RESEARCH ARTICLES

Validation of a Survey Instrument to Evaluate Students' Learning During Community-based Advanced Pharmacy Practice Experiences

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Objective. To develop and validate a preceptor/student self-report survey instrument to distinguish between different advanced pharmacy practice experience (APPE) models based on pharmaceutical care competencies.

Methods. The survey instrument's psychometric properties and differential impacts of 3 community-based APPE models were evaluated retrospectively.

Results. Five dimensions characterized APPE learning: importance of 14 pharmaceutical care competencies; agreement with pharmaceutical care procedures in practice; gains in perceived pharmaceutical care abilities; and learning climate and preceptor support. Most of the survey instrument scales detected student/preceptor differences as well as differences in APPE model structures. A streamlined, 30-item short form was validated against the full 78-item survey instrument.

Conclusions. This study confirms that APPE learning can be quantified to: (1) identify high-risk students, (2) train new or continuing preceptors, (3) promote skills-training for select pharmaceutical care competencies, (4) add clarity and structure to APPE learning objectives, and (5) provide students and preceptors with common frameworks for negotiating the APPE experience.

Keywords: survey, pharmaceutical care competencies, advanced pharmacy practice experience (APPE), assessment, community pharmacy

INTRODUCTION

Both Canadian and American accreditation standards have charged pharmacy schools to ensure that students have the necessary competencies to engage in pharmaceutical care (this term is used synonymously with patient-centred care).^{1,2} These standards have placed emphasis on the experiential components of pharmacy education where students have unique opportunities to combine cognitive, psychomotor, and affective skills. However, unlike the classroom setting where student activities are structured, the experiential practice setting is multidimensional and students are frequently placed in unplanned activities with patients and other health professionals.³ Within such a complex and dynamic setting, the learning environment as well as the effective and efficient use of learning opportunities at a practice site can clearly impact the students' abilities to attain the desired outcomes of the APPE. Thus, educators must design ex-

periential programs that incorporate student performance measures and practice setting evaluations to ensure appropriate learning opportunities for students.⁴

Accordingly, the structured practice education program (SPEP) at the Faculty of Pharmaceutical Sciences, University of British Columbia (UBC) in Vancouver, Canada, undertook several sequential initiatives to develop, improve and evaluate its community-based advanced pharmacy practice experience (APPE).⁵⁻⁹ The evaluation process had 2 overarching goals - to quantify the added pharmaceutical care delivered by students at the enhanced APPE sites compared to those at the original (traditional) APPE sites; and to assess the impact of the enhanced APPE's learning climate (trained preceptors, explicit SPEP guidelines, student training and support) on the extent of pharmaceutical care learning opportunities provided to the student, extent of skills acquisition as a result of such opportunities, and students' point of view regarding the importance of various features related to the practice of pharmaceutical care.^{8,9} These initiatives were grounded in a 5-stage learning model: (1) an enhanced learning climate should lead to (2) better utilization of APPE learning opportunities, including (3) more frequent student/patient consultations, which would lead to (4)

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improved skills acquisition, and ultimately to (5) more favorable attitudes towards pharmaceutical care practice.

To assist with the evaluation process, the pharmacy literature was reviewed to identify previously developed preceptor/student survey items with published reliability and validity parameters. While the review suggested increased initiative among pharmacy schools to develop assessment tools and processes for global assessment of their overall programs or of individual classroom courses/laboratories, there were only a few survey instruments identified that evaluated student and preceptor perceptions of student performance during APPEs.¹⁰⁻²² However, transferability of these instruments to evaluate the impact of an APPE learning climate on students' learning and acquisition of pharmaceutical care competencies was problematic since none had been validated, nor did any single survey include all the elements of interest. Similarly, the literature search revealed limited research in the area of acquiring students' points of view on various features of pharmaceutical care.²³⁻²⁵ The single study examining students' perception of the various features of pharmaceutical care did not validate the survey instrument.¹⁵ Notably, only a few studies had triangulated student perceptions against either external expectations (standards of practice) or preceptor assessments.^{18,22}

Hence, an important component of the evaluation process was to devise a comprehensive post-APPE survey instrument for both students and their preceptors that captured their different/varied experiences with (1) the competencies and skills required to deliver pharmaceutical care; (2) the 5 stages of its learning model; and (3) respondents' summary assessments about the value of the APPE experience and its accountability systems. Results of this pilot study instrument are discussed elsewhere.⁹ Building on earlier work, this project extends SPEP's quality improvement initiatives to an all-student final-year cohort and a broader spectrum of urban and rural community pharmacy settings, with specific objectives to: (1) develop a self-report survey instrument distinguishing among APPE models which differed in length, pre-orientation, and preceptor training; (2) establish scale reliability, validity, and sensitivity; (3) develop normative profiles for each scale; and (4) devise streamlined, rigorous APPE learning scales.

