then take two required credits of independent study in both the fall and spring semesters of their fourth year (total four credits of independent study) to complete their project, make and present a poster of their findings, and produce a research report.

In Spring 2021, physical distancing and stay-at-home mandates imposed due to COVID-19 forced the aforementioned research proposal course to transition from its usual in-person format to an online, virtual format using Zoom technology (Zoom Video Communications, Inc, San Jose, CA). The same course assignments were used in the online course as were used in the previous in-person course. The instructor's goal was to maintain the same level of student engagement with the content using the virtual format. Previous scientific literature has described best practices for implementing remote learning with professional students and described how students interact with online and electronic learning tools.⁹⁻¹¹ Skill-based courses have also been evaluated in the dual campus model for their quantitative outcomes and it has been found that campus type does not influence academic performance.¹²

The recent literature describes the effectiveness of online learning generally⁹⁻¹⁰ and in specific courses such as pharmacokinetics and communications.¹³⁻¹⁴ However, there is limited information describing student pharmacists' perceptions of a virtually-delivered research proposal course, such as the one described in this paper. Given that the nature of conducting a research project is somewhat different from didactic learning, it is important to understand if students' perceptions are similar or different to what is already known about online learning. Therefore, the objective of this study was to assess third-year student pharmacists' perspectives of a virtually-delivered research proposal course.

METHODS

Study design, eligibility, and course background: Students were eligible to participate in this cross-sectional survey if they were third-year student pharmacists enrolled in the University of [blinded] College of Pharmacy research proposal course in Spring 2021 (N=132). The goal of this two-credit course was to prepare a research proposal that can be completed during the final year of the pharmacy program. All students enrolled in this course had previously completed six credits of coursework in drug literature evaluation courses (e.g., statistics, study design), and three credits of coursework in quality improvement that included a year-long team-based quality improvement project. The research proposal course class met virtually via Zoom for two hours each week throughout the entirety of the Spring 2021 semester. In the class, students decided if they wanted to work independently or form a team of up to five students. Students identified their project advisors, who are often practicing pharmacists and/or University faculty. Students were required to meet frequently with their project advisor to seek their input and feedback on the project proposal. All course materials were provided to students via the online course management software at the start of the course. These materials included a template proposal and example proposals to guide the development of their proposal. Each week in class, the instructor focused on one aspect of the proposal, and guided students through a sequence of tasks to develop their proposal. In class, after an explanation and example of the week's tasks, the remainder of the class time was allocated for students to work on their proposals and seek feedback from the instructor as necessary. Students were then required to complete those tasks by the end of the week. Students were able and encouraged to work ahead of the course schedule to give themselves more time to conduct their study or complete their study early. Towards the end of the semester, the instructor reviewed and provided feedback on a draft of the proposal for students to act on, such that students had a complete proposal for an appropriate project by the

end of the semester. After the proposal was approved by the course coordinator and project advisor, students obtained Institutional Review Board (IRB) approval as necessary and began their project. The content and assignments used in this online version of the course were the same as those used in the previous in-person course. However, there were necessarily practical differences such as all materials being provided electronically and the instructor not being able to move around the classroom to help students independently. An outline of the course content and time spent in each area is provided in Table 1.

Questionnaire: A 23-item questionnaire was designed specifically for this study using REDCap (Research Electronic Data Capture) hosted at The University of [blinded]. REDCap is a secure, web-based software platform designed to support data capture for research studies, providing 1) an intuitive interface for validated data capture; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for data integration and interoperability with external sources.¹⁵⁻¹⁶ The first section of the questionnaire asked students to rate their level of agreement with 15 statements using a six-point Likert Scale (1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=somewhat agree, 5=agree, 6=strongly agree). The first four Likert Scale items evaluated student's perceived ability and motivation to succeed in the course and communicate with the instructor. The next six items assessed student perceptions of whether they gained the skills from the ACPE learning domains that the course was designed to meet. The next three Likert Scale items assessed student perceptions of the requisite research projects in their curriculum, a career in research, and how well the course prepared them for such a career. The final two Likert Scale items assessed student perceptions of the class structure. The next section of the questionnaire consisted of seven demographic and descriptive items about

student characteristics, experience, and goals. The questionnaire ended with a free-text item for participants to provide any additional comments they had about the course. An initial draft of the questionnaire was developed based on items from Darr et al.,¹⁷ with further revisions made until the instrument was deemed to have appropriate face validity by the research team.

Data collection: Data were collected over a three-week period in April 2021. This timeframe was chosen so that students had experienced the majority of the course and would be able to provide feedback on it, without encroaching onto the examination period at the end of the semester. An email containing information about the study and a link to participate in the online questionnaire was sent to eligible participants. A reminder email was sent after one week, and a further reminder email was sent after two weeks. Data collection stopped at the end of the third week. Data were exported from REDCap and analyzed with SAS (V9.4., Cary, NC). The Likert Scale items were summarized using medians with interquartile ranges, nominal items were summarized using frequencies with percentages, and items relating to participant's self-identified experience with videoconferencing and preparedness for the course were summarized using means with standard deviations. This study was approved by the University of [blinded] Human Subjects Protection Program (protocol #2021-005-PHPR, April 2, 2021).

