INSTRUCTIONAL DESIGN AND ASSESSMENT

Multiple Interprofessional Education Activities Delivered Longitudinally Within a Required Clinical Assessment Course

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Objective. To determine if the incorporation of multiple interprofessional educational (IPE) activities delivered as a longitudinal curriculum within a required clinical assessment course changed pharmacy students' perceptions regarding interprofessional collaboration.

Design. Seventy-one third-year pharmacy students participated in Clinical Assessment, a required applications-based course with a laboratory component. Nine separate IPE activities were embedded into the course longitudinally over the semester using various active-learning strategies and simulated patients. The IPE activities required student participation from medical, nursing, and physician assistant students.

Assessment. Pharmacy students completed an 18-item validated survey instrument, the Interdisciplinary Education Perception Scale (IEPS), on the first (pre-survey) and last (post-survey) day of the course. After completing the course, scores improved on 16 of 18 survey items that measured pharmacy students' perceptions of interprofessional collaboration.

Conclusion. Incorporating multiple IPE activities longitudinally into a required clinical assessment course significantly changed pharmacy students' perceptions of interprofessional collaboration.

Keywords: interprofessional, clinical assessment, perceptions

INTRODUCTION

As medications and healthcare practices have become more advanced, the importance of healthcare professionals working together as a team has increased.[1-4] Through interprofessional education (IPE), in which 2 or more professions learn with, from, and about each other to improve collaboration and quality of care, health professions students can learn about interprofessional team-based care prior to starting their careers.[5] Because of increased recognition of the value of interprofessional collaborative practice, national competencies have been developed in the United States to facilitate the delivery of interprofessional education within an academic curriculum.[1]

The South Carolina College of Pharmacy has incorporated interprofessional activities in a variety of places within its doctor of pharmacy (PharmD) curriculum to fulfill the Accreditation Council for Pharmacy Education (ACPE) standards and the Center for the Advancement of Pharmaceutical Education (CAPE) outcomes.[5,6] At the college's Medical University of South Carolina (MUSC) campus, many of the IPE activities were incorporated into a required clinical assessment course because it allowed implementation of these learning activities longitudinally throughout the semester in the corresponding laboratory component of the course. In addition, students would be exposed to working in an interprofessional healthcare team in a variety of settings and learning environments

Many colleges and schools are determining the best way to deliver IPE to their students in order to achieve learning outcomes, impact perceptions, and change student behavior. Pharmacy education experts suggest creating an IPE curriculum that is sustainable and provides students the opportunity for multiple exposures to interprofessional activities, as compared to a single activity.[7-9] In addition, creating IPE activities immersed in experiential learning that builds in complexity over time has been suggested as a model for success.[8] Limited data regarding the use of active-learning strategies, embedded longitudinally in the curriculum, have demonstrated positive effects on students perceptions of IPE and their ability to work as a healthcare team.[7,10] The Clinical Assessment course used a longitudinal curriculum design as a framework to incorporate a variety of interprofessional activities

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to fulfill the IPE competency domains of (1) values/ethics for interprofessional practice, (2) roles and responsibilities, (3) interprofessional communication, and (4) teams and teamwork.[1] In addition, the curriculum fulfilled ACPE standards 11 and 12 and CAPE outcomes, focusing on interprofessional patient-centered care, delivered using active-learning pedagogies.[5,6] The objective of the study was to determine whether the incorporation of multiple IPE activities, delivered as part of a longitudinal curriculum in a required course, changed pharmacy students' perceptions regarding interprofessional collaboration.

DESIGN

The South Carolina College of Pharmacy offers a traditional 4-year PharmD program delivered to 180 students per class on 3 campuses. Students receive the same curriculum at all campuses via distance education. Laboratory activities are taught separately on each campus and can vary in the delivery methods used. This paper only addresses the IPE activities on the MUSC campus (n=71).

Clinical Assessment, a required 3-credit-hour applications-based course, was offered during the spring semester of the third year of the PharmD curriculum. The course consisted of lectures and weekly laboratory sessions that used active-learning strategies to cover a variety of topics (eg, the 9 IPE activities, physical assessment, medication therapy management, patient counseling). In addition to weekly laboratory sessions, students were required to complete a few assignments outside of class and laboratory time. By the time students enrolled in Clinical Assessment, they had completed 3 semesters of pharmacotherapy courses. In addition, the pharmacy students had participated in a university-wide required Interprofessional Day in the first and second years of the PharmD curriculum to introduce them to the concept of interprofessional collaboration.

