






RESEARCH ARTICLE

A multimodal educational approach to non-practice-based pharmacy careers

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Keywords

Career pathway
Elective course
Industry pharmacy
Seminar

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Abstract

Background: Pharmacy students have little exposure to non practice based (NPB) careers. However, their education prepares them for a wide array of NBP career opportunities. This work describes a multimodal approach to exposing students to careers in the pharmacy industry. **Methods:** This study assessed the impact of a multimodal approach to increasing awareness and understanding of NPB pharmacy careers within the PharmD curriculum. Students were surveyed before and after exposure to an elective course titled Pharmacists Roles in Drug Development (PRDD) that included a Value of Industry Pharmacist (VIP) competition and a seminar series about their knowledge, attitudes, and career interests. **Results:** The response rate was 39% (16/41) for students enrolled in the PRDD course and 20% (5/21) for those participating in the VIP competition but not the course. Interest in pursuing a career in industry pharmacy increased significantly after the course ($p=0.018$) from 39% to 56%. Self-perceived knowledge of careers in industry pharmacy increased significantly ($p=0.0003$) after the course. Students were extremely likely (50%), somewhat likely (17%), neutral (28%), or extremely unlikely (5%) to recommend the course to a fellow student. Also, the seminar series contributed to significantly increasing knowledge levels ($p=0.001$), with 20% of students reporting very high or high baseline knowledge that exceeded 60%, indicating very high or high knowledge after the seminar. **Conclusion:** In the current study, students showed a significant increase in interest and knowledge levels in industry pharmacy careers after participating in the course and seminar series, indicating that the methods employed in this multimodal approach were effective in educating students on alternative career pathways and piquing their interest in these pathways.

Introduction

Employment of pharmacists in practice-based careers is projected to have limited growth or decline by an estimated 3% over the next decade, according to the Bureau of Labor and Statistics (U.S. Bureau of Labor Statistics, n.d.). The profession is rapidly reaching a point of labour oversupply with increasing job shortages and wage stagnation within practice-based careers, leading students to explore non-practice-based (NPB) career options (Arya *et al.*, 2020).

At the University of Florida College of Pharmacy (UF COP), a recent student survey and focus group session confirmed that students feel exceptionally well prepared for institution-based pharmacy and adequately prepared for community/retail pharmacy

but inadequately prepared for non-practice-based (NPB) career paths, such as academia or industry. Students reported very little exposure to NPB careers, which is a barrier to learning about and exploring these career options. Similarly, recent reports examining COP curricula have found very little content on NPB careers. Previous findings have shown that pharmacy students have minimal opportunities to explore the biotech and pharmaceutical industries, with less than half of the colleges offering relevant courses (Schmitt *et al.*, 2016). Whenever industry courses are offered, they explore a limited discipline or commercial function, e.g., clinical development (Hartman *et al.*, 2014; Jacob & Peasah, 2019).

Industry provides an environment where pharmacists can apply their scientific and clinical training and

experience. Biotechnology companies continue to fill their talent pipelines with pharmacists, recognising that pharmacists with a Doctor of Pharmacy (PharmD) degree are among the most qualified professionals to contribute to the development, commercialisation, promotion, and optimal use of products ranging from diagnostics to drugs and medical devices. Accordingly, industry post-doctoral fellowships are growing exponentially (Alexander *et al.*, 2021).

The UF COP created a multimodal approach to address a fundamental knowledge gap in industry pharmacy as a potential NPB career path. Two approaches were used to educate and create awareness of this career path: an elective course and a seminar series.

The newly developed elective course (PHA5956 – Pharmacists’ Roles in Drug Development) focused on training students to function within a pharmaceutical company. This elective course taught four key career options related to the drug development process (medical affairs, clinical development, regulatory affairs, and commercial/marketing) through project-based activities that required students to apply critical thinking skills in a self-directed team-based learning environment.

The newly developed seminar series (Seminars in Pharmacy Careers) showcased a variety of career paths for pharmacists. It aimed to raise awareness of the many different NPB career paths and demonstrate how education, experience, and training enable pharmacists to succeed. It presented a wide range of NPB career paths with a focus on industry-related options. Attendees learned how these roles impacted patient lives on a larger scale through new product innovation, access to therapy, and widespread education.

