

The impact of Introductory Pharmacy Practice Experience (IPPE) on students' skills during Advanced Pharmacy Practice Experience (APPE)

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Abstract

Objectives: To evaluate the impact of the Introductory Pharmacy Practice Experience (IPPE) requirement using multiple cohorts of students, including a comparison cohort that did not participate in IPPE. The impact on student experiences in a variety of settings was examined, along with the improvement in confidence with pharmacy practice skills during Advanced Pharmacy Practice Experience (APPE) after participating in IPPE.

Methods: A survey was administered to students from 2010–2015 both pre- and post-completion of their APPE year. The 2010 cohort completed mandatory pharmacy internship experiential hours before starting APPE; however, there was no formal IPPE curriculum. Subsequent cohorts completed a formal IPPE programme. The survey had outpatient (11 items) and inpatient (10 items) pharmacy practice skill scales. Differences between pre- and post-scale scores within cohorts were compared using ANOVA and effect sizes for the change were calculated.

Results: Pre-APPE responses indicated that students had experience in more varied practice settings after IPPE implementation. In 2010, 85% of the students had experience in a chain community pharmacy yet most were lacking experience in other areas. Following implementation of the formal IPPE programme, the percentage of students reporting no experience in other practice settings decreased, for example students reporting no experience in hospital pharmacy decreased from 53% in 2010 to 1%-8% in subsequent cohorts. When comparing pre- to post- mean scores for the outpatient and inpatient scales, there was no statistically significant difference in the 2010 and 2011 cohorts; however, there was a significant difference in the 2012-2015 cohorts with the magnitude of difference increasing over time.

Conclusions: Students completing a formal IPPE programme had experience in more varied practice settings and demonstrated more improvement in confidence across APPE.

Keywords: *Advanced Pharmacy Practice Experience, Experiential Education, Introductory Pharmacy Practice Experience, Pharmacy Education*

Introduction

Since 2006, the United States of America (US) Accreditation Council of Pharmacy Education (ACPE) has implemented requirements for students to complete Introductory Pharmacy Practice Experiences (IPPE) prior to beginning Advanced Pharmacy Practice Experiences (APPE) (ACPE, 2006; ACPE, 2011; ACPE, 2016). The primary objective of IPPE is to advance students' understanding of practice and thus prepare them for success in APPE (ACPE, 2016). IPPE must

account for at least 300 hours of activity. Per the 2016 standards, a minimum of 150 IPPE hours must be based in the community and institutional health-system, with a balance between these two settings. A secondary goal of IPPE is to expose students to common contemporary US practice models thus students should gain exposure to a variety of patient care settings.

Recently, the International Pharmaceutical Federation (FIP) released the Nanjing Statements on Pharmacy and Pharmaceutical Sciences Education (the Nanjing

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Statements) to describe the envisioned future for pharmaceutical education needed to enhance professional standards worldwide (FIP, 2017). These statements consist of 67 statements grouped into eight clusters: (1) Shared Global Vision; (2) Professional Skills Mix; (3) Recruitment of Students; (4) Foundation Training and Leadership; (5) Experiential Education; (6) Resources and Academic Staff; (7) Quality Assurance; and (8) Continuing Professional Development. Cluster 5 addresses experiential education as these programmes are "...where students incrementally develop their pharmacy practice and science skills in a wide variety of real-life settings" and provides 11 statements on what should be done. This study specifically examines Statements:

5.3 "Pharmacy students should participate in direct patient care experiences in hospital and community practice settings and in other practice experiences defined by local needs for pharmacists"

5.6: "Students should have the opportunity to participate in internships / rotations with appropriate supervision and guidance, based on mutually determined learning objectives" prior to the APPE year, and

5.4 "Students should be provided with supervised laboratory and clinical experience throughout the curriculum, including demonstrations and simulations"

Throughout the US, the change in the standards resulted in overall changes to Doctor of Pharmacy (Pharm.D.) curricula where students progressing through the Pharm.D. curriculum develop and expand their knowledge, skills, and attitudes with didactic instruction complemented by introductory pharmacy practice experiences. This programmatic change is built on the premise that prior knowledge (e.g., gained through IPPE) influences learning and student achievement (e.g., skills gained in APPE) (ACPE, 2016). Studies have demonstrated that prior knowledge gained from previous experiences significantly influences student achievement (Hailikari, Katajavuori & Lindblom-Ylänne, 2008). Some studies demonstrated that declarative knowledge did not contribute to student achievement, while a more integrated prior-knowledge base did contribute (Hailikari, Nevgi & Lindblom-Ylänne, 2007). The goal of IPPE is to create an integrated prior-knowledge base, which will lead to more skill and knowledge gain during APPE.

