BRIEF

An Innovation Sprint to Promote Problem-solving and Interprofessional Skills Among Pharmacy and Public Health Students

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Objective. Innovation sprints are a novel pedagogy where small groups of students find creative solutions to problems. The purpose of this study was to extend our understanding of innovation sprint pedagogical design by investigating the impact of an innovation sprint on pharmacy (PharmD) and public health (MPH) students' interprofessional (IP) collaboration and problem-solving skills. We hypothesized that the innovation sprint would increase student self-efficacy and that IP collaborative behaviors would be demonstrated by individuals on a team.

Methods. MPH and professional year 3 PharmD students were assigned to teams and participated in a required two-hour innovation sprint. Faculty observed student teams and evaluated their IP collaboration skills using a rubric modeled after the Modified McMaster-Ottawa scale. Students completed a post-program survey assessing their IP collaborative behaviors and attitudes toward the innovation sprint.

Results. Of the 133 students participating in the innovation sprint, 127 completed the post-program survey (response rate=95%). Faculty determined 123 students (92%) met the IP collaboration competencies. The mean interprofessional collaborative competencies attainment survey scores increased for both PharmD and MPH students. Qualitative analyses highlighted themes of IP collaboration and problem-solving skills that students valued. Overall, students enjoyed working with each other and engaging in creative problem-solving.

Conclusion. An IP innovation sprint involving PharmD and MPH students demonstrated a positive impact on student self-assessed IP collaboration and problem-solving skills. Further, faculty observed a high rate of IP behaviors within student teams. Based on these findings, an innovation sprint may be an effective pedagogical tool to enhance students' skills in these areas.

Keywords: interprofessional education, innovation sprint, problem-solving, teamwork, collaboration

INTRODUCTION

Innovation is a key outcome of personal and professional development within pharmacy curricula,^{1,2} and thus Schools and Colleges of pharmacy are tasked with fostering creative thinking and problem-solving skills. The required and recommended elements of pharmacy education are extensive and time to nurture these skills is limited.^{3,4} Additionally, opportunities for interdisciplinary problem-solving may be lacking.⁵ Therefore, collaboration with other health professions enhance pharmacy students' problem-solving skills while also developing interprofessional (IP) skills like communication and teamwork.

Innovation sprints are a novel pedagogy where small, diverse groups of students find creative solutions to problems.⁶ Innovation sprints are modeled after "hackathons," which are 24-hour to week-long events originally developed to solve technological issues, now seen as a way to accelerate innovation in pharmacy.⁵ Innovation sprints typically follow a sequence of events including orientation to the problem, brainstorming, and culminating with a solution or "pitch." The pitch presentation is delivered to experts in the field who provide feedback. Innovation sprints can be an opportunity for students to practice problem-solving, teamwork, and communication skills.

Innovation sprints could benefit students of pharmacy and other health professions in several ways. They encourage problem-solving, innovation, entrepreneurship, interprofessionalism and teamwork, fulfilling the American Council of Pharmacy Education (ACPE) Standards and Center for the Advancement of Pharmacy Education (CAPE) Outcomes.^{1,2} Additionally, innovation sprints could be a novel approach to IP education (IPE). IPE is a requirement of

most health professions curricula and should include experiences ensuring health professions students graduate proficient in Interprofessional Education Collaborative (IPEC) core competencies.^{7,8}

The University at Buffalo School of Pharmacy and Pharmaceutical Sciences partnered with the School of Public Health and Health Professions and University Libraries to design an IP innovation sprint for Doctor of Pharmacy (PharmD) and Master of Public Health (MPH) students. The purpose of this study was to investigate the impact of an innovation sprint on students' IP collaboration and problem-solving skills. We hypothesized that the innovation sprint would enhance student self-assessed IP and problem-solving skills, and students would demonstrate IP collaborative behaviors to faculty observers.

METHODS

The IRB determined this study as exempt. Year 3 PharmD and MPH students were required to participate in the innovation sprint for course credit during Fall 2020. Students were organized into teams of three PharmD students and one MPH student. The following challenge statement was provided: "How might we increase medication adherence among low-income patients?" Prior to the activity, students watched a video introducing the innovation sprint (4 minutes), explored the library guide (20 minutes), and watched a video on creative problem-solving (4 minutes). The library guide was prepared by a health sciences librarian (MZ) as an online repository of references on medication adherence and preparing a pitch presentation.