This study aimed to evaluate the impact of this multimodal approach on increasing PharmD students’ awareness and understanding of NPB careers by assessing their knowledge, attitudes, and career interest before and after exposure to the elective course and seminar series.

Methods

Subjects

Pharmacists’ Roles in Drug Development (PRDD) was a one-credit elective class offered at the UF COP during the 2020 fall term. This course was modelled on the Values in Industry Pharmacists (VIP) competition hosted by the Industry Pharmacist Organization (IPhO) (Industry Pharmacist Organization, 2023). The course was available to second and third-year PharmD students. First-year students were allowed to

participate in the VIP competition and audit the course but did not receive elective credit.

The Seminars series was open to students, faculty, and staff and designed to support career pathway planning and advising, respectively. Attendance was voluntary. Students who attended received co-curricular credits if they completed a survey.

PRDD course design

The elective course was developed by faculty members and student leaders and approved by the College Curriculum Committee. It was promoted through local IPhO chapters and presented as the first industrial pharmacy elective for those interested in pursuing a career in industry or seeking to learn about industrial pharmacy. The course included participants from each of the three campuses of the College: Gainesville, Jacksonville, and Orlando.

The course was designed to complement the VIP team competition. For the competition, students self-selected their preferred workgroup (medical affairs, clinical development, regulatory affairs, and commercial/marketing), which consisted of 4-6 members per group. They created a drug development plan and were assigned tasks and objectives directly aligned with the VIP Competition Guide. The course was self-directed, with students completing assignments within their workgroups. Supplementary lectures were provided by the lead instructor, who is the lead author of this manuscript, to facilitate understanding of the pharmacy industry and guide on completing the assignments. Each team had an appointed student leader who liaised with the specific campus IPhO liaison to ensure each objective was addressed. Each workgroup met biweekly to discuss the key competencies of the functional area, how to address each objective, and details of the role of the pharmacist in drug development. Details related to the VIP case competition can be found on the IPhO website (Industry Pharmacist Organization, 2023).

Student evaluation and grading consisted of individual block written reports (30%), individual oral presentations with defence (30%), individual oral presentations of “top concepts” (10%), and group final written project (30%). The course began in September and ended in December. Each workgroup was required to present its drug development plan for the competition at the final presentation component of the course, which included a 30-minute post-presentation defence and a discussion section where team members defended their plan in response to faculty inquiries. Three full-time UF COP faculty and nine guest faculty (2-3 per session) from the pharmaceutical industry participated in this final presentation component.

Students were required to attend all presentations and write two discussion points.

Course design for seminars in pharmacy career

Seminars were scheduled every other week throughout the 16-week spring 2021 term. All presenters were registered pharmacists and graduates of the UF COP. Presentations were ACPE-approved for one hour of pharmacy continuing education credit and structured to provide a broad understanding of pharmacists' roles beyond patient care functions. Key discussion items presented included: (1) functional roles that pharmacists can fill within the industry, (2) examples of how pharmacists transfer science, disease state management and clinical acumen to NPB careers, and (3) how career development occurs.

Survey methods and ethical considerations

A survey was created using Qualtrics to assess students' interest and knowledge related to industry pharmacy roles. The 45-question survey assessed students' pre- and post-interest in the pharmaceutical industry, perceptions of their knowledge of the roles of pharmacists in industry pharmacy careers, and their likely career path. Students who participated in the PRDD elective and VIP competition were surveyed. Participation was anonymous and voluntary. Each participant provided informed consent. The study was approved by the UF Institutional Review Board.

Survey methods for seminars in pharmacy careers

Students completed a survey that included questions evaluating the quality of the seminar content (n=5), the effectiveness of the speakers (n=2), and the impact on students' knowledge of pharmacists' career paths beyond direct patient care (n=4). The survey also evaluated student knowledge and interest in NPB careers before and after the seminar.

