Assessing the Self Efficacy Development in Doctor of Pharmacy Students Enrolled in a Professional Development Seminar Series

Nicholas G. Popovich
Norman L. Katz
Cherdsak Iramaneerat
Everett V. Smith, Jr.

ABSTRACT. The authors assessed the perceived self-efficacy in professional skills and abilities of students enrolled in an elective professional development seminar series over time from four classes of doctor of pharmacy students using their responses to a retrospective 13-question self-efficacy questionnaire along with seven course outcomes questions administered in April 2005. The analysis of questionnaires using the Rasch rating scale model revealed that 44 out of 49 participating students (i.e., 90%) showed statistically significant improvement in self-efficacy after participating in the seminar series. The increase of students' self-efficacy was independent of the number of semesters they had been enrolled. This study also demonstrated a need to include more writing opportunities for the students in future offerings to help improve their

Nicholas G. Popovich, Ph.D., is Professor and Head, Department of Pharmacy Administration, Norman L. Katz, Ph.D., and Cherdsak Iramaneerat, M.D., are Professors in the Department of Biopharmaceutical Sciences, and Everett V. Smith, Jr., Ph.D., is Professor of Educational Psychology at the University of Illinois at Chicago, Chicago, IL.

Address correspondence to: Dr. Popovich at University of Illinois at Chicago, Department of Pharmacy Administration, 833 South Wood Street, Chicago, IL 60612 (E-mail: nickp@uic.edu).

writing skills and to provide opportunities to discuss ethical issues related to the practice of pharmacy. doi:10.1300/J060v14n02_04 *[Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH. E-mail address: <docdelivery@haworthpress.com> Website: <http://www.HaworthPress.com>* © *2007 by The Haworth Press. All rights reserved.]*

KEYWORDS. Professional development, pedagogy, self efficacy, Rasch model, pharmacy students

INTRODUCTION

In Background Paper II: Entry-level, Curricular Outcomes, Curricular Content and Educational Process, the Commission to Implement Change in Pharmaceutical Education recommended that AACP member schools immediately commit themselves to curricular change.[1] Specifically, the schools would commit to engender competencies and outcomes essential to pharmaceutical care and strengthen the effectiveness of the process of pharmaceutical education. In Background Paper II, the Commission identified ten general outcomes/competencies that underlie the education of a professional and citizen. Subsequently, many schools of pharmacy have adopted these as an integral component within their doctor of pharmacy curricula.

The goal of professional education should be to provide students a strong academic pharmacy background and educate them to become well rounded pharmacists so that they can enter the profession with abilities to provide pharmaceutical care to patients. Therefore, a strong foundation in the pharmaceutical sciences that serves as a basis for problem-solving in professional practice is necessary. Curricular instruction should stimulate curiosity, emphasize the scientific method and creative thinking, and afford learning opportunities that develop problem-solving and effective verbal and oral communication skills, among others. This presents a distinct challenge to the colleges, i.e., to deliver "cutting edge" educational methods and strategies that actively involve students in their educational process to develop these skills. The goal, too, must be to help the student develop his/her self-efficacy. That is, if an individual has the requisite knowledge and skills and positive outcome expectations, and personally values the outcome, the self-efficacy expectations ultimately determine the individual's decision to engage in a behavior. It also predicts one's willingness to persist and

persevere when confronting barriers, and possess the resiliency to confront adverse situations.

Bandura has proposed the self-efficacy theory as a model to examine the role of an individual's belief in his/her competence and whether he/she would be capable of successfully performing a particular task.[2] He defined perceived self-efficacy as peoples' judgments of their capabilities to organize and execute a course of action required to attain designated types of performance (i.e., professional skills). Historically, self-efficacy has been used interchangeably with self confidence.[2,3] Confidence in one's ability to perform a certain task parallels perceptions of self-efficacy in performing the task. Self-efficacy is not concerned with the skills a person possesses. It is related with the person's judgment of what he/she can do with those skills. This implies that learning involves more than learning to obtain skills in the environment.[2] One also learns about oneself and one's ability to perform certain actions in certain situations. In the pharmacy curriculum, the interaction between actual ability/skill and perceived ability/skill has important implications for a student as a learner during the Advanced Pharmacy Practice Experiences (APPEs), for example, and ultimately as a future practitioner. Bandura emphasized that effective, competent functioning requires knowledge/skills and self-efficacy beliefs to use them well.[2]

Besides promulgating and conducting educational strategies that foster student development of professional, performance-based skills, it is also important for colleges of pharmacy to help students career plan. It is the observation of the authors that oftentimes students matriculate through the pharmacy curriculum with their "heads down," concentrating on the next examination without paying heed to their future. It is crucial that students be afforded opportunities during their professional years to discover and learn about the breadth of opportunities available on entry into the practice of pharmacy.