Based upon these broadly defined requirements, individual schools have developed a variety of IPPE models (Galinski *et al.*, 2014; Devine & Darbishire, 2015). In 2007, with the adoption of these new standards, the University at Buffalo School of Pharmacy and Pharmaceutical Sciences (SPPS) initiated updated IPPE requirements with students admitted that autumn. The graduating classes of 2010 or before did not participate in the new IPPE curriculum; however, beginning with the Class of 2011, a formal six course sequence was adopted as part of the first three years of the Pharm.D.

curriculum. The curriculum has implemented several changes intended to improve quality over the years. Improvements include increased preceptor development and programmatic changes to match clearer delineation of student requirements by ACPE (ACPE, 2011). The SPPS IPPE sequence included in-class training, professional organisation meeting participation, simulation, and reflective journaling in addition to the requisite practice experience hour requirements. Pharmacy students complete a minimum of 300 hours of IPPE over the three pre-APPE years of the programme. Information about the design of the programme is presented in Table I. Each year is designed in a progressive manner with rotation length increasing, along with additional clinical activity requirements and evaluations.

Table I: Structure of IPPE programme

Programme year	Minimum hours	Number of activities	Description	Activity duration (hours)
PY1	50	>8	Shadowing/ observation	2-6
PY2	100	≥8	Basics of intern practice	12.5-25
PY3	150	3	Mini-APPE	40-55
Total	300	>19		

PY = Professional Year

Previous studies have examined the impact of IPPE on APPE (Crill *et al.*, 2009; Mort *et al.*, 2010). One study (Crill *et al.*, 2009) assessed the effect of integrating IPPE by measuring preceptors' perception of student performance on APPE before and after the integration but the study included only one survey of preceptors and they were asked to make comparison by memory. The impact of an IPPE course was measured by comparing results to an evaluation tool completed by faculty members (not all preceptors) in a cohort prior to implementation of the course (control group, N = 57) and a cohort after implementation of the course (N = 56); the faculty members perceived that students who took the course performed the desired clinical behaviours more often than the control group (Mort *et al.*, 2010). Both studies had limitations, including the evaluation of a newly developed short-term IPPE programme with one cohort and a limited sample. The authors note that IPPE are a major curriculum component with the goal of improving performance on subsequent practice experiences (*i.e.*, APPE), which should be examined. The study reported here fills this gap by examining the impact of curricular changes in IPPE longitudinally on APPE skills confidence.

The authors first hypothesised that students in the formal IPPE programme would have increased exposure to a variety of pharmacy settings compared to students in the

cohort prior to the IPPE requirement. This was examined by calculating the percentage of students with experience in various pharmacy settings for each of the cohorts.

In addition, because activities performed in IPPE are expected to expose students to responsibilities and tasks that will be encountered during the APPE year (in order to prepare students with prior knowledge before entering APPE), it was hypothesised that the addition of a formal IPPE programme to the curriculum would increase student confidence during APPE. Research has demonstrated that improved instruction may not lead to detectable increases in student outcomes immediately and that there may be a delayed effect of two or three years for improvement in outcomes (Silverstein *et al.*, 2009; Maerten-Rivera *et al.*, 2016). Based on this research, the authors hypothesised that the change in student outcomes may appear in the first cohort to experience formal IPPE, yet subsequent cohorts would benefit more from the curriculum changes as the effect was delayed. That is, the full impact of a new IPPE programme would not be evidenced in the first year. It would take multiple years for preceptors and the programme to fully develop and for the full benefit of the programme to be witnessed.

To assess the impact of a developing IPPE programme on student confidence on their ability to perform activities typical of inpatient and outpatient APPEs, the authors examined the pre- and post-scores on two pharmacy skills scales for each of the cohorts in a longitudinal study. They then compared the mean change on the scales for each of the cohorts. It was expected that a greater increase in student responses would occur in later years, as students participated in IPPE, which created an integrated prior-knowledge base allowing for greater skill development during APPE. Although pharmacy schools in the US are required to include IPPEs in the pharmacy curriculum, programmes in other nations will benefit from understanding the impacts of implementation of IPPE in general and as they relate to achievement of the Nanjing Statement.

Methods

The Institutional Review Board at the State University of New York at Buffalo approved this study (IRB ID: STUDY00000287).