Statistical analysis

Demographic data were analysed using parametric descriptive statistics. Questions assessing students' perspectives before and after the VIP course or seminar were converted from Likert scale descriptors to a rank score, with positive valence responses receiving a 5 (very likely) or 4 (somewhat likely) and negative valence responses receiving a 1 (very unlikely) or 2 (somewhat unlikely). The data were statistically analysed using the nonparametric sign rank test.

Results

PRDD

Table I presents the demographics of students who responded to the VIP course survey and seminar survey (n=21).

Table I: PRDD/VIP and Seminar demographics

Item	PRDD/VIP (%)	Seminar (%)
Class year		
1PD	5 (24%)	66 (47%)
2PD	5 (24%)	42 (30%)
3PD	11 (52%)	15 (11%)
4PD	0	17 (12%)
Campus		
Gainesville	6 (29%)	64 (46%)
Orlando	15 (71%)	51 (36%)
Jacksonville	0	26 (19%)
Course enrollment	16 (76%)	
Leadership role	10 (48%)	
Assigned work group		
Medical affairs	4 (19%)	
Clinical research	8 (38%)	
Regulatory affairs	6 (29%)	
Marketing	3 (14%)	
Prior VIP participation	11 (50%)	
Previous industry experience		
None	7 (33%)	
Minimal (talk with industry)	12 (57%)	
Some (1-6 months)	1 (5%)	
Moderate (6-12 months)	0 (0%)	
A lot (> 1 Year)	1 (5%)	

PRDD = Pharmacist role in drug development course

VIP = Value of industry pharmacy competition

The response rate was 39% (16/41) for students enrolled in the PRDD course and 20% (5/21) for those participating in the VIP competition but not the course. The response rate was skewed to the Orlando campus (88%) versus the Gainesville campus, with a 25% (6/24) campus response rate. While 52% of respondents were third-year professional students, the distribution between first and second-year students was equal (first-year students were not eligible for the elective course). Half of the respondents participated in the VIP competition in previous years, and half had a leadership role (functional group leader) in the VIP competition that occurred within this course. There was unequal weight in survey response by the

functional group, where more respondents were from the clinical development (38%) or regulatory affair (29%) groups than the other groups. Most students who responded had minimal or no industry experience.

Before taking the course, 41% of students showed interest in industry pharmacy, while 23% considered hospital/healthcare system pharmacy, and 18% were undecided. After the course, interest in pursuing an industry career increased significantly ($p=0.018$) from 39% before to 56% after the course. Student

knowledge of industry pharmacy before the course was mostly low to moderate; it increased significantly ($p=0.0003$) after the course, ranging from moderate to very high, with no students reporting low or no knowledge. Similarly, knowledge of the various industry pharmacy functions increased significantly after the course, with the highest knowledge change occurring for the medical affairs function (Figure 1). Overall, students preferred the medical affairs function if industry experience is required as part of their education (e.g., APPE) (Figure 2).