At the University of Illinois at Chicago College of Pharmacy (UIC COP), students select an academic advisor toward the end of the first semester of his/her first professional year. This process is "one way" with the student selecting the faculty advisor. There is no "cherry picking" of advisees on the part of the faculty member. After that point, the relationship between student and advisor determines the success of this advising experience. However, without a formal agreement on meeting, oftentimes a student may matriculate through the curriculum with little or no interaction with his/her academic advisor. In response to this, an advising strategy was previously described that successfully nurtured pharmacy students in the development of their performance-based

skills in a manner that was structured and time efficient (i.e., seminar pedagogy).[4] That study described the details and specifics of an ongoing Advisor's Seminar Series (now renamed as the Professional Development Seminar series) which employs an academic advising model to mentor students. Specifically, the faculty member's advisees enrolled in an elective, one credit hour course, for the fall and spring semesters during the academic year for a letter grade (i.e., A, B, C, D).

The Professional Development Series was a concept designed to create a "win-win" situation for the student and his/her academic advisor. At that time, the data reported the outcome of the model for only first and second professional year students.[4] Subsequently, these students have now matriculated through the curriculum and have continued to enroll in this elective course offering each subsequent semester when it did not conflict with another elective in which the advisee wanted to enroll. Thus, the basis of the present study was to assess their continual development over this time and also that of academic advisees from the following classes. Thus, the objectives of this study were to 1) assess the perceived development of professional skills and abilities of enrolled students in the development seminar series over time and 2) evaluate student outcomes from four different classes of doctor of pharmacy students participating in the professional development seminar series.

METHODS

Course

The Professional Development Seminar Course is an elective one-credit-hour course conducted for pharmacy advisees of the two pharmacy authors. Each semester, beginning in the Spring Semester of the first professional year, the academic advisees meet for *en masse* one hour per week with their advisor and participate in a number of in-class "hands on" activities designed to nurture and develop performance-based abilities (e.g., communication skills, interpersonal skills, problem-solving skills). Each class meets independently. In addition, guest presenters are invited to these sessions to share with students about themselves and their career journey. Guests are provided with a template of questions consistent with their professional pharmacy position[4] that they can use to facilitate their session with students. These guests come from all strata of the profession of pharmacy, e.g., academia, clinical practice, long-term care, the pharmaceutical industry.

The intent of the informal, interactive sessions is to help shape students' thoughts about their future career possibilities. At the end of each guest session, students must write a reflective essay on what they have learned from the session. The intent is to get students to think reflectively and provide an opportunity to develop their writing skills. Students are instructed to submit an electronic copy of their essay to the faculty advisor and to place a print-based copy in their pharmacy portfolio. At the end of each semester, students are asked if there are any particular "career types" of presenter to invite for the subsequent semester offering. From those suggestions, potential presenters are identified and invited to participate. In general, all classes over time receive the same instruction except for small adjustments made based on students' needs assessments (e.g., career types of individuals to invite).

Subjects

The subjects used in this study were the academic advisees of the two pharmacy authors. The UIC Office for the Protection of Research Subjects granted approval and exemption status for this research project. In April 2005, 49 enrolled students (12 males; 37 females) from the Classes of 2005, 2006, 2007, and 2008, were administered a retrospective 13-question self-efficacy questionnaire along with seven course outcomes questions. Students were informed that participation was anonymous and voluntary. Females made up 76% of the sample, which was similar to their percentage in the Classes of 2005 though 2008 (637 of 952, 67%).

Study Design

Subjects were assessed in terms of course outcomes using a questionnaire administered at the end of the academic year (Appendix 1). The questionnaire had been previously described and validated for measuring student-perceived learning processes and outcomes.[4] This questionnaire was composed of two sections. The first section focused on evaluating the change in students' self-efficacy, using a single group posttest design with a retrospective pretest.[4-6] The second section focused on obtaining students' perception of outcomes of the course. In the first section, subjects were instructed to rate their levels of self-efficacy on various areas of knowledge and skills addressed in the course at two time points (before and after completing the course sequence) using a five-point rating scale (weak, fair, good, very good, and excellent).

Because there were four groups of students and the items used in the first section were developed based on students' needs assessment at the beginning of the course, each class received slightly different sets of items depending upon the learning experiences they had during the academic year. Thus, the Classes of 2005, 2006, and 2007 received the same set of items which included items 1-4 and 6-13. The Class of 2008 received items 1-3, 5-7, and 13.

In the second section students were asked to give agreement ratings on the statements provided using a four-point scale (disagree, tend to disagree, tend to agree, and agree). These statements described various areas of potential course outcomes. The items used in the second section were also slightly different among classes depending on the course content and the relevance to the activities at their levels of the study program. The classes of 2005 and 2006 received items 14-18. The Class of 2007 received items 14-19. The Class of 2008 received items 14, 16-18, and 20.

In addition to the self-efficacy and course outcome sections, the questionnaire also included three open-ended questions used to soliciting opinions from students about the topics addressed in the course.