METHODS

Design

A retrospective comparative-experimental design was used to evaluate the different impact of 2 models of enhanced community-based APPEs on students' learning and performance in contrast to that of a traditional community-based APPE model.²⁶ The study was con-

ducted between September 2003 and May 2004 in community pharmacies which consistently served as APPE placement sites for UBC students. Ethics approval had been obtained through the university's Office of Research Services and prior consent was obtained from all students and preceptors to allow dissemination and publication of the study's findings.

Participants

This study was undertaken in a unique partnership between the university's pharmacy school, 3 nationally operating pharmacy chains, and a consortium of independently owned pharmacies. As part of this partnership, the national and independent pharmacies agreed to: (1) allow their preceptors to attend a full-day preceptor training workshop at company expense; and (2) to support costs associated with the delivery of the training program and the evaluation of the APPE post-training.

One hundred twenty different community pharmacies were recruited: 31 to the study's 2 intervention arms (14 in the partially enhanced model and 17 in the fully enhanced model) and 89 to the control arm (traditional model). Purposeful selection was used to recruit pharmacies into the 2 intervention (partially enhanced and fully enhanced) arms. A list of all pharmacies that served as APPE sites for UBC students was developed and pharmacies from the partner stores were identified (67 in total). The first 31 partner pharmacies whose managers and pharmacists agreed to participate in a preceptor education program in the coming year were recruited into a common intervention arm, ensuring equal representation in terms of partner affiliation, community size, and urban/rural location. The remaining partner pharmacies were returned to the general pool of APPE sites. The common intervention arm was then divided into 2 arms: (1) a partially enhanced intervention arm that included those intervention pharmacies that declined to provide students with 5 (non-sequential) days of pre-APPE orientation, and (2) a fully enhanced intervention arm that included intervention pharmacies who agreed to provide students with 5 such days of pre-APPE orientation. Only 1 of the 3 partner chains opted to participate in the partially enhanced intervention arm; the other chains chose to remain in the fully enhanced arm.

Although the enhanced APPE experience had been tested and proven superior to the traditional model in the earlier pilot study, its structure was still new and needed further validation among a larger student cohort and across a wider spectrum of participating pharmacy chains. Thus, student participation in any of the enhanced intervention arms was voluntary. The enhanced APPE was advertised to all fourth-year (senior year) students

through e-mail and class presentations, and interested students were recruited on a first come, first served basis. Students were placed at the control sites as part of the normal placement process, a procedure that assigns students at random to 1 of their 5 preferred geographical locations. Each placement site (within both intervention and control arms) accepted a maximum of 2 students at different times within the academic year.

Intervention

Students in both the intervention and control arms were expected to complete an 8-week APPE experience during which time they were to meet similar learning objectives and participate in the same learning activities, and were held to the same learning and performance criteria and evaluation standards. However, the 3 study arms (control, partially enhanced and fully enhanced) differed in 3 key aspects.

First, students in both enhanced (intervention) arms completed their 8-week experience at a single location as part of the enhanced model, whereas those in the traditional (control) arm completed their 8-week experience at 2 different pharmacies, 4 weeks at each site. Second, preceptor support differed between the intervention and control arms. Preceptors in the control arm received traditional support, which consisted of the SPEP manual outlining the APPE's learning activities, expectations, policies, evaluation processes and forms, patient care tools, and conduct standards, with ad hoc telephone support. Preceptors within the 2 intervention arms (partially and fully enhanced) participated in a 2-day preceptor education workshop. On day 1 of the workshop, the proposed pharmaceutical care practice model was discussed, the APPE syllabus was reviewed, the learning tasks expected of students were clarified, and the accountability mechanisms were reviewed using lecture-based and small-group exercises. In day 2 the preceptors were given the opportunity to apply the concepts and tools presented the previous day to artificial patients using case-based, small-group design. Thus, all attendees were trained, and subsequently certified as "clinical instructors." Third, student support differed between the 3 arms. All students allocated to the traditional and the partially enhanced APPE arms participated in a mandatory 3-hour face-to-face orientation session and an online quiz reinforcing the APPE expectations. Students in the fully enhanced APPE arm were provided with 5 days of orientation (not necessarily on consecutive days) at the pharmacy site prior to the start of the APPE to allow pharmacists to assess their students' baseline competencies with various distribution and pharmaceutical care activities.