RESULTS

In sum, 54 of the 132 (40.9%) enrolled students submitted completed questionnaires.

Demographic and descriptive characteristics of study participants are shown in Table 2. Majority of participants were female (61.1%), had not previously conducted research (72.2%), attended the main ([blinded]) campus (59.3%), did not anticipate holding a position that required conducting research upon graduation (81.5%), and were working as part of a group for their project (94.4%).

Participants' level of agreement with survey items are shown in Table 3. The median level of agreement was 4 or above (i.e., indicating at least some level of agreement) for most items, except for "there was no difference in my motivation to succeed in this virtual course versus an in-person course" (median=3.5) and "after taking this course, I am more likely to pursue a career that involves undertaking a research project" (median=3.0).

DISCUSSION

This objective of this project was to assess third-year student pharmacists at The University of [blinded] College of Pharmacy perspectives of a virtually-delivered research proposal course. Four key findings were identified and are each discussed below.

The first key finding was that the student pharmacists surveyed generally had a positive perception of the virtually delivered research proposal course, as indicated by median scores of 4 or above for the majority (13/15) of survey items. This finding indicates the perceived importance of research experiences for student pharmacists and suggests the non-inferiority of virtually delivered research courses. The two items where students had a median score indicating somewhat disagree ("there was no difference in my motivation to succeed in this virtual course versus an in-person course" and "after taking this course, I am more likely to pursue a career that involves undertaking a research project") are discussed further in the next two key findings.

The second key finding was that student pharmacists agreed there was no difference in their ability to succeed in the course or communicate with the instructor in the virtual setting. This aligns with other studies that found student performance was unaffected in virtual laboratory courses,¹² elective immunization course,¹⁸ and pharmacology courses,¹⁹ and suggests that virtual delivery may be appropriate for a research proposal writing course. Interestingly, students did not agree that there was no difference in their motivation to succeed in the virtual course compared to an in-person course. This study did not assess whether there was greater or

less motivation to succeed in the virtual course. Students may be more motivated because they have greater flexibility to complete their tasks, or perhaps they may be less motivated to complete their assignments without an in-person instructor. Although students perceived there was no difference in their ability to succeed in a virtually delivered research proposal course, the finding that they perceived there was a difference in their motivation to succeed in a virtually delivered research proposal course poses questions about whether lower motivation is a hindrance to virtually delivered instruction. Previous work has found student learning in self-paced systems such as virtual courses receive diminished external regulatory cues from their peers and instructor which is associated with lower motivation leading to procrastination.²⁰ Lower engagement in the course could ultimately lead to more time being needed to complete assignments and/or a decline in the quality of the project. Historically, students have identified lower satisfaction with virtual settings, reporting drawbacks such as nonsynchronous interaction and lower quality instructor engagement though it has been observed that students also conclude the experience is ultimately similar to in-person courses.^{12,18,21} More study in this area is warranted as there is limited literature regarding how long-term virtually delivered courses effects student pharmacists' (or other students') perspectives of the environment and their ability and motivation to succeed in the course.

The third key finding was that students expressed a strong level of agreement that research was an important part of their PharmD education, and also agreed that they were better prepared to conduct research after taking this course. However, this study also found that student pharmacists were unlikely to pursue a career that involved conducting research projects. This phenomenon has previously been reported with student pharmacists in research courses.³ Research benefits student pharmacists by improving skills essential for evidence-based pharmacy

practice and offering competitive experience for desired positions post-graduation.²²⁻²⁴ However, the majority do not foresee themselves actively conducting research, perhaps suggesting they intend to utilize scientific literature but do not intend to actively contribute to it. More research, perhaps using focus groups, is needed to clarify and establish student pharmacists' perspectives of how their research education correlates with their future research needs and plans. With the role of the pharmacist growing increasingly complex, the need for pharmacists to be both creators and critical consumers of research is expanding.²⁵⁻²⁶ As the number of student pharmacists advancing to residency and research becomes more common, it is reasonable for institutions to offer formal research experiences to student pharmacists. Existing literature suggests that research experiences offered to student pharmacists through required or elective courses and projects can benefit both the mentor (usually a faculty member or preceptor) and students.^{3,27-28}

The fourth key finding was that students reported they liked the structure of the course that enabled students to work on their proposal at their own pace and use class time to engage with the instructor, rather than a lecture-style course and needing to ask questions outside of class (items 14 and 15). This resembles the flipped classroom mode of instruction, whereby students had access to course materials to review ahead of class and then utilized most of the class time to employ active learning techniques and work on their research projects at their own pace. This approach also enabled students to work ahead of schedule as desired. In a flipped classroom, students prepare for class by reading and/or watching pre-recorded content, and class time is then devoted to applying new knowledge through interactive activities such as problem solving and discussion.²⁹ Flipped classroom designs are being commonly adopted in health care

education and previous work has suggested that its adoption may be associated with a minor gain in student pharmacist knowledge when compared to lecture based courses.³⁰

This study had some limitations. The necessary assumption inherent to survey-based research is that participants understood and responded accurately to survey items. This study had a small sample size of 54 students from one college of pharmacy, and therefore the findings may not be generalizable to all student pharmacists. The response rate of approximately 40% also limits the representativeness of the findings. This study had no comparison or control group and students had received this course in any other modality (e.g., in-person), thus these findings are based on students' perceptions (subjective) and not any objective data. Future studies using large sample sizes of student pharmacists from multiple schools of pharmacy are needed to improve the external validity of the findings.