Measurement Model

Because the items used in the questionnaire were rated on an ordinal scale, raw scores are not appropriate for mathematical operations using parametric statistics.[7,8] Thus, the investigators employed the Rasch rating scale model to convert raw scores to measures on an interval scale. The Rasch rating scale model is an item response theory model for polytomous items that assumes a common rating scale structure across all items.[9-11] It employs a logarithmic function of odds that a student with a given level of latent trait would provide a high rating over a low rating on a particular item to define a student's measure of latent trait and an item difficulty level on the same scale, called *logit scale*. In this study, there was interest in two latent traits, as measured by two sections of the questionnaire. The first section measured students' self-efficacy in pharmacy professional skills. The second section measured students' perception of course outcomes. Students with high logit measures were the ones who provided high ratings, indicating high levels of self-efficacy and perception of having significant improvement in skills by the course. On the other hand, items with high high logits were items that were difficult to endorse and, generally, received low ratings.

Statistical Analyses

Self-Efficacy Questionnaire

The fit of the data to the Rasch rating scale model was evaluated with standardized infit and outfit mean-square statistics. Outfit mean-square statistics are based on unweighted mean square residuals (the differences between observed and expected scores). They summarize how much the observed scores are different from model expectations. However, they are quite sensitive to unexpected responses made by persons on items that are far too easy or too difficult for them to endorse. Infit mean-square statistics are based on weighted mean square residuals so that responses made by persons on items which are far too easy or difficult for them to endorse have less influence on their values.[12] These fit statistics are then transformed into standardized statistics (infit and outfit ZSTDs) that have an approximate unit normal distribution with an expected value of 0 and a standard deviation of 1. Subjects or items with standardized fit statistics equal to or lesser than -2 or equal to or greater than 2 exhibit poor fit to the model expectations. Values equal to or less than -2 indicate observations are too predictable (i.e., redundancy, overfit of the data to the model). Values equal to or greater than 2 indicate unpredictability (i.e., unmodeled noise, underfit of the data to the model).[13]

The quality of questionnaire items in differentiating levels of self-efficacy of students was evaluated with the student separation reliability and student separation ratio. Student separation reliability (analogous to Cronbach alpha) is the ratio of true variance to observed variance and represents the proportion of variance that is not due to error.[14] Its value can range from 0 to 1. As the separation reliability sometimes suffers from ceiling effects, the student separation ratio should also be reported. The student separation ratio is an index of the spread of student measures relative to their measurement error. Its value can range from 0 to infinity.[14] Higher values of both student separation reliability and student separation ratio suggest that items functioned well in separating students with high latent trait from those with low latent trait.

To demonstrate the perceived improvement of self-efficacy in pharmacy professional skills, subjects' measures of self-efficacy were compared before and after taking the course using the Wolfe and Chiu procedure.[15] This procedure was first developed by Wright[16] and elaborated by Wolfe and Chiu.[15] The procedure applies an equating technique to rating scale data to ensure that the changes in students'

measures from before to after taking the course sequence represent real changes in self-efficacy and are not due to changes in students' interpretations of questionnaire items and rating scale categories. The Wolfe and Chiu procedure was implemented using the Facets computer program.[17]

After equating measures of self-efficacy before and after taking the course on to the same scale, the actual change in self-efficacy was assessed for each participant by examining the standardized difference between the estimates from the two time points (i.e., z-scores). A z-score between -2 and 2 indicates no statistically significant change in measure as a result of the course. A z-score equal to or greater than 2 indicates significant increase in the measure, while a value equal to or lesser than -2 indicates significant decrease in the measure.

The differences between the four classes in their self-efficacy changes were examined with the analysis of covariance (ANCOVA), assessing the differences in their mean self-efficacy measures after taking the course sequence, having mean self-efficacy measures before taking the course sequence as a covariate. The analysis was performed under the assumption of a Type I error rate of .05 using the SPSS computer program.[18]

Course Outcome Questionnaire

The standardized fit statistics, separation reliabilities, and separation ratios of students and items were evaluated using the same method described for the course sequence self-efficacy questionnaire using the Winsteps computer program.[19] The measures of student perception of course outcome of the four classes were then evaluated with one-way analysis of variance (ANOVA) to test whether the four classes perceived the course to have the same amount of outcome measures. The Scheffe' test was used in the post-hoc analyses to demonstrate which pairs of classes have significant difference in mean outcome measures.

RESULTS AND DISCUSSION

Self-Efficacy Questionnaire

An initial analysis (i.e., before implementing the Wolfe and Chiu procedure) of student self-efficacy data before taking the course yielded a student separation reliability of .85 and a separation ratio of 2.40. All

items demonstrated fit statistics within the acceptable range except the standardized outfit statistic of Item 1 (i.e., knowledge about the diversity of pharmacy career choices) which had a value of 2.5. An analysis of student self-efficacy after taking the course yielded a student separation reliability of .83 and a separation ratio of 2.23. Two items showed significant misfit, including Item 6 (i.e., interpersonal skills) which had both standardized infit and outfit statistics of −2.8, and Item 8 (i.e., STAR interviewing technique) which had standardized infit and outfit statistics of 2.8 and 3.0, respectively.