Nine IPE activities were integrated into the course: (1) a student team provided care to a simulated patient using a human-patient simulator mannequin during a Code Blue; (2 & 3) a student conveyed clinical information including a pharmacotherapy recommendation to an attending physician in an outpatient clinic setting using SBAR (situation, background, assessment, recommendation) communication technique; (4 & 5) a student conveyed pharmacotherapy recommendations to an attending physician during inpatient rounds; (6) student teams watched a video with basic information including communication techniques from the TeamSTEPPS training program and then applied TeamSTEPPS in simulations using human-patient simulation mannequins; (7 & 8) student teams conducted a two-part hybrid simulation that used a human-patient simulator mannequin and a standardized patient. In Part 1, student teams provided acute care to an unstable patient. In Part 2, student teams developed a transition of care plan for hospital discharge and communicated this plan to the patient; and (9) Student teams participated in a home-visit to a senior mentor (geriatric patient) to interview the patient and conduct a medication assessment. Additional logistical information is provided in Table 1. an in-depth description and assessment of each IPE activity and the associated student learning outcomes is not reported in this paper as many of the activities have been previously described in the literature.[11-13] All of the activities were either newly developed or offered as a uniprofessional activity during previous semesters and modified to be interprofessional activities for this course. During these activities, pharmacy students worked with medicine, nursing, and/or physician assistant students. The other interprofessional learners were selected based on the clinical needs of the scenario and schedule availability. The students applied IPE competencies using experiential learning in a variety of clinical settings including workshops, simulations, and patient visits. All of the IPE activities were required for students to complete the course, but they were not graded on performance. Students received pass/fail credit based on participation. The activities were developed for application of IPE competencies using a formative assessment method. Students received written or verbal feedback, often via a formal debriefing session.

The overall time for students to complete the IPE activities varied. Some activities were as brief as 20 minutes while others lasted as long as 3 hours. Most of the activities were held during scheduled laboratory time and students did not have much preparatory work outside of class. Information about the activities that required students to complete a component outside of classroom or laboratory time was provided in the syllabus on the first day of the course.

EVALUATION AND ASESSMENT

Changes in pharmacy students' perceptions regarding interprofessional collaboration were assessed using a survey instrument that was administered before and after the course. The Interdisciplinary Education Perception Scale (IEPS) is a validated instrument containing 18 Likert-scale items (1=strongly disagree to 5=strongly agree) that evaluate 4 subfactors: (1) competence and autonomy, (2) perceived need for cooperation, (3) perception of actual cooperation, and (4) understanding of others' value.[14] The survey instrument was administered on the first day (pre-survey) and last day (post-survey) of the course. All pharmacy students enrolled in the course were asked to voluntarily and anonymously complete the survey instrument.

Table 1. Interprofessional Education Learning Activities Embedded Longitudinally Within a Clinical Assessment Course

Learning Activity Name	IPEC Competency Domain	Interprofessional Learners Involved	Logistics of Learning Activity
Code Blue Simulation	Interprofessional Communication; Teams and Teamwork	Physician assistant students	February: 1-hour simulation/debriefing during laboratory session
Standardized Colleague Outpatient SBAR[a] Simulation #1 and #2	Interprofessional Communication	Standardized colleague portrayed role of an attending physician[b]	January and February: 2 separate simulations; 20-minute simulation/ debriefing during laboratory session
Standardized Colleague Inpatient Rounds Simulation#1 and #2	Interprofessional Communication	Standardized colleague portrayed role of an attending physician	February and March: 2 separate simulations; 60-minute simulation/ debriefing during laboratory session
TeamSTEPPS[c] Workshop	Values/Ethics for Interprofessional Collaboration; Interprofessional Communication; Teams and Teamwork	Medical, nursing, physician assistant students	April: 3-hour workshop including simulation/ debriefing during didactic lecture period and required some outside of classroom time
Simulated Interprofessional Rounding Experience #1 and #2	Roles and Responsibilities; Interprofessional Communication; Teams and Teamwork	Nursing, medicine, physician assistant students	April: 2 separate simulations 1 week apart; 2-hour simulation/ debriefing during laboratory session
Senior Mentor Geriatric Medication Assessment	Values/Ethics for Interprofessional Collaboration; Roles and Responsibilities; Interprofessional Communication	Medicine students	April: 2 hours for home-visit and debrief session; home-visit is outside of class time and debrief session during lecture period

[a] SBAR= situation, background, assessment, recommendation/request; a team communication technique.
[b] Standardized colleague= an actor or faculty member (in our case a pharmacy faculty member) portrays the role of a healthcare team member during a simulation.
[c] TeamSTEPPS=a teamwork system designed for healthcare professionals to provide safe and quality patient care

Each student was provided a unique code to place on their survey instrument to allow the investigators to match pre-survey and post-survey responses. This IEPS survey was only administered to pharmacy students.