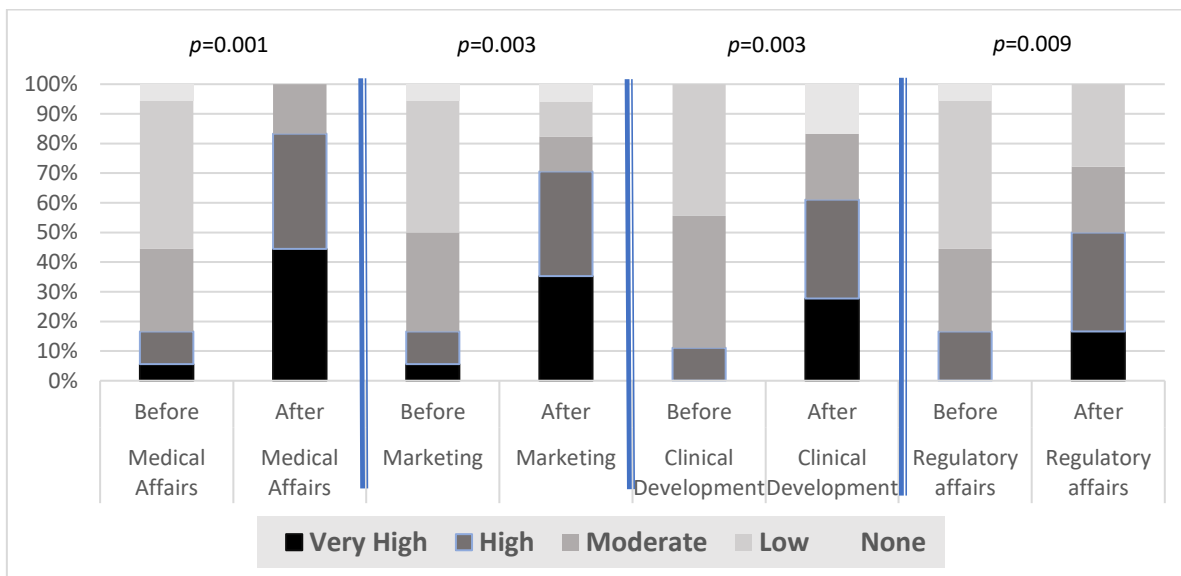


Figure 1: Knowledge level of industry pharmacists' roles and responsibilities before and after completing the VIP course/competition

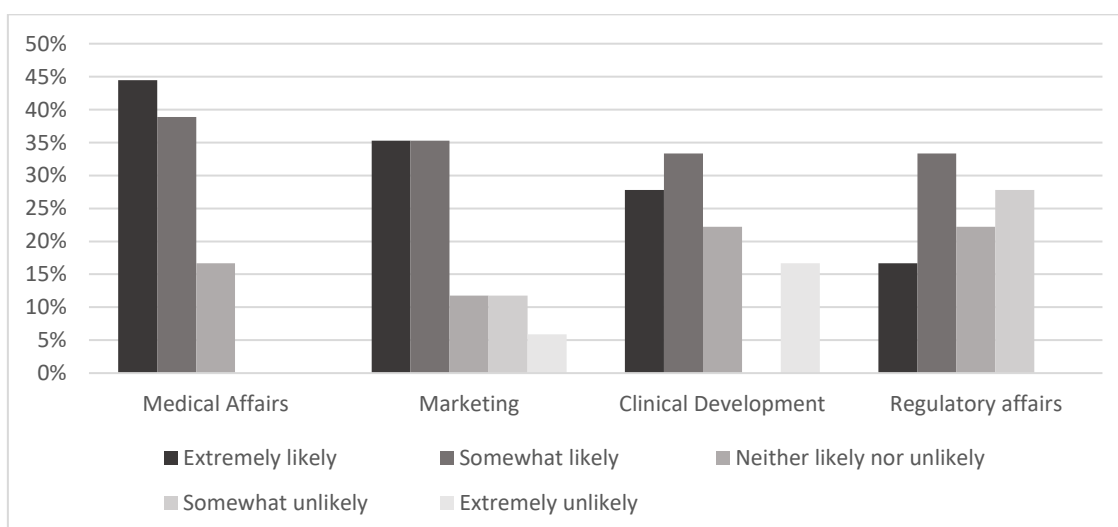


Figure 2: Function role preference after completing the course/competition

According to student feedback, the PharmD curriculum should contain more content related to medical affairs

and clinical development functions and dedicate a small amount of content to the marketing function. The

majority of students agreed (56%) that the course objective statements guided the learning process for the course, while 23% disagreed. Most students were moderately (33%), highly (27%), or very highly (20%) prepared for their final presentation, while 13% stated that they had a very low level of preparedness.

The most highly ranked part of the course was the contribution of the guest faculty, who attended the presentations and provided perspectives, comments, and questions. These sessions also improved students' awareness and interest in industry pharmacy. Over 87% of the students rated the value of the guest faculty as very high, and none rated it as low or very low. Students rated the overall value of the question-answer session

and the feedback from guest faculty as moderate (33% for both) to highly valued (53% and 47%, respectively). They also strongly agreed (78%) that the course would have been more educational if industry experts had been available throughout the course.