Using the Wolfe and Chiu procedure, measures of self-efficacy before and after taking the course were calibrated on to the same logit scale, as demonstrated in the variable map (Figure 1). Student measures of self-efficacy before taking the course ranged from −6.47 to 0.80 logits with a mean of −2.10 logits and a standard deviation of 1.23 logits. The student separation reliability was .84 and a separation ratio was 2.26. Student measures of self-efficacy after taking the course sequence ranged from −1.05 to 4.61 logits with a mean of 0.83 logit and a standard deviation of 1.11 logits. The student separation reliability was .81 and the separation ratio was 2.10. Comparing student measures before and after taking the course sequence, the course sequence was associated with an increase in students' self-efficacy.

After calibration of item measures on the same logit scale, item measures before taking the course had a separation reliability of .87 and a separation ratio of 2.54. The item that was easiest to endorse was Item 6 (i.e., interpersonal skills), which has an item measure of −1.38 logits. The most difficult item to endorse was Item 8 (i.e., STAR interviewing technique), which had an item measure of 1.58 logits. Two misfitting items were Item 1 (i.e., knowledge about the diversity of pharmacy career choices) (standardized outfit = 2.12) and Item 7 (i.e., oral communication skills) (standardized infit and outfit = −2.15). Item measures after taking the course sequence had a separation reliability of .92 and a separation ratio of 3.34. The item that was easiest to endorse was Item 2 (i.e., content of a *curriculum vitae*), which had an item measure of −1.46 logits. The most difficult item to endorse was Item 8 (i.e., STAR interviewing technique), which had an item measure of 2.31 logits. Three misfitting items were item 3 (i.e., ability to develop a *curriculum vitae*) (standardized infit = −2.15 and standardized outfit = −2.13), Item 6 (i.e., interpersonal skills) (standardized infit = −3.31 and standardized outfit = −3.41), and Item 8 (i.e., STAR interviewing technique) (standardized infit = 3.31 and standardized outfit = 3.41) (Table 1).

FIGURE 1. Variable map of student and item measures of self-efficacy before and after the course. Each student is represented with a number ranging from 1 to 49, following by a letter representing the class of that student (a = class of 2005, b = class of 2006, c = class of 2007, d = class of 2008). Each item is represented with a number ranging from 1 to 13. Measures on the far left column are in logit units. Students and items underlined are those with no significant change in measures from before to after the course sequence. All other students and items are those with significant change in measures.

```
|Measr|+Student      before  |+Student       after    |-item before|-item after |
-------------------------------------------------------------------------------------
      |  High self-efficacy  | 9b                      |  Difficult to endorse     |

  4 +                        +                         +            +              +


                              45d

  3 +                        +                         +            +              +
                              7a

                              34c
                              3a                                                 8
  2 +                        + 13b   16b               +            +            +
                              24c   2a
                                                                    8
                              10b   14b   1a
                              22c   29c   5a
                              40d   41d   42d   46d  49d
  1 + 45d                    + 11b   15b   31c         +            +            +
                              30c
                              35c   39c   47d  48d  8b     3              4
       41d                     12b   25c   27c             2      4
                              37c                          1             12
                              26c   28c                                  7
                              18b                                        5
  0 +                        + 21c                     +  10         +   +
                              36c   44d                   11             9   10 11 13
       29c   35c               19b   20c   33c  38c        12    13
                              17b   4a                     5     7    9
       13b                     23c                                     1
       36c                                                              3   6
 -1 + 10b   37c              + 32c   43d   6a          +            +            +
       24c
       11b   30c   40d   44d                              6              2
       20c   43d   48d   49d  7a
       34c   8b
       25c   38c   46d   47d
       19b   26c
 -2 + 9b                     +                         +            +            +
       16b   33c   3a    5a
       42d
       1a

       21c   22c   27c   28c
 -3 + 12b   2a               +                         +            +            +

       4a

       31c   39c   6a
 -4 + 15b   18b              +                         +            +            +

       14b   17b


 -5 +                        +                         +            +            +
       23c



 -6 +                        +                         +            +            +
       32c                     Low self-efficacy           Easy to endorse
-------------------------------------------------------------------------------------
|Measr|+Student      before  |+Student       after    |-item before|-item after |
-------------------------------------------------------------------------------------
```

TABLE 1. Item Difficulty Measures and Their Fit Statistics of Items in the Self-Efficacy Questionnaire

Items	Before the course				After the course			
	Measure	S.E.	InfitZSTD	OutfitZSTD	Measure	S.E.	InfitZSTD	OutfitZSTD
1	0.37	0.22	0.41	**2.12**	-0.52	0.21	-1.05	-0.99
2	0.52	0.23	0.07	-0.62	-1.46*	0.23	-1.58	-1.43
3	0.73	0.23	0.54	-0.27	-0.65	0.22	**-2.15**	**-2.13**
4	0.42	0.26	-0.75	-0.78	0.73	0.22	-0.97	-0.92
5	-0.55	0.42	-0.51	-0.47	0.18	0.45	0.90	0.86
6	-1.38*	0.20	-0.37	-0.40	-0.75	0.22	**-3.31**	**-3.41**
7	-0.43	0.20	**-2.15**	**-2.15**	0.26	0.20	-0.87	-0.77
8	1.58^{+}	0.35	0.01	-0.21	2.31^{+}	0.23	**3.31**	**3.41**
9	-0.56	0.23	-1.46	-1.29	-0.21	0.23	-1.76	-1.65
10	0.06	0.25	-1.47	-1.58	-0.10	0.23	-0.08	-0.20
11	-0.23	0.24	0.94	0.37	-0.15	0.23	1.14	0.99
12	-0.29	0.24	-1.27	-1.43	0.44	0.22	-1.66	-1.62
13	-0.26	0.21	-0.04	0.04	-0.08	0.21	0.23	0.02