Instrument Development

The initial pilot study employed a 70-item bubble-sheet survey instrument to gather information. For the current study, these questions were substantially revised, extended, and restructured into a much more user-friendly 78-item, 5-page paper/pencil survey instrument consisting of questions with 5-point Likert-scale response categories that both students and instructors could complete at their leisure. The form consisted of 6 sections: (1) importance of pharmaceutical care competencies (14 questions); (2) agreement with pharmaceutical care procedures (14 questions); (3) learning opportunities available during the APPE (20 questions); (4) ability gains during the APPE (20 questions); (5) learning climate and preceptor support (9 questions), together with an estimate of the number of patients to whom they had provided comprehensive pharmaceutical care (1 question); and (6) 5 open-ended questions about various aspects of the APPE that they had found either challenging, rewarding, frustrating, or enjoyable, and any important new insights they had gained. In general, each of the 14 competency domains was queried 3 times: once in terms of its importance, once in terms of recognizing or locating learning opportunities to perform or practice the domain and once more to measure ability gained in each competency domain. The conceptual stems of these 14 competencies are shown in Table 1.

Benchmarks

The 78 survey items represented a deliberate oversampling of issues so that we might be able to distinguish a good APPE from a poor one, or an enhanced APPE from a traditional one, or a strong student from a weaker one. The conventional indicators of scale utility are reliability, validity (both convergent and discriminant), and sensitivity. The benchmarks against which the 5 scales were examined included: self-assessment, preceptor assessment, objectives met, patient consultations, portfolio quality, and course grade for the APPE.

Instrument development activities focused on verifying that the scales (and their constituent items) conformed to generally accepted scale development criteria, ie, that the scales (1) were interpreted similarly by both students and their preceptors, (2) distinguished effectively between enhanced and control settings; (3) demonstrated alpha reliabilities equal to or exceeding Nunnally's rule-of-thumb threshold of $\alpha = 0.70$; (4) converged reliably on their respective themes; (5) did not spill across to other themes; and (6) correlated positively with the benchmarks. Items and scales passing these tests were retained for subsequent refinement into a shorter

Table 1. Pharmaceutical Care Competency Domains Queried Within the Survey

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- Asking patients what expectations they have about their drug therapy.
 - Using treatment guidelines in conjunction with patient-specific characteristics when evaluating different treatment options - both drug and non-drug.
 - Assessing patients' drug therapy to determine whether each of their medications is necessary, effective, safe, and whether they have concerns regarding management and adherence.
 - Collecting relevant patient information from available sources (patient records, pharmacy profiles, patient interviews) in order to assess drug-related needs.
 - Integrating patient information (including their disease and medication information) to identify existing actual and potential drug-related problems.
 - Questioning patients to verify their current experiences in order to determine the effectiveness (or even undesirable effects) of their drugs.
 - Prioritizing patients' drug-related problems.
 - Knowing about patients' questions or concerns in order to understand how they're managing and adhering to their current medications.
 - Clarifying with patients how they should monitor their own therapy.
 - Documenting all necessary information for supporting or evaluating the clinical decisions involved in providing pharmaceutical care.
 - Documenting pharmacy care plans to ensure continuity of patient care.
 - Ensuring continuity of care by documenting patient information in forms that could be used by another pharmacist or other health care practitioner.
 - Providing patients with telephone or in-person follow-ups.
 - Pharmacists providing full pharmaceutical care even when it duplicates the efforts of other health care providers.
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and more streamlined APPE Performance Inventory (API).^{27,28}

Data Collection

Both the students and their preceptors completed retrospective survey instruments shortly after completion of the APPE. As well, both groups were assured that survey results would not affect the students' final grades. The survey instructions requested that the preceptors in the enhanced group and students from both groups reflect from the completion of their APPEs back to the baseline day of their 8-week APPE and report changes, learning opportunities, and ability gains during that interval. Students in the control settings were assessed both at the end of their first 4-week APPE and again at the completion of their final 8 weeks.

While both the students and preceptors were asked about the same topics, the survey items and instructions were phrased to be appropriate to their respective audiences. All questions were answered on individually labeled 5-point scales ranging from not important to extremely important, strongly disagree to strongly agree, or no gain at all to extensive gains. Students completed the survey instruments online using WebCT, while preceptors received and returned their paper/pencil versions either by mail or in person. A student researcher managed data collection and collation.

Analysis

An instrument developer/statistician was hired to assist with the analysis. Data were first cleaned and verified, then survey results were collated and analyzed using SPSS 15.0 for Windows and progressed through a series of analyses: overall summaries (SPSS Frequencies and Descriptives), differences between intervention arms (ANOVA), and differences between preceptor and student assessments (*t* tests, ANOVA). Combining student and preceptor responses, measures of internal consistency were computed as Cronbach's α ; confirmatory factor analysis (principal component analysis with quartimax rotation) verified that the 5 intuitive scales demonstrated empirical validity. Pearson correlations examined the relationships between the 5 scales and the study's benchmark validity indicators. For ease in cross-scale comparisons and interpretability, multi-item scale totals were divided by the number of items in each scale so that results were reported on the same 1-to-5 interval as the original items were measured.