Students were extremely likely (50%), somewhat likely (17%), neutral (28%), or extremely unlikely (5%) to recommend the course to a fellow student. Figure 3 illustrates the overall ranking of the course components, most of which were highly rated, with more than 50% receiving high or very high, except for the introduction lecture, written block assignments, final written report, and presentation of top concepts.

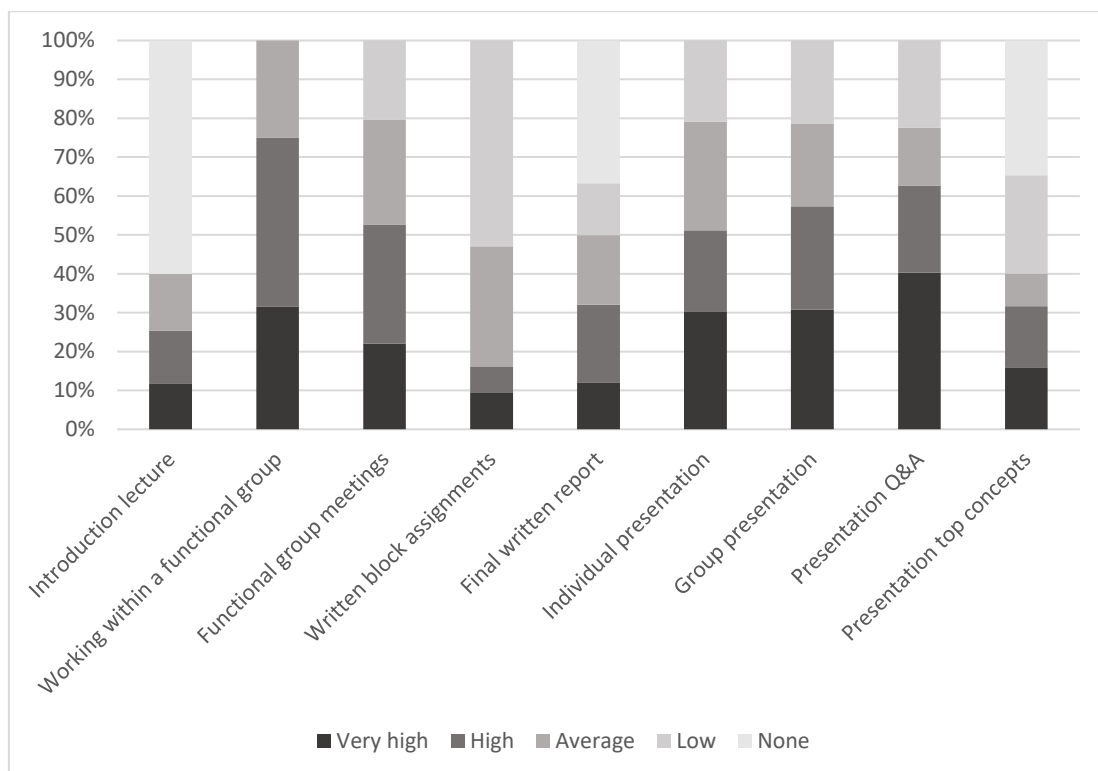


Figure 3: Rating of educational value of each component of the course/competition

Seminar programme

The six seminars were attended by 153 students, with 140 participants (92%) responding to the survey. Non-student attendees numbered 201, with an average of 34 attendees per programme (range = 25-40). The first programme had a low student survey response (N=1) due to communication logistics. The following two programmes represented 75% of the total seminar survey responses (n=72 and 38, respectively). First- and second-year students represented more than 75% of the seminar attendance, while the representation across campuses was equal when normalised to total student count at each campus (Table I).