A survey instrument was developed to collect information from students at one school of pharmacy before (pre) and after (post) completing their APPE rotations. The survey was developed by two pharmacy practice faculty and was designed to address relevant practice skills from the inpatient (*e.g.*, acute care hospital, hospice, long-term care) and outpatient (*e.g.*, community pharmacy, ambulatory care) settings. Three additional pharmacy practice faculty and two volunteer preceptors reviewed the survey and provided input on content and semantics. The survey was piloted with five Professional Year 3 (PY3) pharmacy students who provided additional suggestions. Administration of the

survey was performed *via* Vovici, an online survey software, to students graduating between 2010 and 2015. Responses were anonymous. Participants could omit responses and were not required to complete the survey.

Survey items were categorised according to the following sections: (a) past experience in various pharmacy settings (pre only); (b) ability to perform pharmacy practice skills during an outpatient APPE rotation; and (c) ability to perform pharmacy practice skills during an inpatient APPE rotation. In order to evaluate the impact of IPPE on student exposure to a variety of practice settings, the past experience categories used were no experience, volunteer (including shadowing), educational (including IPPE), and paid. The percentage of students reporting each level of experience for each practice area was calculated for each cohort and trends in the data were examined.

Items evaluating confidence in the outpatient or inpatient setting used a seven-point Likert rating system with 1 = very uncomfortable, 4 = neither comfortable nor uncomfortable, and 7 = very comfortable. The responses to eleven items on outpatient activities were combined to create the outpatient confidence scale; the items included checking prescriptions, transferring prescriptions, responding to drug information questions, providing presentations, writing care plans, counselling, receiving phone prescriptions, calling about prior authorisations, dealing with insurance issues, calling physician offices, and preventing or managing medication errors. The responses to ten items on inpatient activities were combined to create the inpatient confidence scale; the items included checking/verifying orders, compounding intravenous (IV) admixtures, responding to drug information questions, providing presentations, writing care plans, participating in rounds, conducting admissions interviews/reconciliation, analysing lab values, communicating with nurses and other healthcare professionals, and preventing or managing medication errors.

Scores for the outpatient and inpatient pharmacy practice skills scales were computed using the total mean of the responses to the items that comprised the scale. Use of the mean of the item responses, as opposed to the summated score made the scores easier to interpret as they could be interpreted the same as the Likert scale. The reliability of the obtained scale scores was estimated using Cronbach's *alpha* (α). Cronbach's α reliabilities of 0.70 or above are considered generally acceptable for instruments with low stakes (Nunnally, 1978).

To examine differences from pre- to post- each year, data were analysed using analysis of variance (ANOVA) methods. The ANOVA analyses were conducted using IBM SPSS Version 22 software (IBM SPSS Statistics for Windows). For the purpose of these analyses, a *p*-value less than 0.05 was considered statistically significant. In addition to examining the significance level, the partial-eta squared (η^2) measure of effect size was reported. In this analysis, η^2 values greater than 0.01 and less than 0.06 are considered small; greater than 0.06 and less than 0.14 are considered medium; and greater than 0.14 are considered large (Cohen, 1988).

Results

Table II lists the pre- and post- response rates for each year. It should be noted that in earlier years (*i.e.*, 2010-2012), the response rates were higher whereas in 2014 and 2015 response rates dropped below 60%.

Table II: Response rates to student survey for 2010 to 2015 cohorts

Year	Class Size	Pre		Post	
		Number Responses	Response Rate (%)	Number Responses	Response Rate (%)
2010	114	97	85	110	96
2011	113	96	85	69	61
2012	116	94	81	90	78
2013	113	69	61	59	52
2014	113	68	60	40	35
2015	131	72	55	73	56

Results for questions regarding past experience in various pharmacy settings for all years are presented in Table III. Data from 2010 demonstrate that prior to the IPPE requirement, the types of experience students had was very different to subsequent years when the IPPE requirement was in place. In 2010, most students had experience in a chain community pharmacy (85%) yet were lacking experience in all of the other areas examined (independent community pharmacy, ambulatory care/outpatient clinic pharmacy, hospital pharmacy, and clinical/specialty hospital pharmacy) with the percentage reporting no experience in these areas ranging from 53-78%. Beginning in 2011, fewer students reported having no experience in each of the areas and most students had an educational or paid experience in each of the areas across years. Generally, levels of experience reported in the independent community pharmacy, hospital pharmacy, and clinical/specialty hospital pharmacy were similar from 2012-2015. From 2012-2015, the area of pharmacy that many students continued to report not having any experience or minimal shadowing in was the ambulatory care/outpatient clinic pharmacy with the percent reporting no experience in this area from 2012-2015 ranging from 22-46%.