RESULTS

Survey forms were submitted by all 123 students at the end of their 8-week experience: 28 in the partially enhanced arm, 30 in the fully enhanced arm, and 65 in the control arm. One hundred ten (92%) preceptor survey

instruments were returned at the end of the 8-week experience: 27 from the partially enhanced arm, 29 from the fully enhanced, and 54 from the control arm. Additionally, all 65 students and 53 (82%) preceptors in the control arm returned their survey instruments at the end of their first 4-week APPE. There were 24 preceptor survey instruments that were either absent or substantially incomplete, 1 from each of the intervention arms and 11 from the control arm.

As an initial step, exploratory factor analysis was conducted and confirmed that virtually all 78 items were helpful in one way or another. Further processing of the items revealed that the 5 scales of the survey instrument that had been intuitively derived from the pilot study outcomes (importance, agreement, learning opportunities, ability gains, and climate/preceptor supports) were confirmed by the rotated factor structure of the 78 survey instrument items, thus providing further evidence that (1) the APPE could be both measured and dimensionalized, and (2) the 5 sections of the survey instrument provided a good approximation of the distinctly different ways in which respondents assess the experiences of the APPE.

Scale Descriptions

The 5 scales are labeled to reflect their essential content and Table 2 shows how students and preceptors responded to each of these scales. However, a somewhat deeper insight is gained by examining the 3 or 4 items showing the highest α -reliability that anchor each scale, and by exploring in general how people reported within each scale. The best scale definers are commonly not those with the highest means because ceiling effects can compromise people's ability to express a range of opinion, thereby reducing an item's contribution to scale variation.

Importance. Importance of pharmaceutical care competencies is a 14-item scale best characterized by people's high- α responses to the following items: "documenting pharmacy care plans to ensure continuity of patient care," "integrating patient information to identify existing actual and potential drug-related problems," "clarifying with patients how they should monitor their own therapy," "prioritizing patients' drug-related problems," and "providing full pharmaceutical care even when it duplicates the efforts of other health care providers." All of the scale's 14 items were deemed "moderately important" or higher, although the

Table 2. Means, Standard Deviations, Reliability and Validity Estimates for Original and Streamlined Scales for Measuring Effectiveness of Pharmacy APPE

	Original Scales						Streamlined Scales						
	Important Agreement		Learning Opportunity	Ability Gains	Climate/Support	Total	Estimated Consults	Important	Agreement	Learning Opportunity	Ability Gains	Climate/Support	Total
A. Scale Norms													
Number of Items	14	14	20	20	9	77	1	6	6	6	6	6	30
Means (/5)	3.89	3.95	3.95	3.59	4.00	3.88	6.34	3.74	4.07	4.07	3.62	4.08	3.92
SD	0.52	0.46	0.70	0.63	0.57	0.42	5.0	0.67	0.53	0.76	0.69	0.61	0.46
Observed Min	1.9	2.0	1.2	1.5	2.2	2.2	0	1.5	1.5	1.2	1.3	2.2	2.0
Observed Max	5.0	5.0	5.0	5.0	5.0	4.9	20	5.0	5.0	5.0	5.0	5.0	5.0
B. Scale Reliability													
α -Reliability	0.89	0.87	0.92	0.94	0.84	0.90	0.53	0.83	0.82	0.87	0.87	0.81	0.82
C. Scale Sensitivity (means)													
(to Respondent)													
Preceptor Scores*	3.90	4.01	4.23	3.57	4.09	3.96	14.29	3.81	4.12	4.34	3.62	4.19	4.02
Student Scores*	3.89	3.91	3.71	3.59	3.92	3.80	7.99	3.69	4.03	3.84	3.12	3.99	3.84
(*Sig; p<)	ns	0.04	0.00	ns	0.01	0.00	0.00	ns	ns	0.00	ns	0.00	0.00
(to Study arm)													
Traditional†	3.91	3.97	3.91	3.55	3.97	3.86	9.70	3.78	4.09	4.05	3.68	4.06	3.92
Partially Enhanced†	3.68	3.82	4.05	3.44	3.92	3.78	9.62	3.50	3.94	4.16	3.45	4.00	3.81
Fully Enhanced†	4.01	4.01	4.01	3.82	4.21	4.01	16.52	3.84	4.11	4.07	3.88	4.26	4.03
(†Sig; p<)	0.01	ns	ns	0.00	0.01	0.01	0.01	0.01	ns	ns	0.00	0.04	0.04
D. Scale Validity (Pearson r's)													
Factor scores	0.84	0.82	0.91	0.94	0.74	0.64	0.30	0.92	0.94	0.94	0.92	0.88	0.51
Original Scale	---	---	---	---	---	---	---	0.92	0.95	0.93	0.94	0.95	0.97
(Internal)													
Preceptor + Student Self Rating	0.75	0.74	0.71	0.74	0.70	---	0.08	0.70	0.72	0.65	0.71	0.64	0.97
Question: APPE Meet Objectives?	0.40	0.34	0.29	0.41	0.66	0.58	0.12	0.38	0.36	0.28	0.40	0.69	0.60
Preceptor Estimated Consults	-0.05	0.07	-0.09	0.07	0.10	0.08	---	-0.01	0.05	0.07	0.07	0.16	0.08
(External)													
Preceptor Rating	0.12	0.17	0.20	0.29	0.26	0.29	0.05	0.06	0.16	0.21	0.24	0.27	0.27
Actual Consults	0.03	0.08	0.05	0.02	0.14	0.09	0.56	0.00	0.07	0.05	0.15	0.13	0.08
Portfolio Grade	0.14	0.17	0.06	0.02	0.14	0.09	0.38	0.09	0.15	0.06	0.12	0.09	0.15
Clerkship Grade	0.13	0.17	0.08	0.11	0.13	0.17	0.39	0.07	0.16	0.08	0.13	0.11	0.16