Note: Extreme fit statistics (overfit and underfit) are listed in bold text.
Items 4, 5, 8, 9, 10, 11, and 13 are items with no significant change in measures between two time points.
* The easiest item to endorse.
+ The most difficult item to endorse.

After the course sequence Items 2 and 3 were significantly easier to endorse than before the course sequence because students were initially introduced to the concept, content and development of the *Curriculum Vitae* (*CV*) during the first professional seminar. In addition, Item 1 (i.e., knowledge about the diversity of pharmacy career choices) was also become significantly easier after the course sequence because students were exposed to a number of guest speakers from a variety of pharmacy careers each semester.

Initially, Item 6 (i.e., interpersonal skills) was easy to endorse. A review of the course enrollees demonstrates that most were involved in

on-campus student groups and many eventually became leaders of their respective organizations. In addition, over 50% of the students had previously earned a baccalaureate degree. Thus one would expect that it would be easy for them to endorse that item given their experience in working with others. It was not surprising that Item 8 (i.e., STAR interviewing technique) was the most difficult to endorse at the beginning and at the end of the course sequence. This is because only one class, i.e., Class of 2005, was exposed to this technique. The Classes of 2006, 2007, and 2008 had never experienced it.

After equating student and item measures, the standardized difference between measures was examined to determine which students and which items had statistically significant change in self-efficacy measures between the two time points. Among the 49 subjects, only five students did not have significant improvement in self-efficacy measures. Forty-four students (90%) demonstrated statistically significant improvement in self-efficacy after participating in the course (Figure 1).

Because of the anonymity of the subjects, it is difficult to ascertain why five students did not show significant improvement in their self-efficacy. It was possible that all five had already attained a high degree of self-efficacy. Figure 1 demonstrates that these five students (indicated on the variable map by underlined numbers) were comparatively higher in self-efficacy at the beginning of the course sequence and that after completion their gain in self-efficacy was not that great, and in comparison to the remaining subjects they were now "in the middle of the pack" or towards the bottom. The lesson learned for future research is to capture more student demographic information (e.g., whether the subject had earned a prior degree before admission, whether the subject was a member of an organization).

To assess whether the course sequence was associated with different levels of self-efficacy improvement for students among the four classes, an analysis of covariance (ANCOVA) was conducted, comparing mean self-efficacy measures of the four classes after taking the course, controlling for the effects students' self-efficacy before taking the course. Table 2 summarizes mean self-efficacy measures of the four classes before and after taking the course sequence. These measures showed no evidence of violation of statistical assumptions for ANCOVA (including homogeneity of variance, homogeneity of regression slopes, independence of errors, normality, and linearity). When controlling for the difference in self-efficacy measures before taking the course sequence, there was no statistically significant difference in self-efficacy measures after taking the course between the four classes ($F(3,44) = 2.27$, $p =$

TABLE 2. Measures of Students' Self-Efficacy of the Four Classes Before and After the Course Sequence

Class	Number of students	Before the course		After the course	
		Mean	S.D.	Mean	S.D.
2005	7	-2.61	0.75	1.14	1.40
2006	12	-2.57	1.36	1.18	1.35
2007	20	-2.32	1.54	0.47	0.83
2008	10	-1.18	1.02	0.91	1.08

.09). This indicated that the course exposure was associated with improved students' self-efficacy in their professional skills, regardless of how many years they were in the program.

There were some items that were classified as misfit items. It is important to focus on items with high positive fit statistics because these can distort the measurement. From Table 1, the specific items identified were Item 1 (before the course) and Item 8 (after the course). High fit statistics imply that the observed ratings were largely different from what the model expects. With respect to Item 1 (i.e., knowledge about the diversity of pharmacy career choices), some students may have "undervalued" or "overvalued" their knowledge of career choices in reflection back to the time before they were enrolled in the seminar series. With respect to Item 8 (i.e., ability to use the STAR interviewing technique), as mentioned previously, because the majority of the students (i.e., Classes of 2006, 2007, 2008) were not exposed to this technique, students could be confused and had no knowledge of it, leading to random responses.