Overall, student assessment of the seminar objectives was high, with most students strongly agreeing (56-78%) that the seminar objectives were met. Students highly rated the speakers, where overall quality was rated as excellent (84%) or good (15%). Approximately 40% of students were interested or very interested in an industry pharmacy career before the seminars, and none were unlikely or not interested. This interest level was similar for each seminar in the series, with a trend for higher interest for the later seminars. Of note, the results of the first seminar were removed as there was only one respondent. Averaging across all seminars, student interest level in industry pharmacy increased

from 40% before the seminar to 69% after ($p < 0.001$, Figure 4). Before each seminar, knowledge of industrial pharmacy was rated moderate to very low by approximately 80% of respondents for the first seminars. Pre-seminar knowledge levels tended to increase with the latter seminar programmes, with 20% more students reporting that their knowledge was very

high or high. Knowledge ratings were significantly higher after each seminar, with an average change from approximately 20% of students reporting having very high or high knowledge before the seminar to over 60% reporting very high or high knowledge after the seminar ($p = 0.001$; Figure 4).

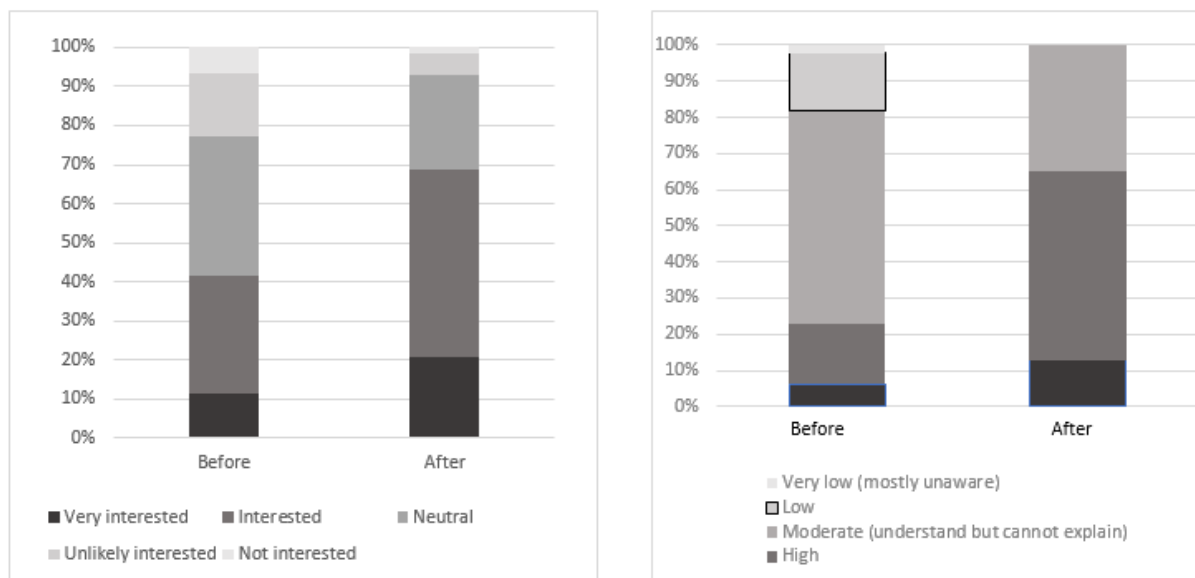


Figure 4: Student ratings regarding industry career interest (left figure) and knowledge before and after attending a seminar (right figure)

Students also provided unsolicited written feedback. Examples include statements regarding the impact of the seminar series on career education: (1) "The seminar exposed me to a "real-life" example of the power behind being open-minded and willing to learn by taking on challenges. A PharmD provides us with a set of skills that include problem-solving. We are only "stuck" in a position if we say we are"; (2) "Each seminar, I learn more and more about untraditional paths to pharmacy. It shows that there are so many options and opportunities in the field, even if you're unsure what you are going to pursue"; (3) "A career in industry is more than just being an MSL." For another student, the seminar series helped them understand how an industry career might not be the best fit: "While I have been enjoying the seminars from individuals who have found career paths in industry, the evidence is mounting that it is not a field I would enjoy."

Discussion

Before developing this multimodal education approach, student focus groups revealed that students

wanted more exposure and education about non-practice-based (NPB) careers. Our college has curricular content covering the drug development process. However, the content is specific to the process (the how) rather than the critical thinking required to develop a product that meets an unmet need (the why). Teaching students why drugs are developed in a particular manner provides a perspective on how a pharmacist can contribute to the process as a career.