item “assessing patients’ drug therapy to determine whether each medication is necessary, effective, safe and whether patients have concerns regarding management or adherence” was ranked highest of all. The overall mean importance (3.89) of these pharmaceutical care competencies (more than “moderately important” and almost “very important”) suggests that respondents had internalized the importance of the structural elements of pharmaceutical care.

Agreement. Agreement with pharmaceutical care procedures scale was also a 14-item scale but focused more on procedural and attitudinal issues than on competencies. The 4 highest α items included: “using patient follow-ups to clarify misunderstandings or misconceptions that patients may have about their illness or drug therapies,” “providing pharmaceutical care even when it seems too time-consuming to be immediately cost-effective,” “taking the time and expense to perform patient follow-ups,” and “using pharmaceutical care delivery as a means of identifying and preventing drug-related problems.” Peoples’ opinions were divided on items such as “taking time to fully document care provided to some patients even when it interferes with providing effective care to other patients,” but respondents were near unanimous in agreeing with “utilizing pharmaceutical care to get a clear sense of patients’ drug-related needs.” Again, Table 2 shows a mean attitudinal agreement with pharmaceutical care procedures of 3.95, indicating that they agreed with the procedures of pharmaceutical care delivery as well as with the importance of its competencies.

Learning Opportunity. The Learning Opportunities scale required people to report how difficult it was during the APPE to locate (or create) opportunities to perform or practice each of 20 pharmaceutical care-related tasks. The high- α definers of this scale were: “integrating patient information in order to identify existing actual or potential drug-related problems,” “integrating information from patients with multiple problems and drug therapies,” and “evaluating different treatment options using treatment guidelines together with patient-specific characteristics.” Learning Opportunities items were reflected to show ease (rather than difficulty) of finding practice opportunities; and people reported the fewest difficulties in “carrying out the normal and expected pharmaceutical care activities at this store,” but were most challenged in locating opportunities to “make presentations to other health care providers or patient support groups” or “developing professional relationships with other health care providers (including physicians) to enhance specific patient outcomes.” The resulting overall mean (3.95) indicates that most learning opportunities were “moderately easy” or “quite easy” to locate or identify.

Gains. The Ability Gains scale required people to examine the same list of 20 pharmaceutical care-related tasks as Learning Opportunities, but to report how much skill and competence they had gained since the first day of the APPE. The high- α definers of Ability Gains were: “determining whether patients had questions or concerns about their drugs that might interfere with managing their medications,” “prioritizing drug-related problems so that the most relevant problems get addressed first,” and “questioning patients to determine their current experiences about any undesirable effects of the drugs they were taking.” Even though the same 20 activities were involved, abilities gained were not generally the same as opportunities available and the 2 scales were only moderately correlated ($r = 0.34$). The least gains were reported for “making presentations to other health care providers or patient support groups,” and the highest gains for “providing basic pharmaceutical care to assess patients’ drug-related needs.” Basic pharmaceutical care was defined in the SPEP manual as “care associated with new/refill prescriptions and nonprescription medications,” and required collecting relevant patient information from sources such as patient records, pharmacy profile, and patient interviews. Across its 20 items, the Ability Gain mean (3.59) suggests that respondents gained more than “some” and approaching “quite a lot” of skill or competence.

Climate and Support. The 9 Climate and Preceptor Support items were all strongly endorsed, but most so in high- α items such as “the community clerkship provided me with multiple opportunities to practice and improve my pharmaceutical care skills” and “my preceptor identified activities to help me meet the learning objectives related to pharmaceutical care.” Those least endorsed included “early in the rotation, my preceptor helped me select patients who were suitable for comprehensive pharmaceutical care” and “the SPEP program was a key factor in stimulating pharmaceutical care delivery to patients in this store location.” The scale’s overall mean (3.99) indicates that they “agreed” that the preceptor support features and learning climate elements were present and helpful.