Teams were scheduled for a one-time, 120-minute virtual meeting in the evening. The agenda is outlined in Table 1. During the final 30-minutes, students worked on pitch presentations in a separate virtual meeting room and recorded the session. Teams submitted the recording to faculty, who evaluated their interprofessional skills using a based on the Modified McMaster-Ottawa scale. This instrument was developed to assess individual student performance on a team within an IP experience, using a yes/no scale.⁹ The rubric assessed four areas based on the IPE competency domains: values and ethics, roles and responsibilities, communication, and teamwork.^{7,8} Students were deemed to have met all domains if faculty recorded yes to each competency area.

Students completed a post-program survey after the experience. The survey consisted of 39 items including: five demographic questions, the IP Collaborative Competency Attainment Survey (ICCAS), seven retrospective pre- and post-rating questions related to the affective domain (ACPE Standards 3 and 4), and seven questions evaluating the program. A previous study has validated the use of ICCAS and demonstrated that the use of the retrospective design does not subject it to social desirability or response shift bias.¹⁰

The ICCAS is a 20-item, seven-point Likert scale instrument developed to self-assess IP collaborative behaviors based on established IP competencies in six domains: communication, collaboration, roles and responsibilities, collaborative patient/family-centered approach, conflict management/resolution, and team functioning.¹¹ The reliability and validity of the instrument has been examined and supports using the instrument for measuring self-report retrospective pre- and post- IP education intervention competency attainment.^{12,13} In addition, the researchers developed seven items related to the affective domain (ACPE Standards 3 and 4) which used the retrospective pre- and post-experience rating and seven-point Likert identical to the ICCAS. The items were worded to reflect the intention of the outcomes in ACPE Standards 3 and 4 but avoided profession-specific language. The wording of these items was reviewed and approved by MPH faculty (JK). Two optional open-ended questions were asked: "What did you enjoy about the innovation sprint?" and "What would you change about the innovation sprint?"

The pre- and post-program ICCAS domain score, affective domain item score and total affective domain scale score for each student were reported as means. Use of the mean of the items, as opposed to the summated score, makes the scores easier to interpret.¹³ The mean and standard deviation (SD) pre- and post-experience scores, along with the mean and SD of the differences were examined by student group (ie, PharmD and MPH).

Paired sample t tests were conducted to examine differences between pre- and post-experience scores. The Cohen's d effect size was computed for each comparison.¹⁴ Paired sample t-tests were conducted separately for each student group because preliminary analyses suggested that the two student groups differed on many of the variables examined. Reliability was estimated for scale scores using Cronbach α . Ideally, Cronbach α reliabilities of 0.90 or above are desired but not below 0.70, which indicates that the items may not be measuring the same underlying construct.¹⁵ All statistical analyses were conducted using SPSS Statistics 24 (IBM Corp., Armonk, NY).

There were five questions evaluating the overall program, using a five-point Likert scale (1=strongly disagree to 5=strongly agree). The frequencies, percentages, means, and standard deviations were calculated for each item. A thematic analysis approach was used.¹⁶ Two authors established themes based on a subset of responses. Then the two authors independently reviewed the open-ended responses and coded based on the themes, adding additional themes of needed; discrepancies in codes were discussed until agreement was reached. The number and percent of responses coded for each theme was computed. Specific comments were presented as examples.

RESULTS

A total of 133 students participated in the innovation sprint, with 127 students completing the post-program survey (response rate=95%). More MPH students (40%) had previously participated in an innovation sprint compared to PharmD students (1%) ($p<.001$). More PharmD students (100%) had completed at least one required IPE experience in their professional training compared to MPH students (57%, $p<.001$).

A total of 123 (92%) students met all core competency domains. Of the 10 (8%) students, all PharmD students did not meet all the core competency domains, most (7 of 10) did not contribute to their group's work except for speaking briefly during the final pitch presentation. The remaining (3 of 10) did not speak at all.

Comparisons of pre- and post-experience ICCAS scores are summarized in Table 2. The overall trend in mean ICCAS score increases were from a mean corresponding to "slightly agree" at pre- to a mean corresponding to "moderately agree" at the post-test. Similarly, prior to the innovation sprint, all students responded that they "slightly agree" they displayed behaviors related to the affective domain (Table 2). The overall trend in score increases were from a mean corresponding to "slightly agree" at pre- to a mean corresponding to "moderately agree" at the post-test. The Cronbach α at pre-experience were 0.95 and 0.90 and at post-experience was 0.98 and 0.87 for PharmD and MPH students, indicating high reliability.

The items evaluating the innovation sprint experience are summarized in Table 3a. Mean total scale scores (out of 5) for PharmD ($M=4.0$ $SD=1.1$) and MPH ($M=4.1$ $SD=0.9$) students' evaluation of the innovation sprint experience were high. The themes derived from open-ended programmatic evaluation questions are summarized in Table 3b. Overall, students enjoyed working with students from other professions and engaging in creative problem-solving. Opportunities to improve the learning experience centered around organization, duration of experience, and adding more professions.