Course Outcome Questionnaire

An analysis of the course outcome questionnaire (items 14-20) using the Rasch rating scale model yielded a student separation reliability of .61 with a separation ratio of 1.25. Student measures of perception of course outcome ranged from -1.35 to 5.08 logits with a mean of 1.52 logits and a standard deviation of 1.91 logits (Figure 2). Item measures had a separation reliability of .79 with a separation ratio of 1.96. The

FIGURE 2. Variable map of student and item measures of perception of course outcome. Each student is represented with a number ranging from 1 to 49, following by a letter representing the class of that student (a = class of 2005, b = class of 2006, c = class of 2007, d = class of 2008). Each item is represented with a number ranging from 14 to 20. Measures on the far left column are in logit units.

```
-----------------------------------------------------------------
| Measr| +Students                                   ||-items   |
-----------------------------------------------------------------
|      |  Achieving higher outcomes                  || Difficult|
+    4+  3a    5a    7a   13b  16b  24c  45d  47d  +  to achieve|
|      |                                             |          |
|      |                                          2a |          |
|      |                                          T  |          |
|      |                                         49d |          |
|      |                                             |          |
+    3+                                               +         +
|      |                                             |          |
|      |                                         39c |          |
|      |              8b   12b  14b  15b  17b         |          |
|      |                                             |          |
|      |                                         41d S|         |
+    2+                                         30c  +          +
|      |                                             |          |
|      |                                             |          |
|      |                                             |T         |
|      |             22c  25c  29c  31c  34c         |          |
|      |                            42d  46d  |  16   |          |
+    1+                                         +     +          +
|      |              1a    6a    9b  18b  19b M|      |          |
|      |                            21c  32c   |S     |          |
|      |                                         |  18  |          |
|      |             10b  40d  43d  44d  48d  |  15   |          |
+    0+                   20c  33c  37c  38c   +M 14  +          +
|      |                                             |          |
|      |                                         S|  19  |        |
|      |             4a   11b  23c  26c  27c  28c  |S    |          |
+   -1+                                         +     +          +
|      |                                         |  17  |         |
|      |                            35c  36c   |      |          |
|      |                                         |T    |          |
|      |                                         T|    |          |
+   -2+                                               +          +
|      |                                             |          |
|      |                                             |          |
|      |                                             |          |
+   -3+                                               +          +
|      |                                             |          |
|      |                                             |          |
|      |                                             |          |
+   -4+ Achieving lower outcomes                 +  20        +
-----------------------------------------------------------------
| Measr| +Students                                   ||-items   |
-----------------------------------------------------------------
```

easiest item to endorse was Item 20 (establishing rapport), which has a course outcome measure of −4.57 logits. The most difficult item to endorse was item 16 (improving writing skills), which has a course outcome measure of 1.14 logits. Two items in this questionnaire showed evidence of misfit to the model: Item 14 (ability to blend knowledge with skills), which has a standardized infit statistic of −2.66 and a standardized outfit statistic of −2.56, and Item 18 (interest in a career in pharmacy education), which has a standardized infit statistic of 2.40 and a standardized outfit statistic of 2.32 (Table 3).

The positive misfit statistic for Item 18 (i.e., interest in pursuing an academic career) might indicate that it was measuring something different from the remaining items. It would appear that as the other items directly addressed student activities within the pharmacy curriculum (i.e., skills, clerkship rotation, rapport with one's faculty advisor), Item 18 did not. The negative misfit statistic for Item 14 (i.e., an ability to blend knowledge with skills) indicated the redundancy in students' responses to this item. Students only rated tend to agree or agree on this item (i.e., no ratings of disagree or tend to disagree) and their responses were not quite useful in differentiating those with high latent trait on course outcome from those with low latent trait.

TABLE 3. Item Difficulty Measures and Their Fit Statistics of Items in the Course Outcome Questionnaire

Items	Measure	S.E.	Infit ZSTD	Outfit ZSTD
14	0.06	0.32	**-2.66**	**-2.56**
15	0.08	0.35	-1.45	-1.50
16	1.14+	0.31	-0.02	0.03
17	-1.20	0.33	0.63	0.61
18	0.36	0.32	**2.40**	**2.32**
19	-0.45	0.46	0.38	0.43
20	-4.57*	1.87	0.00	0.00

Note: Extreme fit statistics (overfit and underfit) are listed in bold text.

* The easiest item to endorse.
+ The most difficult item to endorse.

To assess whether the four classes had achieved the same level of course outcomes, an analysis of variance (ANOVA) was conducted comparing mean course outcome measures among the four classes. The analysis of variance revealed that there were statistically significant differences in mean course outcome measures between the four classes ($F(3,45) = 3.23$, $p < .05$). However, post-hoc pair wise comparison with the Scheffe' test showed no significant differences in group means between all pairs of classes. From specified contrast tests, it was determined that the average course outcome measure of the Classes of 2005, 2006, and 2008 was significantly higher than the course outcome measure of the Class of 2007 (contrast = 4.74, S.E. = 1.59, $t(45) = 2.98$, $p <$ .05). That is, students in the Class of 2007 perceived that they benefited less from taking the course sequence than those in the Classes of 2005, 2006, and 2008.