While all 5 scales reflect positive attributes of APPE experience as discussed, they are 5 separate and distinct features as confirmed by both the (orthogonal) factorial structure of the survey instrument’s 78 items and the low-to-moderate intercorrelations of the scales themselves. The average inter-scale correlation is 0.42 (not shown), highest for Importance/Agreement ($r = 0.72$) and lowest for Agreement/Climate ($r = 0.40$); thus, it makes the most sense to regard APPEs as experiences with (at least) 5 importantly different aspects, ie, divergent validity, rather than as a single “summary experience.”

Scale Norm Summaries

To maintain a consistent framework to examine all the scales' different psychometric properties, Table 2, section A through section D, compares both long-form and streamlined scale results on a common grid. The basic norms for each of the 5 long-form scales are reported in section A of Table 2. In general, students and preceptors reported that the overall APPE was a positive experience, with a mean score across the 5 scales of 3.88 on a 5-point rating system. Scores ranged from 2.2 to 4.9, showing that the overall experience for some was more positive than for others. Opinions were the most diverse concerning the availability of learning opportunities during the APPE (SD = 0.7).

Reliability

Internal consistency within each of the 5 scales was also measured using Cronbach's α -reliability to determine how well each item assigned to a scale actually measured the same construct (Table 2, section B). All 5 measures of the APPE experience showed internal consistency well exceeding Nunnally's threshold of 0.70²⁹. Since this was a single-panel, cross-sectional, retrospective study, test-retest reliabilities could not be calculated, but such reliability estimates are generally even higher than their inter-item concurrent counterparts.³⁰

Sensitivity

The 5 scales and their overall total were sensitive to both respondent categories and to different learning conditions, as reflected in the 3 study arms. Comparisons between preceptor and student ratings on the 5 dimensions of the APPE experience are given in section C of Table 2. Both preceptors and students understood the survey questions in similar ways and they responded to them correspondingly, although not identically, and the survey instrument was sensitive in detecting these differences. While both groups' reports are decidedly positive, preceptors were more positive than students. Similarly, 3 of the 5 scales (Importance, Ability Gains, and Climate/Support) were sensitive to outcomes resulting from the different learning conditions in the overall APPE's 3 study arms. In all instances but one, the fully enhanced sites outperformed the traditional sites, and in most instances, also outperformed the partially enhanced sites (those that lacked the 5 days of in-store orientation).

Validity

As seen in Table 2, section D, the high correlations confirm that each scale, even though intuitively constructed, is clearly benchmarked against a corresponding factor in the internal structure of the survey instrument.

Internal validity was tested for each scale against 3 benchmarks built into the survey instrument. These included: (1) whether the scales correlate strongly with the survey's overall total, (2) whether scales correlate with respondents' reports about how well the overall SPEP objectives were met, and (3) whether scales correlate with the self-estimated numbers of patients to whom students provided comprehensive pharmaceutical care. Scale correlations with overall total were moderate, ranging from 0.70 for Climate/Support to 0.75 for Importance of Pharmaceutical Care Competencies. Correlations with self-estimates that the SPEP overall objectives were met were mid-range, averaging 0.42. Correlations with self-estimates of numbers of patient consultations provided were small and not significant for any of the 5 scales. Students in the fully enhanced arm estimated almost double the number of consultations (16.5 consults) as did students in the traditional arm (9.7 consults) or the partially enhanced arm where students lacked the 5 days of pre-APPE orientation experience (9.6 consultations). External validity included measures external to students' own survey reports, such as preceptor ratings, numbers of actual consultations performed (recorded in logged records), portfolio assignment, and their final APPE grade as adjudicated by the SPEP director's office. Because the final APPE grade was a composite score consisting of preceptor ratings, attendance, bonus marks, and portfolio quality (which was subsequently smoothed for graduation purposes), the portfolio grade was a truer indicator of overall APPE performance than the APPE grade or any of its components. Students' portfolio grade as the bottom-line indicator of external validity are reported in section D of Table 2. Site-by-site comparisons of students' own self-ratings on the 5 scales (not shown) agreed moderately with their respective preceptors' ratings, ranging from a low of 0.18 for Learning Opportunities to 0.37 for Climate/Support, and averaging 0.30. Preceptors thought there were more learning opportunities available to students than students reported, and preceptors thought students were providing more pharmaceutical care consultations than students themselves estimated. In terms of numbers of actual (logged) consultations, none of the 5 scales correlated significantly with objective consultation counts. The 5 scales all correlated positively but weakly with adjudicated APPE grades ($r \sim 0.17$) and correlations with portfolio scores correlations were also positive but weak, averaging about 0.14.