Statistical analyses were performed using SAS, v9.2 (SAS Institute Inc., Cary, NC). Demographic data were analyzed using descriptive statistics. Pre- and post-survey results were analyzed using the 2-sided Wilcoxon signed rank test. The university's Institutional Review Board approved this study.

All third-year pharmacy students (n=71) completed the interprofessional activities throughout the year. Sixty-three pharmacy students (88%) completed both the pre- and post-survey instrument. The cohort consisted of 52% male and 48% female students with a mean age of 25 years. The demographic data were representative of the entire class.

After completing the longitudinal interprofessional curriculum, pharmacy students' responses regarding their perceptions of interprofessional collaboration improved on 16 of 18 questions ($p<0.05$). Mean responses for the remaining 2 items did not change; however, they were positive (based on a median Likert scale response of 4 or 5) before and after the interprofessional activities (Table 2). The results were consistent for all 4 subfactors of the IEPS survey instrument. The greatest positive changes in perceptions were observed in subfactor 1, which evaluated competence and autonomy. The following 2 survey items had the largest change in response: (1) "individuals in other professions respect pharmacists," and (2) "individuals in

Table 2. Pharmacy Students' Perceptions Toward Interprofessional Collaboration Before and After a Required Course That Used Longitudinal Curriculum to Deliver Interprofessional Education

Questions	Presurvey, Mean[a] (SD)	Presurvey, Median[a]	Postsurvey, Mean[a] (SD)	Postsurvey Median[a]	*P*
Individuals in my profession are well-trained.	4.3 (0.8)	4	4.6 (0.5)	5	<0.001
Individuals in my profession are able to work closely with individuals in other professions.	4.2 (0.7)	4	4.6 (0.5)	5	<0.001
Individuals in my profession demonstrate a great deal of autonomy.	3.9 (0.9)	4	4.1 (0.8)	4	0.035
Individuals in other professions respect the work done by my profession.	3.4 (1.0)	4	4.1 (0.7)	4	<0.001
Individuals in my profession are very positive about their goals and objectives.	3.8 (0.9)	4	4.3 (0.6)	4	<0.001
Individuals in my profession need to cooperate with other professions.	4.8 (0.5)	5	4.7 (0.5)	5	0.83
Individuals in my profession are very positive about their contributions and accomplishments.	3.9 (0.9)	4	4.4 (0.7)	5	<0.001
Individuals in my profession must depend upon the work of people in other professions.	4.5 (0.6)	5	4.3 (0.8)	4	0.014
Individuals in other professions think highly of my profession.	3.4 (0.9)	4	4.0 (0.7)	4	<0.001
Individuals in my profession trust each other's professional judgment.	3.9 (0.8)	4	4.2 (0.7)	4	0.002
Individuals in my profession have a higher status than individuals in other professions.	2.9 (0.9)	3	3.3 (1.0)	3	0.041
Individuals in my profession make every effort to understand the capabilities and contributions of other professions.	3.5 (1.0)	4	4.1 (0.8)	4	<0.001
Individuals in my profession are extremely competent.	3.9 (0.9)	4	4.3 (0.7)	4	<0.001
Individuals in my profession are willing to share information and resources with other professionals.	4.5 (0.7)	5	4.7 (0.5)	5	0.16
Individuals in my profession have good relations with people in other professions.	4.1 (0.7)	4	4.4 (0.7)	5	0.004
Individuals in my profession think highly of other related professions.	4.1 (0.8)	4	4.4 (0.7)	4	0.003
Individuals in my profession work well with each other.	4.1 (0.8)	4	4.5 (0.5)	5	<0.001
Individuals in other professions often seek the advice of people in my profession.	4.0 (0.8)	4	4.5 (0.7)	5	<0.001

[a] Responses rated on Likert scale ranging from 1= strongly disagree to 5 = strong agree.

my profession are positive about their goals and objectives." The mean improvement on both items was 0.61 (Table 2).

Faculty time for developing the IPE activities was extensive. Some of the learning activities were adapted from existing assignments to make them interprofessional, which saved time; however, many of the activities had to be created and piloted prior to implementing them in the course. Additionally, creation of some of these IPE activities required collaboration with faculty members from other colleges. An estimated 160 hours of faculty time was needed to develop all of the IPE activities. The number of faculty facilitators needed for each activity varied; on average, faculty members volunteered to help on 3 activity days, which translated into 9 hours of their time for the semester. Some of the IPE activities used simulations that included human-patient simulator mannequins or standardized patients or colleagues. For the majority of standardized patient/colleague activities, a faculty member portrayed the role of the patient/colleague instead of paying an actor in order to decrease costs. Use of the human-patient simulators was free because the simulation center on the MUSC campus is an "interprofessional space."