Open-Ended Questions

With respect to the three open-ended questions, for question one (concepts learned in the course that will help your professional development) the consensus across the four classes of students included *curriculum vitae* (*CV*) development, microteaching/presentation skill development, guest speakers, interpersonal/communication skill exercises, and the time and stress management exercises. For question two, (indicate one professional course topic that they would consider replacing with another), the consensus was that some of the "in-class" interpersonal skills exercises, "character-habits," "values," and "success/failure," among others might be combined. The thought was that overall some of these exercises are opinion-based with philosophy and overlap. The students' concerns and criticism might be valid. However, a caution before doing this too soon would be the loss of valuable time for "in class" discussion which is focused toward the development of interpersonal and communication skills. Also, students do not understand the value of open discussion as a method to include everyone, and do not always "connect the dots," with respect to the value of the individual session with others in the continuum of learning. It is important for the instructor to reinforce periodically the basic intent of these exercises as these develop and enhance communication skills.

In response to the third question, the most frequent suggestions for in-class discussion in future offerings were information about the professional licensure examination (i.e., NAPLEX) and a discussion on tips/guidance for job interviews. Thus, it appears that the inclusion of the STAR interviewing technique would be a good addition back into

the course sequence. Subsequently, NAPLEX information has been implemented for third professional advisees in this seminar series. The third question also asked the students to identify those topics that should not be changed and maintained within the professional development series. The frequent answers to this question across the four classes of students included the guest speakers, the microteaching exercises, *CV* development, and the interpersonal skills exercises.

Since the inception of the professional development seminar series four years ago, two additional pharmacy educators-practitioners from the Department of Pharmacy Practice have created their own professional development seminar series for their advisees. They have developed their own semester course syllabi using the framework established by the authors. They also have invited their own guest speakers to meet their advisees needs. However, when there is mutual interest in a speaker across the four faculty members' advisees, an *en masse* session is planned for all of the advisees.

This research has also demonstrated a method for students to assess their development of professional abilities through a professional development seminar series. Further, it has provided the faculty insights to improve the offerings on a continual basis and develop a relationship with their advisees. The authors believe that this form of "connection" between pharmacy advisees is well worth the time and effort. Having three classes of advisees on campus (i.e., P1, P2, P3) during the semester necessitates only three hours of the week beyond preparation for the group sessions. Experience of the authors demonstrates that preparation time for all three groups of students total does not take more than an average of one hour per week once the original time investment to prepare materials is completed. With time, the assignments are "tweaked," as needed and the inviting of guest speakers takes place one to two months before the semester begins. While the start up preparation necessitates time investment, eventually this aspect becomes small. The authors highly recommend implementing this type of professional development seminar series for one's advisees and welcome the opportunity to guide interested, fellow academicians in implementing such a teaching/learning strategy. The return on investment cannot be calculated because the reward is intangible.

LIMITATIONS

This study involved doctor of pharmacy students who were enrolled in the professional curriculum at the University of Illinois at Chicago

College of Pharmacy. As mentioned earlier, within the professional curriculum, pharmacy students select their academic advisees rather than being assigned or "cherry picked" by faculty. The results of this study might not apply to a situation where students do not enroll into the professional development seminar series sequence on a volunteer basis. Furthermore, the results might not be applicable to other programs that employed a different format of the Professional Development Seminar Series. In addition, there was no control group in any of the classes to rule out "confounding" factors within the curriculum that might also help the students to develop self-efficacy.

This study employed a retrospective pretest/posttest format. This method of assessment was utilized because the traditional pretest was not thought to be an effective tool and, predictably, would provide student "over estimation" or "inflated" responses to the items. When one can reflectively think back on the experience/intervention, one is more apt to be able to discern between "then" and "now." Further, this format provides data that can be used to evaluate the effectiveness of a professional development intervention, and unlike the traditional pretest, does not risk negatively impacting intervention effectiveness by introducing terms and concepts unknown to the participants before they encounter them. Alternatively, this format does have some limitations. There is always the possibility of "fabricated" and/or biased responses. The participants may think there is a need to demonstrate a "learning effect." Participating students were instructed, however, to be honest and forthright in their completion of the self efficacy questionnaire. Further, memory recall, history, and regression to the mean may introduce threats to validity. Methodologically, this evaluation mechanism challenges traditional logic because the pre-data and post-data are collected at the same time.

CONCLUSION

This study has demonstrated that the professional development seminar series was an effective means to develop rapport between the advisees and their advisor. It also was associated with an increase in student knowledge and self-efficacy about the diversity of pharmacy career choices and the content, development, and updating of a *curriculum vitae*. Further, the seminar series helped improve students' ability to self assess their learning needs, and increase students' interest in selecting an elective, P4 academic-clerkship rotation. This evaluation also dem-

onstrated a need to include more writing opportunities for the students in future offerings to help improve their writing skills and more opportunities to discuss ethical issues related to the practice of pharmacy.

REFERENCES

1. Background Paper II. Entry-Level, Curricular Outcomes, Curricular Content and Educational Process. *Am J Pharm Educ* 1993; 57(4): 377-385.