Streamlining

To complete a 78-item survey instrument thoughtfully and attentively is a time-consuming and tedious

exercise. To streamline this process, the 78 items constituting the 5 scales were screened and refined according to 5 simultaneous criteria: candidate items for the refined version had to: (1) be highly reliable representatives of their respective scales, (2) be sensitive discriminators between respondent groups and study conditions, (3) be representative of a majority of the 14 pharmaceutical care competencies, (4) yield abbreviated scales that were acceptably reliable in their own right, and (5) correlate highly with the original "long scales." Certain pointers were taken from scales currently used in medicine to document the effectiveness of clinical instruction; in particular, the 26-item Stanford Teaching Evaluation Form (SFPD26) and Cleveland Clinic's 15-item Clinical Teaching Effectiveness Instrument (CTEI) represent brief, to-the-point scales which operationalize about a half-dozen latent traits with 4 or 5 items each, although many other good examples are available.^{33,34} Although other options were tested (5, 7 and 8-item scales), the optimum scale length was found to be 6 items for each of 5 scales, yielding a 30-item streamlined form of an APPE Performance Inventory (API), see Appendix 1.

The scale norms for the streamlined API are reported in section A of Table 2. Means, standard deviations, and ranges for the API short-form are largely comparable to their parallels in the longer survey, but with some helpful differences. Most short-form scale means are fractionally higher except for pharmaceutical care importance, and the standard deviations are uniformly higher suggesting somewhat better scale differentiation. Similarly, the overall reliability coefficients remain above 0.80 (Table 2, section B), and there was only a slight loss of sensitivity to differences between respondent groups or to differences among different APPE structures (section C). Furthermore, certain validity attributes of the streamlined API also improved (Table 2, section D).

Profiling

In table form, scale scores and other measures are not particularly compelling representations of important information. But what a student's Learning Opportunity score of 2.8 might mean or an Ability Gain of 4.1 is less obvious until the scores are transformed into more visually meaningful formats. Graphic scales that are normalized as percentiles provide immediate visual clarity; thus, we transformed the 5 scales to a single sheet API Norms Profile, which allows plotting of students' or preceptors' scores for each scale and provides greater clarity and meaning to their perspectives and experiences. Figure 1 shows a segment of a typical profile, which contrasts student means (S) against preceptor means (P) for the 5 scales, plus an overall total. Note how the right and left far

margins anchor the percentile norms and provide visual guides at the 25th, 50th, and 75th percentile levels. In this cut-away view, preceptors and students are seen to have similar averages for Importance of Pharmaceutical Care Competencies and Ability Gains, while preceptors report substantially greater Learning Opportunities than their students see. Moderate differences also exist for Learning Climate and Preceptor Support, as well as for the Total APPE Score. Note also how the normalizing "irons out" scale-to-scale differences in raw scores, means, and standard deviations, and highlights that might seem like small raw-score differences take on added importance as percentile differences. Further contrasts that could be visually explored include: (1) individual student strengths, weaknesses, or inconsistencies, (2) student-to-student contrasts, (3) student understanding of key instructional features, (4) preceptor grasp of the APPE curriculum, and others. Copies of the API Norms Profile can be obtained from the corresponding author. APPE educators may find that the normalized figures provide clearer information than simple raw numbers or tables.

DISCUSSION

While APPEs are complex experiences, this investigation confirms that they can nevertheless be measured in terms of 6 attributes: (1) how well they inculcate the importance of patient care competencies, (2) agreement with patient care practices and procedures, (3) assessing learning opportunities available during the APPE, (4) measuring ability gains acquired during the APPE, (5) assessing the learning climate and degree of preceptor supports available to students, and (6) providing an overall single index of the APPE's effectiveness. The psychometric analysis of both the long and streamlined survey (API) provided strong evidence that the 5 scales serve as appropriate data-collecting devices for this purpose. While the external validity appears to be weak, this may be a reflection of the fact that the 5 scales are actually new measures of APPE performance; hence, are conceptually novel and need to be considered distinct from portfolio scores or class grades. Thus, measurement of the APPE using the survey adds new precision to measuring routine course or classroom performance.

In this study, the scales successfully detected the benefits of the fully enhanced APPE over the partially enhanced and traditional model. As well, the scales detected differences between the partially enhanced and the traditional sites where the traditional sites generally outperformed the partially enhanced sites on all scales except learning opportunities. Whether these outcomes relate more to differences between pharmacy-chain practices or to honing of preceptor and student skills that occurred

Figure 1. Profile Sheet for Percentilized Norms for APPE Performance Inventory (API): copies can be obtained from corresponding author. Key: S = student means; P = preceptor means.

during the 5 days of pre-APPE orientation is outside the scope of the current study. Additionally, the finding that preceptors sometimes believed certain learning opportunities to be available and obvious when these were not so apparent to the students themselves was important as a first step toward instructional improvements to promote student learning experiences and preceptors' roles as educators and facilitators.