DISCUSSION

Incorporating multiple IPE activities longitudinally within a required course resulted in a significant improvement in pharmacy students' perceptions regarding interprofessional collaboration. The IPE activities fulfilled pharmacy accreditation standards and provided opportunities for students to apply all 4 US IPE competency domains.[1,6] These IPE activities embedded in a required

course exposed all of the health professions students who participated to IPE and positively affected their perceptions of interprofessional collaboration.

Exposing students to multiple examples of interprofessional collaboration in classroom and experiential settings has a greater impact on knowledge, skills, and attitudes than providing a single isolated IPE experience.[8,9] However, limited assessment data exist and more models of best practice, such as this study, are warranted. A consistent approach to interprofessional education curriculum design, specifically how to deliver IPE, does not exist. Literature regarding interprofessional collaboration, including pharmacy students, has reported mixed results on students' perceptions.[15-18] However, most of these studies assessed a single or short activity, a voluntary experience, or an elective class that only influenced a small cohort of students.

This study contributes to the literature in many ways. Embedding multiple IPE activities delivered as a longitudinal curriculum into a required course could be used as an instructional design model for delivery of IPE for other institutions. This design was effective and addressed many of the challenges of delivering interprofessional education, such as building multiple opportunities and requiring all students to participate rather than requiring a single IPE experience or offering IPE as a voluntary or elective activity. When developing the multiple IPE activities, a variety of experiential learning scenarios that used different clinical settings and instructional methods were created for students to apply IPE concepts and sustain these over an entire semester. The students were exposed to these interprofessional learning activities at least once per month during the semester, and for each experience they received formative feedback and reflected on interprofessional collaboration. Based on the experience and feedback received, these multiple exposures within the longitudinal curriculum allowed students to improve and build on the IPE concepts learned during the next IPE activity.

This study went beyond simple description and used a psychometrically validated survey instrument to assess the impact of IPE on student perceptions.[13] A large sample of students completed this survey instrument, with a good response rate (greater than 80%) that was representative of the entire class.

This study had some limitations. While student scores on the majority of survey items did improve significantly, the educational significance of these improvements may be debated. For example, moving from a median score of a 4 to a 5 on a Likert scale is significant, but does that indicate the activities had a meaningful impact on the student? Combining the quantitative data with qualitative data from focus groups could have addressed this limitation. Our study demonstrated that students already had positive perceptions (based on pre-survey median responses of 4 or 5); therefore, seeing dramatic increases in perceptions was not possible. In addition, student perceptions about interprofessional collaboration were measured; however, it is not known if this improved perception of interprofessional work will translate to behavior changes or improved outcomes for patients in the future. The activities that used standardized colleagues introduced students to the interprofessional communication tools needed to interact with physicians; however, the experience cannot be viewed as a purely interprofessional activity because the faculty members portraying the standardized colleagues were pharmacists. Other colleges and schools of pharmacy should carefully consider the resources needed to implement some of the IPE activities and to create activities that most effectively use the resources specific to that institution. Finally, this study does not prove that embedding multiple IPE activities longitudinally in a required course is a superior approach to interprofessional curriculum design. This study served as one best-practice example that successfully impacted student perceptions and could be used as a model for how to effectively deliver IPE. Future research using a different methodological approach with either a crossover or controlled study design should be considered to determine the best method for delivering IPE.

The IPE activities have continued to be embedded longitudinally within the required course. The individual IPE activities have been refined, but all remain the same in terms of concept and design. An additional IPE activity using the standardized colleague inpatient instructional design has been developed and will be incorporated into the course, which will increase the number of IPE activities from 9 to 10. Finally, improved faculty development is planned to provide facilitators within the course with better information regarding interprofessional collaboration, to improve their formative feedback and debriefing sessions with the students. Other colleges and schools of pharmacy could consider implementing multiple IPE activities delivered as a longitudinal curriculum within a required course to help fulfill ACPE standards and US IPE competencies, but should also consider the amount of resources that are required.

SUMMARY

Embedding multiple IPE activities within a required clinical assessment course and introducing/conducting them longitudinally throughout the curriculum significantly affected pharmacy students' perceptions about interprofessional collaboration. Use of a longitudinal curriculum design to expose students to multiple and sustained interprofessional activities was a successful educational model

for IPE. Other colleges and schools could consider implementing a similar curriculum to fulfill pharmacy accreditation standards and national interprofessional competencies.

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