The data from the current study highlights the lack of knowledge among students regarding NPB careers in the pharmaceutical industry. Also, students have little knowledge of how a pharmacist can play an intricate role in the pharmaceutical industry. Students reported a much higher interest in industry careers after participating in the elective course and seminar series, indicating that these courses and seminars were effective in increasing career interest and knowledge of pharmacists' roles in industry.

The educational component that provided the highest value was the interaction with guest faculty who had decades of industry experience in one or more functional areas. Equally important was how the guest faculty shared case studies that exemplified specific

drug development problems and how a pharmacist can contribute to solving these issues. The feedback and coaching provided by the guest faculty was more impactful because it had depth and real-world perspective. Faculty who had no industry experience focused on theoretical application rather than real-world experience. In the future, it may be beneficial to incorporate guest faculty throughout the elective course to stimulate interest and provide perspectives on their role in industry.

The findings of this study are consistent with previous reports assessing student opinion on elective courses related to pharmacists' roles within the pharmaceutical industry. One study described the survey results of a two-hour elective course, where students had to fulfil a typical pharmacist role within a pharmaceutical company (e.g., create advertising materials). A higher percentage (17.9%) of students who had taken a pharmaceutical industry elective course pursued a pharmaceutical industry fellowship compared to PharmD graduates who did not take the course (4.8%) (Hartman *et al.*, 2014). Another study on a pharmaceutical industry course that emulated pharmacist roles unique to the pharmaceutical industry setting showed that the course was associated with increased positive attitudes of students toward the pharmaceutical industry, such as how the industry contributes to society, the reliability in providing drug information, and the communication of safety concerns (Jacob & Peasah, 2019). The present study and previous reports indicate that exposing students to industry-based pharmacist roles shapes their overall career interests and path and provides a broader perspective on career options, including NPB careers in the pharmaceutical industry.

Strengths and limitations

Our study is unique in several ways. First, it employed a multimodal approach, where students were not required to enrol in the elective course to participate in the learning. Students could participate in the VIP competition, audit the course, and/or attend seminars. This strategy allows students to "test drive" their interests before committing to an elective course. Second, the course was designed to support the student VIP competition. Most students had little knowledge of how to create a drug development plan, a VIP requirement. The course used a structured approach to provide guidance and education so that students could meet or exceed the VIP objective requirements. The goal was to produce a learning experience that enhanced student performance in the VIP competition.

The pharmaceutical industry interest in hiring pharmacists in clinical and scientific roles demonstrates the need to expose students to the opportunities available to them after graduation. The PharmD curriculum prepares the student to excel in any clinical or scientific role with their drug and disease knowledge background. Introducing NPB career paths into curricula offer students the opportunity to prepare for this career path earlier in their pharmacy training, giving them time to explore the options.

The elective course modelled on the VIP competition and the seminars are just two recent implementations at UF COP. However, more industry pharmacy exposure during the curriculum is needed and desired by the students. Although both the elective course and the seminar series were highly rated, the main limitations of the responses received were the small sample sizes. The smaller sample size precluded generalisable conclusions on how students perceived the course. Additionally, response rates were higher for two of the four functional groups and yielded less information to draw firm conclusions about the other two functional groups. Nevertheless, response rates were higher than 90% for the seminar programme, which increased confidence in the assessment of seminar-related data.

Conclusion

Students reported a significant increase in interest and knowledge level in industry pharmacy careers after participating in the course and seminar series. This finding indicates that the methods employed in this multi-modal approach were effective in educating students on alternative career pathways while piquing their interest in these pathways. Ideally, all colleges of pharmacy should design their curriculum so that students are exposed to non-practice-based careers within the Doctor of Pharmacy programme, allowing the student to make a more informed career decision. This study also demonstrates that the amount of content focused on non-practice-based pharmacy careers is minimal compared with clinical education but was highly impactful in guiding career choices.

Conflict of interest

The authors declare no conflict of interest.

Source of funding

The authors did not receive any funding.

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