Messick has added new theme of consequential validity to the validity discourse by inviting instructors and program managers to consider carefully how such scales are used and what are their consequences in the lives of students and in the improvement of professional training programs.^{31,32}

Limitations

The study was an end-of-year and end-of-APPE retrospective study; hence, it lacked the immediacy of real-time designs such as the mini-CEX,³⁵ nor did it offer the same comprehensiveness as face-to-face debriefings with course instructors, program administrators or store man-

agers. Additionally, the use of a 5-point scale may have been limiting due to possible ceiling effects or diminished variability with 5-point items, even when all 5-scale points are individually labeled and the end-anchors are widely separated (strongly disagree to strongly agree; not important to critically important). As well, all validation studies are challenged in selecting sensible benchmarks (both internal and external) against which validity can be calibrated. Self-ratings, preceptor ratings, portfolio quality, and course grades are obvious but not exhaustive benchmarks. Longitudinal applications of the API scales pre-APPE, mid-APPE and post-APPE can overcome some of the drawbacks of retrospective methodologies.

This was a single institution's student cohort; accumulating data across different schools of pharmacy in different locations and jurisdictions or across numerous student cohorts in multi-year studies are important extensions to single-site, snapshot studies. We suggest that the streamlined API is a well-grounded starting point for other pharmaceutical care-based pharmacy schools to examine student performance, preceptor alignment,

and instructional specificity. We offer it for other schools to implement in their own programs.

SUMMARY

While community pharmacy APPEs are “a dose of fast reality” for most final-year pharmacy students, the essentials of the APPE experience can be measured and quantified – both in terms of intended content (pharmaceutical care competencies and practices) and of structured exposure to pharmacy community practice. Using the scales represented in the API, gains in students’ abilities were evident both to students and to their preceptors; although, more so in the enhanced than the traditional APPEs. While grounded in a broad and comprehensive retrospective examination of the APPE experience, a streamlined API bears promise as an efficient tool for quick check-ups before, during, and after APPE training.

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Appendix 1. Streamlined Clerkship Performance Inventory – Student Version

A. Important: Different people have different beliefs about the importance of various features of pharmacy practice. Please circle the correct letter code indicating how important each of these statements is to you. Not = Not Important; Slt = Slightly Important; Mod = Moderately Important; Vry = Very Important; Ext =

Extremely Important

How important is...?

1. Integrating patient information (including their disease and medication information) to identify existing actual and potential drug-related problems.	Not	Slt	Mod	Vry	Ext
2. Clarifying with patients how they should monitor their own therapy.	Not	Slt	Mod	Vry	Ext
3. Using treatment guidelines in conjunction with patient-specific characteristics when evaluating different treatment options – both drug and non-drug.	Not	Slt	Mod	Vry	Ext
4. Prioritizing patients' drug-related problems.	Not	Slt	Mod	Vry	Ext
5. Ensuring continuity of care by documenting patient information in forms that could be used by another pharmacist or other health care practitioner.	Not	Slt	Mod	Vry	Ext
6. Pharmacists providing full pharmaceutical care even when it duplicates the efforts of other health care providers.	Not	Slt	Mod	Vry	Ext

B. Agreement: Considering what you actually think and believe, how much do you agree or disagree with the following statements? SD = Strongly Disagree; D = Disagree; N = Neutral; A = Agree; SA = Strongly Agree

Would you generally agree with...?

7. Using patient follow-ups to clarify any misunderstanding or misconceptions that patients may have about their illness or drug therapies.	SD	D	N	A	SA
8. Taking the time and expense to perform patient follow-ups.	SD	D	N	A	SA
9. Graduating and starting to provide pharmaceutical care to patients.	SD	D	N	A	SA
10. Providing pharmaceutical care for all patients on drug therapy.	SD	D	N	A	SA
11. Using pharmaceutical care delivery as a means to identifying and preventing drug-related problems	SD	D	N	A	SA
12. Providing pharmaceutical care even when it seems too time-consuming to be immediately cost-effective.	SD	D	N	A	SA

C. Learning Opportunities: During your SPEP rotation, how difficult was it for you to find the opportunity (or to create the circumstances) to perform or practice each of the following 6 tasks? N = Not Difficult at All; S = Slightly Difficult; M = Moderately Difficult; Q = Quite Difficult; E = Extremely Difficult

13. Integrating patient information (including disease and medication information) in order to identify existing actual or potential drug-related problems.	N	S	M	Q	E
14. Evaluating different treatment options (drug and non-drug) using treatment guidelines together with patient-specific characteristics.	N	S	M	Q	E
15. Questioning patients to determine their current experiences regarding the effectiveness of the drugs they are taking.	N	S	M	Q	E
16. Discussing monitoring parameters with patients regarding their drug therapies.	N	S	M	Q	E
17. Integrating information from patients with multiple problems and drug therapies in order to identify drug-related problems.	N	S	M	Q	E
18. Providing basic pharmaceutical care in practice (as defined in the SPEP manual).	N	S	M	Q	E

D. Gains in Abilities: Since the first day of your clerkship, how much skill and competence have you gained in your abilities to perform each task. N = None at all; L = A Little; S = Some; Q = Quite a lot; E = Extensive gains in ability.