DISCUSSION

An IP innovation sprint involving PharmD and MPH students positively impacted students' self-assessed IP collaboration and problem-solving skills. A high percentage of students demonstrated IP collaborative behaviors as evaluated by faculty. Additionally, students rated the experience highly and qualitative analyses further support the themes of IP teamwork, communication, and problem-solving. Based on these findings, an innovation sprint may be an effective pedagogical tool to enhance students' IP collaboration and problem-solving skills.

Fostering innovation and entrepreneurship in pharmacy education can be challenging.^{3,4} Schools and colleges of pharmacy have diverse approaches to addressing ACPE Standards 3 and 4. Students may be exposed to these concepts through student professional organizations,^{17,18} elective courses,¹⁹ or co-curricular activities.²⁰ Mogul et al. reported on a co-curricular activity, modeled after the popular television series *SharkTank*.²⁰ Students ($n=38$) were assigned teams and tasked with developing a solution (or pitch) to a pharmacy services related problem. Faculty evaluated students using a standardized rubric and students completed a pre- and post-program survey. The authors found that students performed better in more basic areas of the challenge and performed worse with higher-level activities.²⁰ These findings are important in understanding where students may need additional training or guidance within the problem-solving process. Our data complement these results with a larger sample of students from multiple professional programs. Additionally, we analyzed two other important sources of data: student self-assessed demonstration of IP competencies through the ICCAS instrument and, faculty assessment of individual student performance on the team using the Modified McMaster-Ottawa Scale. Our data revealed that students' self-efficacy as it relates to interprofessional skills increased, and a high percentage of students demonstrated interprofessional behaviors in all core competency domain areas. Of note, the magnitude of effect was primarily small across almost all measures for PharmD students but primarily large for MPH students. This is most likely due to more pharmacy students having participated in required IPE experiences and, pharmacy students having more exposure to experiential education due to the timing of their field training.

The structure of the innovation sprint closely models the process of "design thinking" which has recently been advocated for to promote creative problem-solving in schools and colleges of pharmacy.²¹ The "design thinking" process includes three phases: inspiration, ideation, and implementation. During the innovation sprint, student teams were provided with a challenge statement (inspiration), guided through the creative problem-solving process (ideation), and created their final pitch or solution (implementation). Our data indicate that the innovation sprint had positive effect on students' attitudes related to creative problem-solving and may be a pedagogical tool that mirrors "design thinking."

Study strengths included a large sample size, use of validated instruments, and a concrete exercise that links to both the affective domain of ACPE Standards and IP collaboration core competencies. Study limitations included the one-time activity with one cohort of students. Results could differ with a different challenge statement or other professional students. The innovation sprint was hosted virtually, and it is unclear if findings would be similar if the event was hosted in-person. Although an advantage of the ICCAS instrument is its retrospective pre/post design, this design may introduce

recall and social desirability bias.²² Additionally, at pre-experience both PharmD and MPH students rated themselves highly (mean >5 on a 7-point scale) using the ICCAS, which is not uncommon among IPE evaluation instruments but can affect the magnitude of change observed.²² Violato et al. noted that this effect size could be due to overconfidence on the students part or a student's lack of baseline knowledge.²³ In future innovation sprints, the timeframe could be increased, along with the number of professions. Students are familiar with virtual meeting platforms, yet there may be an element of fatigue with this technology, especially when sessions run late into the evening.

CONCLUSION

An IP innovation sprint involving PharmD and MPH students demonstrated a positive impact on student self-assessed IP collaboration and problem-solving skills. Further, faculty observed a high rate of IP behaviors within student teams. An innovation sprint may be an effective pedagogical tool to enhance students' skills in these areas.