Table III: Pre-APPE experience in various pharmacy settings for 2010-2015 cohorts

	Community Pharmacy (Chain) % (n)	Community Pharmacy (Independent) % (n)	Ambulatory Care/ Outpatient Clinic % (n)	Hospital Pharmacy % (n)	Hospital (Clinical/ Specialty) % (n)
2010 (No Formal IPPE)					
No experience	11 (11)	75 (73)	78 (76)	53 (51)	66 (64)
Volunteer	2 (2)	10 (10)	9 (9)	21 (20)	18 (17)
Educational	2 (2)	2 (2)	10 (10)	4 (4)	5 (5)
Paid	85 (82)	12 (12)	2 (2)	23 (22)	11 (11)
2011 (Formal IPPE Cohort 1)					
No experience	2 (2)	24 (23)	25 (24)	3 (3)	15 (14)
Volunteer	2 (2)	23 (22)	26 (25)	9 (9)	11 (11)
Educational	35 (34)	37 (35)	47 (45)	59 (57)	65 (62)
Paid	60 (58)	17 (16)	2 (2)	28 (27)	9 (9)
2012 (Formal IPPE Cohort 2)					
No experience	0 (0)	12 (11)	22 (21)	1 (1)	7 (7)
Volunteer	1 (1)	19 (18)	29 (27)	18 (17)	18 (17)
Educational	33 (31)	48 (45)	47 (44)	50 (47)	60 (56)
Paid	66 (62)	21 (20)	2 (2)	31 (29)	14 (14)
2013 (Formal IPPE Cohort 3)					
No experience	0 (0)	17 (12)	32 (22)	7 (5)	10 (7)
Volunteer	4 (3)	13 (9)	29 (20)	23 (16)	28 (19)
Educational	46 (32)	48 (33)	35 (24)	45 (31)	48 (33)
Paid	49 (34)	22 (15)	4 (3)	25 (17)	15 (10)
2014 (Formal IPPE Cohort 4)					
No experience	0 (0)	12 (8)	34 (23)	3 (2)	18 (12)
Volunteer	2 (1)	18 (12)	25 (17)	31 (21)	24 (16)
Educational	54 (37)	52 (35)	35 (24)	54 (37)	52 (35)
Paid	44 (30)	19 (13)	6 (4)	12 (8)	7 (5)
2015 (Formal IPPE Cohort 5)					
No experience	0 (0)	13 (9)	46 (33)	8 (6)	25 (18)
Volunteer	3 (2)	17 (12)	15 (11)	25 (18)	18 (13)
Educational	47 (34)	47 (34)	33 (24)	50 (36)	43 (31)
Paid	50 (36)	24 (17)	6 (4)	17 (12)	14 (10)

Table IV: Outpatient confidence scale survey results

	Cronbach's α [*]	n	Scale Mean (SD) [†]	Mean Difference	p value [‡]	η^2 (effect size)	$\eta^{2\ddagger}$ (magnitude)
2010 (No Formal IPPE)							
Pre	0.99	97	5.5 (1.5)				
Post	0.97	110	5.5 (1.6)	0.0	0.95	0.00	small
2011 (Formal IPPE Cohort 1)							
Pre	0.93	96	5.3 (1.3)				
Post	0.97	69	5.7 (1.6)	0.4	0.14	0.01	small
2012 (Formal IPPE Cohort 2)							
Pre	0.92	94	5.2 (1.2)				
Post	0.96	90	5.7 (1.4)	0.5	0.01*	0.04	small
2013 (Formal IPPE Cohort 3)							
Pre	0.92	69	4.9 (1.2)				
Post	0.96	59	5.9 (1.2)	1.0	<0.001*	0.15	large
2014 (Formal IPPE Cohort 4)							
Pre	0.93	68	5.0 (1.2)				
Post	0.96	40	5.6 (1.5)	0.6	0.02*	0.05	small
2015 (Formal IPPE Cohort 5)							
Pre	0.96	70	4.9 (1.6)				
Post	0.92	73	6.1 (0.9)	1.2	<0.001*	0.17	large