2. Bandura A. *Self-efficacy: The Exercise of Control*. WH Freeman and Company, New York NY, 1997.

3. Pintrich PR, Schunk DH. *Motivation in Education: Theory, Research, and Applications*, Prentice Hall, Englewood Cliffs NJ (1996).

4. Popovich NG, Jackson TR. Evaluation of a Seminar Pedagogy as a Means for Developing Positive Advisor/Advisee Relationships. *Am J Pharm Educ* 2004; 68(3): article 64.

5. Jackson TR, Popovich NG. The development, implementation, and evaluation of a self-assessment instrument for use in a pharmacy student competition. *Am J Pharm Educ* 2003; 67(2):article 57.

6. Nicholson T, Belcastro PA. Retrospective pretest-posttest analysis versus traditional pretest-posttest analysis. *Psychol Rep* 1985; 57:525-526.

7. Merbitz C, Morris J, Grip JC. Ordinal scales and foundations of misinference. *Arch Phys Med Rehab* 1989; 70:308-312.

8. Wright BD, Linacre JM. Observations are always ordinal; measurement, however, must be interval. *Arch Phys Med Rehab* 1989; 70:857-860.

9. Andrich D. Application of a psychometric rating model to ordered categories which are scored with successive integers. *Appl Psych Meas* 1978; 2:581-594.

10. Anderson EB. The rating scale model. *In* van der Linden WJ, Hambleton RK, eds. *Handbook of modern item response theory*. New York: Springer-Verlag, 1997. pp. 67-84.

11. Andrich D. A rating formulation for ordered response categories. *Psychometrika* 1978; 43:561-573.

12. Wright BD, Masters GN. *Rating scale analysis*. Chicago, IL: MESA Press, 1982.

13. Linacre JM. What do infit and outfit, mean-square and standarized mean? *Rasch Meas Transaction* 2002; 16(2):878. Available from: URL: http://rasch.org/rmt/rmt162f.htm. Accessed October 2005.

14. Fisher WP, Jr. Reliability statistics. *Rasch Meas Transaction* 1992; 6(3):238. Available from: URL: http://www.rasch.org/rmt/rmt63i.htm. Accessed October 2005.

15. Wolfe EW, Chiu CWT. Measuring pretest-posttest change with a Rasch rating scale model. *J Outcome Meas* 1999; 3:134-161.

16. Wright BD. Time 1 to time 2 comparison. *Rasch Meas Transaction* 1996; 10(1):478-479. Available at: http://www.rasch.org/rmt/rmt101f.htm. Accessed October 2005.

17. Linacre JM. Facets [computer program]. version 3.57. Chicago, Ill.: Winsteps, 2005.

18. SPSS Inc. SPSS for Windows [computer program]. version 11.5. Chicago, Ill.: SPSS Inc., 2002.

19. Linacre JM. Winsteps [computer program]. version 3.57. Chicago, Ill.: Winsteps, 2005.

APPENDIX 1. Professional Development Seminar Self-Efficacy and Course Outcome Questionnaire

Section One: Self-Efficacy Questionnaire Items
For items 1-13, consider your experience with the advisor's professional development course, please rate each statement on a five-point scale:

0 = weak   1 = fair   2 = good   3 = very good   4 = excellent

A. as you initially felt before you attended the course, and
B. as you feel now (after participating in the course).

1. My knowledge about career choices in pharmacy
2. My knowledge about the content of a curriculum vitae
3. My ability to develop my own curriculum vitae
4. My knowledge about behavioral interviewing techniques
5. My ability to execute effective time management principles
6. My ability to interact effectively (i.e., interpersonal skills) with my fellow advisees
7. My oral communication skills in small groups
8. My ability to use the STAR interviewing technique
9. My knowledge about ethical issues related to the practice of pharmacy
10. My confidence in my ability to create a microteaching lesson
11. My confidence in developing learning objectives for my microteaching lesson
12. My confidence in my ability to deliver a microteaching lesson
13. My self-confidence as a pharmacy student at this point in my program

Section Two: Course Outcomes Items
For items 14-20, please rate your agreement on each of the following statements on a four-point rating scale:

0 = disagree 1 = tend to disagree 2 = tend to agree 3 = agree

14. As a result of this professional development course, my ability to blend knowledge with skills improved.
15. As a result of this professional development course, my ability to engage in scholarly activities (i.e., poster, in-service presentation) improved.
16. As a result of this professional development course, my writing skills improved.
17. As a result of this professional development course, my ability to self-assess my learning needs has improved.
18. As a result of this professional development course, my interest in pursuing a career in pharmacy education has increased.
19. As a result of this seminar, my interest in pursuing a clerkship rotation with instructors of this course has increased.
20. The advisor has established rapport with students during class.

Section Three: Open-Ended Questions

21. List two topics/concepts that you have learned in this professional development course series which you believe will be useful to you in your professional development.

22. During your professional development course experience, select the one professional development course topic that you would consider "replacing with another topic" and explain what contributed to your decision.

23. To date (i.e., from all your semesters attending the professional development course), select one professional development course topic that you would consider "a keeper" and explain what components of the topic contributed to your decision.