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Table 1. Agenda for Interprofessional Innovation Sprint with Pharmacy and Public Health Students

Agenda Item	Description	Time (min)
Welcome	Plenary	5
Background / Setting the Stage	Plenary	10
Overview of Creative Problem-Solving Process	Plenary	15
Ideate, Vote, Build Consensus	Breakout	15
Introduction to Convergent Tool	Plenary	5
Teams Complete Convergent Tool	Breakout	30
Introduction to Pitch Deck	Plenary	5
Teams Complete Pitch Deck	Breakout	30

Table 2. Comparison of Pre- and Post-Innovation Sprint Interprofessional Collaborative Competency Attainment Scale (ICCAS) Scores for and Items Related to the Affective Domain PharmD (n=97) and MPH (n=30) Students

	Pre M (SD)	Post M (SD)	Difference M (SD) ^c	p	Cohen's d	Magnitude of Effect ^d
ICCAS Subscales						
Communication ^a						
PharmD (pre $\alpha=.93$, post $\alpha=.96$)	5.5 (0.9)	5.9 (1.1)	0.4 (0.8)	<.001*	0.51	medium
MPH (pre $\alpha=.80$, post $\alpha=.87$)	5.5 (0.8)	6.2 (0.6)	0.7 (0.7)	<.001	1.02	large
Collaboration ^a						
PharmD (pre $\alpha=.86$, post $\alpha=.93$)	5.4 (0.9)	5.9 (1.1)	0.5 (0.9)	<.001*	0.52	medium
MPH (pre $\alpha=.85$, post $\alpha=.81$)	5.4 (1.0)	6.1 (0.8)	0.7 (0.8)	<.001*	0.91	large
Roles and Responsibilities ^a						
PharmD (pre $\alpha=.91$, post $\alpha=.95$)	5.5 (0.9)	5.9 (1.1)	0.4 (0.9)	<.001*	0.43	small
MPH (pre $\alpha=.81$, post $\alpha=.81$)	5.7 (0.8)	6.3 (0.6)	0.6 (0.6)	<.001	1.01	large
Collaborative Patient/Family-Centered Approach ^a						
PharmD (pre $\alpha=.90$, post $\alpha=.90$)	5.5 (0.9)	5.8 (1.1)	0.3 (0.8)	<.001*	0.41	small
MPH (pre $\alpha=.81$, post $\alpha=.85$)	5.2 (1.1)	6.1 (0.7)	0.9 (0.8)	<.001*	1.06	large
Conflict Management/Resolution ^a						
PharmD (pre $\alpha=.90$, post $\alpha=.90$)	5.7 (0.9)	5.9 (1.2)	0.3 (0.9)	.008*	0.28	small
MPH (pre $\alpha=.80$, post $\alpha=.80$)	5.9 (0.8)	6.3 (0.8)	0.5 (0.6)	<.001*	0.75	medium
Team Functioning ^a						
PharmD (pre $\alpha=.92$, post $\alpha=.97$)	5.5 (1.0)	5.9 (1.2)	0.3 (1.1)	.002*	0.32	small
MPH (pre $\alpha=.87$, post $\alpha=.90$)	5.6 (0.9)	6.3 (0.7)	0.7 (0.8)	<.001*	0.85	large
Items Related to the Affective Domain						
Recognize social determinants of health that impact health disparities ^b						
PharmD	5.5 (0.9)	5.9 (1.1)	0.4 (1.1)	.001*	0.35	small
MPH	6.2 (0.8)	6.7 (0.5)	0.5 (0.6)	<.001*	0.74	medium
Describe how population-based care influences patient-centered care ^b						
PharmD	5.5 (1.0)	5.9 (1.1)	0.4 (1.1)	.001*	0.35	small
MPH	6.0 (1.0)	6.5 (0.8)	0.5 (0.6)	<.001*	0.74	medium
Identify problems ^b						
PharmD	5.6 (1.1)	5.9 (1.2)	0.4 (1.1)	.002*	0.32	small
MPH	6.2 (0.8)	6.6 (0.6)	0.5 (0.7)	.001*	0.69	medium
Explore and prioritize potential strategies to address a problem ^b						
PharmD	5.6 (1.0)	5.9 (1.1)	0.4 (1.1)	.001*	0.34	small
MPH	5.8 (1.0)	6.4 (0.9)	0.6 (0.7)	<.001*	0.84	large
Design a viable solution to a problem ^b						
PharmD	5.5 (1.0)	5.9 (1.1)	0.4 (1.1)	<.001*	0.37	small

MPH	5.6 (1.1)	6.2 (0.8)	0.5 (0.6)	<.001*	0.85	large
Demonstrate responsibility for creating and achieving shared goals ^b						
PharmD	5.6 (1.0)	5.9 (1.1)	0.3 (1.0)	.006*	0.28	small
MPH	5.9 (1.0)	6.5 (0.6)	0.6 (0.7)	<.001*	0.78	large
Engage in innovative activities by using creative thinking to envision better ways of accomplishing professional goals ^b						
PharmD	5.5 (1.0)	5.8 (1.2)	0.3 (1.1)	.008*	0.27	small
MPH	5.5 (1.1)	6.3 (0.9)	0.8 (0.9)	<.001*	0.90	large
Total affective domain scale score ^a						
PharmD (pre α =0.95, post α =0.98)	5.5 (0.9)	5.9 (1.1)	0.4 (1.0)	.001*	0.36	small
MPH (pre α =0.90, post α =0.87)	5.9 (0.8)	6.4 (0.5)	0.6 (0.5)	<.001*	1.08	large