Table V: Inpatient confidence scale survey results

	Cronbach's α [*]	n	Scale Mean (SD) [†]	Mean Difference	p value [‡]	η^2 (effect size)	$\eta^{2\ddagger}$ (magnitude)
2010 (No Formal IPPE)							
Pre	0.99	97	4.5 (1.5)				
Post	0.95	110	4.7 (1.5)	0.2	0.29	0.01	small
2011 (Formal IPPE Cohort 1)							
Pre	0.95	96	4.5 (1.4)				
Post	0.97	69	4.9 (1.6)	0.4	0.09	0.02	small
2012 (Formal IPPE Cohort 2)							
Pre	0.92	94	4.5 (1.1)				
Post	0.95	90	5.1 (1.3)	0.6	0.001*	0.06	medium
2013 (Formal IPPE Cohort 3)							
Pre	0.95	69	4.3 (1.3)				
Post	0.95	59	5.2 (1.3)	0.9	<0.001*	0.12	medium
2014 (Formal IPPE Cohort 4)							
Pre	0.94	68	4.2 (1.3)				
Post	0.95	40	5.1 (1.5)	0.9	0.003*	0.08	medium
2015 (Formal IPPE Cohort 5)							
Pre	0.95	72	4.3 (1.3)				
Post	0.94	73	5.4 (1.1)	1.1	<0.001*	0.19	large

*Cronbach's α (α) reliabilities of 0.70 or above are considered generally acceptable for evidence of reliability for instruments with low stakes.

[†] The scores are based on a 7-point rating system and are the mean of the responses to the items.

[‡] ANOVA was used to determine significance, defined as $p < 0.05$ between pre and post APPE survey results. Statistically significant results are denoted with *

[¶] $\eta^2 > 0.01$ is considered a small effect size; $\eta^2 > 0.06$ is considered medium, and $\eta^2 > 0.14$ is considered large.

Table IV presents results of the analysis of responses related to outpatient confidence. The Cronbach's α for the scores on this scale were all greater than 0.70, indicating acceptable reliability. In 2010, the mean outpatient confidence score was the same at pre- and post-. In all other years, the pre- outpatient confidence mean was lower than at the conclusion of the APPE year (post-). The difference between pre- and post-outpatient confidence was statistically significant in 2012 through 2015. The mean difference increased with each cohort, with the exception of the 2014 cohort. The mean difference in the 2014 cohort was higher than the 2012 cohort, but not higher than the 2013 cohort. The magnitude of effect for these differences ranged from small (2010, 2011, 2012, and 2014) to large (2013 and 2015). The means for the pre- outpatient confidence scale decreased across years.

Table V presents the results of the analysis of inpatient confidence. The Cronbach's α for the scores on this scale were all greater than 0.70, indicating acceptable reliability. In all years, the pre- inpatient confidence mean was lower than the post-. The difference between the pre- and post- inpatient confidence was statistically significant in the 2012-2015 years. The mean difference increased with each cohort with the exception of the 2014 cohort. The mean difference in the 2014 cohort was of the same magnitude as the 2013 cohort.

Discussion

This survey confirmed that students experiencing IPPEs entered the APPE year with a broader range of experience, which reflects success in achievement of Nanjing Statement 5.3 (*"Pharmacy students should participate in direct patient care experiences in hospital and community practice settings and in other practice experiences defined by local needs for pharmacists"*); 5.6 (*"Students should have the opportunity to participate in internships/rotations with appropriate supervision and guidance, based on mutually determined learning objectives"*); and 5.4 (*"Students should be provided with supervised laboratory and clinical experience throughout the curriculum, including demonstrations and simulations"*), (FIP, 2017). The 2011 cohort and beyond had a much broader base of experience heading into the APPE year as compared to the pre-IPPE 2010 cohort. In particular, there was a significant shift from students having been exposed solely to the community pharmacy setting to students experiencing a variety of settings.

Other studies examined the impact IPPE activities have on APPE performance (Hailikari *et al.*, 2007; Hailikari *et al.*, 2008; Mort *et al.*, 2010; Mort, Laible & Johnson, 2011). The 2007 Standards were modified with IPPE in order to enforce students obtaining a base of knowledge of pharmacy practice prior to the APPE requirement. The study demonstrated that this previous knowledge may contribute to greater confidence during APPE. This finding is similar to results in other studies outside of pharmacy that demonstrate previous knowledge

contributes to greater levels of achievement (Hailikari *et al.*, 2007; Hailikari *et al.*, 2008).