CONCLUSION

This cross-sectional observational study found that third-year student pharmacists at The University of [blinded] generally had a positive perception of a virtually delivered research proposal writing course. Students generally liked the design of the course and agreed that it offered them opportunities to develop various skill sets. Student pharmacists perceived they were able to succeed in the course and communicate with the instructor in the virtual setting. Students also perceived research projects were an important part of their pharmacy education and were prepared to conduct a research project after taking the course. However, students typically did not agree that there was no difference in their motivation to succeed in the virtual course versus an in-person course, and reported they were not likely to conduct research in future. These findings provide some evidence to support conducting research projects in the pharmacy curricula and that students perceived it is appropriate to offer a research proposal writing course virtually. However, further research with a larger sample size and student cohorts from other

schools of pharmacy are needed to produce more generalizable findings.

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TABLES AND FIGURES

Table 1. Overview of Course Content and Time Spent on Each Area

Course Content: Topic	Time Spent
Course overview, finding a project and project advisor, reviewing research proposal templates and examples	2 hours
Writing the problem statement, literature review, purpose statement, and specific aims/hypotheses	2 hours
Literature searching	2 hours
Writing the methods section	4 hours
Developing data collection forms and a data dictionary	4 hours
Timeline, budget, & references	2 hours
Human Subjects/IRB	4 hours
Reviewing proposal drafts	4 hours
Preparing for fourth year research project and APPE rotations	6 hours

Abbreviations: IRB=institutional review board; APPE=advanced pharmacy practice experiences

Table 2. Third-Year Student Pharmacist Demographic and Descriptive Characteristics (N=54)

Variable	Result
Male gender, N (%)	21 (38.9)
Had previous research experience before writing the research proposal, N (%)	15 (27.8)
Attend main ([blinded]) campus, N (%)	32 (59.3)
Anticipate holding position conducting research after graduation, N (%)	10 (18.5)
Working independently on research project, N (%)	3 (5.6)
Self-identified videoconferencing experience ^a , Mean (SD)	7.8 (1.7)
Self-identified level of preparation for course ^b , Mean (SD)	6.4 (2.1)

Abbreviations: SD=standard deviation

^a Evaluated with a ten-point scale where 0=not all experienced and 10=extremely experienced

^b Evaluated with a ten-point scale where 0=not all prepared and 10=extremely prepared

Table 3. Third-Year Student Pharmacist's Level of Agreement with Survey Items (N=54)

Item	Survey Statement ^a	Median (IQR)
1	There was no difference in my ability to succeed in this virtual course versus an in-person course.	4.5 (3.0)
2	There was no difference in my motivation to succeed in this virtual course versus an in-person course.	3.5 (3.75)
3	There was no difference in my ability to communicate with the instructor in this virtual course versus an in-person course.	4.5 (3.0)
4	There was no difference in my motivation to communicate with the instructor in this virtual course versus an in-person course.	4.0 (3.0)
5	The virtual workshop design of the course is an innovative teaching strategy.	4.5 (1.75)
6	The virtual workshop design of the course is appropriate for the Doctor of Pharmacy curriculum.	5.0 (1.0)
7	The virtual workshop design of the course aided in the development of my self-directed learning skills.	5.0 (1.0)

8	The virtual workshop design of the course aided in the development of my problem-solving skills.	4.0 (1.0)
9	The virtual workshop design of the course aided in the development of my time management skills.	4.0 (2.0)
10	The virtual workshop design of this course aided in the development of my videoconferencing skills.	4.0 (1.0)
11	Completing a research project is an important part of my Doctor of Pharmacy education.	5.0 (2.0)
12	After taking this course, I am more likely to pursue a career that involves undertaking a research project.	3.0 (2.0)
13	After taking this course, I am better prepared to pursue a career that involves undertaking a research project.	4.0 (2.0)
14	I prefer having the proposal writing instructions and examples at the start of the semester so I can work on the proposal at my own pace rather than having instructions and examples provided as lectures each week in class.	5.5 (2.0)
15	I prefer using class time to discuss any questions I have about my project with the instructor rather than asking questions outside of class or via email.	5.0 (2.75)

Abbreviations: IQR=interquartile range

^a All statements were evaluated on six-point Likert scale where 1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=somewhat agree, 5=agree, 6=strongly agree