^a The scale scores are based on a seven-point rating system and are the mean of the responses to the items; 1=strongly disagree, 2=moderately disagree, 3=slightly disagree, 4=neutral, 5=slightly agree, 6=moderately agree, 7=strongly agree

^b The scores are based on a seven-point rating system and are the mean of the responses to the items; 1=strongly disagree, 2=moderately disagree, 3=slightly disagree, 4=neutral, 5=slightly agree, 6=moderately agree, 7=strongly agree

^c Paired sample t-test was used to determine significance, defined as $p < .05$ between pre and post results. Statistically significant results are denoted with *

^d $d < 0.2$ is considered a very small effect size; d between 0.2 and 0.5 is considered small, d between 0.5 and 0.8 is considered medium, and $d > 0.8$ is considered large

Table 3. Summary of PharmD (n=97) and MPH (n=30) Students' Evaluation of the Innovation Sprint

3a. Summary of Quantitative Items							
	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly Agree n (%)	Missing n (%)	M (SD)
I think that doing this activity was useful for development of attributes of teamwork (e.g., communication, commitment, sharing ideas, responsibility).							
PharmD	5 (5.2)	1 (1.0)	15 (15.5)	29 (29.9)	47 (48.5)	0 (0.0)	4.15 (1.06)
MPH	0 (0.0)	2 (6.7)	5 (16.7)	8 (26.7)	15 (50.0)	0 (0.0)	4.20 (0.96)
I would recommend this activity for other students							
PharmD	6 (6.2)	4 (4.1)	17 (17.5)	30 (30.9)	40 (41.2)	0 (0.0)	3.97 (1.15)
MPH	1 (3.3)	2 (6.7)	7 (23.3)	8 (26.7)	12 (40.0)	0 (0.0)	3.93 (1.11)
This experience added value to my professional development							
PharmD	6 (6.2)	5 (5.2)	17 (17.5)	28 (28.9)	40 (41.2)	1 (1.0)	3.95 (1.17)
MPH	0 (0.0)	3 (10.0)	8 (26.7)	7 (23.3)	12 (40.0)	0 (0.0)	3.93 (1.05)
The innovation sprint helped me learn about creative problem solving.							
PharmD	7 (7.2)	2 (2.1)	14 (14.4)	33 (34.0)	41 (42.3)	0 (0.0)	4.02 (1.14)
MPH	0 (0.0)	0 (0.0)	7 (23.3)	10 (33.3)	13 (43.3)	0 (0.0)	4.20 (0.80)
This experience helped prepare me to be a future health professional.							
PharmD	6 (6.2)	4 (4.1)	20 (20.6)	26 (26.8)	40 (41.2)	1 (1.0)	3.94 (1.17)
MPH	0 (0.0)	1 (3.3)	4 (13.3)	13 (43.3)	12 (40.0)	0 (0.0)	4.20 (0.80)
3b. Summary of Qualitative Items							
	Theme	PharmD n (%) ^a	MPH n (%) ^a	Sample comments			
What about this learning experience did you enjoy most?	Collaboration	22 (39)	12 (46)	I enjoyed collaborating with other healthcare students and coming up with innovating solutions to real healthcare problems.			
	Interaction with other professions	14 (25)	6 (23)	I enjoyed seeing the public health student's perspective of the problem and solution.			
	Creative problem-solving	11 (20)	5 (19)	I liked the creative problem-solving portion where no idea is a bad idea - it's an effective way to get a lot of ideas to work through and can be applied to a broad range of problems.			
What would improve this learning experience?				Less back and forth between break out rooms. Zoom Fatigue is real.			
	Organization of sprint	17 (30)	4 (16)	Less time spent on brainstorming and more on explaining the assignment.			

Timing of the Sprint:			The scheduled time can be changed because 6-8 pm may not be ideal. (G)
General (G)	G: 3 (5)	G: 4 (16)	It would be better if we could have more time to work through the problem. (L)
Longer (L)	L: 8 (14)	L: 2 (8)	I would keep the duration shorter as people tend to lose concentration around the 45 minutes mark. (S)
Shorter (S)	S: 2 (4)	S: 2 (8)	
Include students from other professions	8 (14)	6 (25)	Perhaps having more students from different healthcare professionals to learn about their perspectives.