Similarly studies have examined the impact of IPPE on various measures of APPE. Mort *et al.* analysed how the addition of a specific IPPE course affected students' performance of future practice activities during APPE (Mort *et al.*, 2010). They used an evaluation tool to have faculty members assess their APPE students on specific skills, such as reference utilisation and monitoring plan creation, during the third week of the first rotation. It showed that students who completed the IPPE course scored better on all skills analysed compared to the students who previously did not take the course. The authors utilised the same evaluation tool to compare student behaviours before and after a number of curricular revisions, including the addition of IPPE, that took place to address ACPE Standards 2007 (Mort *et al.*, 2011). Faculty again assessed student skills during the third week of their first APPE rotation. The results demonstrated that students who completed the new curriculum significantly outperformed students from the old curriculum in all skills that were evaluated. While these studies focused on specific skills that improved across pre-APPE curricular updates (Mort *et al.*, 2010; Mort *et al.*, 2011) are in contrast to this research regarding changes in student confidence, they both identify a similar trend: enhancements to an IPPE programme can have a positive impact on future APPE knowledge, skills, and attitudes.

Although not a focus of this study, the pre- means on both scales did not increase after the implementation of IPPE. Generally, the means remained the same or decreased slightly. One reason this may have occurred is that prior to the IPPE programme, students may not have possessed the awareness to be able to objectively evaluate themselves on the various pharmacy practice skills (*i.e.*, they did not have experience in various settings to effectively assess what they did and did not know) (Dunning, 2011).

The results of this study demonstrated that both inpatient confidence and outpatient confidence did not increase from pre- to post- in the 2010 and 2011 cohorts, but did increase from pre- to post- in the 2012 through 2015 cohorts. Thus, a significant change in student confidence was not noted until the second year of the IPPE programme. Furthermore, the effect size corresponding to pre- to post- analysis generally started small in 2012 and increased over the years. The increasing familiarity of preceptors with the IPPE programme and expectations of IPPE students across Pharm.D. programme years may have led to improved experiences for the students as the IPPE programme matured. This trend is consistent with findings reported in other education research indicating that improved instruction may not lead to detectable increases in student outcomes immediately (Wayne *et al.*, 2008). Some studies have found a delayed effect of two or three years for improvement in outcomes as it takes time for the curriculum to be implemented as intended (Silverstein *et al.*, 2009; Maerten-Rivera *et al.*, 2016).

Overall, the findings indicate that students may develop more during the APPE year following completion of IPPEs. Therefore, the ACPE IPPE requirement (ACPE, 2006) may provide measurable value to student development. Strengths of this study include its examination of data collected over multiple years using both a pre- and post- assessment. Confidence during the APPE year would not be identified if students were surveyed only after completing the APPEs.

A limitation of the study was that use of de-identified surveys did not allow for examination of changes at individual student level. Although the overall response rate was 67%, with a pre-APPE response rate of 71% and post-APPE response rate of 63%, the response rates decreased over the course of the study. The 2014 cohort had a post-APPE response rate of 35%, which was lower than the range of response rates for prior collection periods included in the study. Data from the 2015 cohort are based on response rates of 55-56%, which also makes non-response bias a viable concern based on discussion of ideal response rates in pharmacy education literature (Fincham, 2008). A limitation which impacts the comparison of paid work experience pre- to post-implementation of IPPE. Prior to implementation of the formal IPPE programme, students were required to obtain a minimum number of hours of paid experience in a pharmacy setting to progress to the APPE year. Once this requirement was removed, students may have been less aggressive in attempting to obtain employment.

Opportunities remain for future research in this area. It would be beneficial to assess specific skills and compare between pre-IPPE and post-IPPE groups as opposed to only collecting student perceptions of those various skills. This would be accomplished by involving reality-based evaluation of students by preceptors during IPPE and APPE activities. Student career path interest should be evaluated to determine to what extent IPPE and APPE activities inform career decisions. In addition, an examination of the impact of IPPE experiences on students' ability to accurately self-assess and identify their strengths and weaknesses as they relate to various pharmacy practice skills that are essential to their professional success would be valuable.

Conclusion

Students completing a formal IPPE programme gained early exposure to a wider variety of pharmacy practice settings, improving achievement of Nanjing Statement 5.4. This exposure may have an impact on their selection of future APPE activities as well as an overall impact on career choices, although this was not examined in this study. Additionally, a formal IPPE programme was found to be beneficial at increasing students' self-perception of development during the APPE year. Specifically, students who experienced IPPEs demonstrated a greater overall improvement in confidence across their APPE year than students who had

not experienced IPPEs. The results also indicate that a large curricular change, such as the implementation of IPPEs, requires time to develop and achieve its full benefit.

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