

Evaluating Preceptors' Perceptions of Student Preparedness for Advanced Pharmacy Practice Experiences

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ABSTRACT. The objective of this study was to evaluate preceptors' assessment of students' preparedness for advanced pharmacy practice experiences (APPE) following a problem based learning (PBL) curriculum. A questionnaire instrument was administered anonymously in March 2004 and March 2005 to rate the adequacy of students' preparedness in the areas of knowledge acquisition, self-directed learning, and clinical reasoning. Preceptors reported optimal performance by students in researching reputable and pertinent primary literature (90%), incorporating primary literature into patient care decision making (73%), efficiently retrieving current medical information (94%), and evaluating drug regimen appropriateness based on the patient population (78%). Preceptors reported only average performance in identifying significant drug interactions (33%) and incorporation of knowledge from all academic disciplines (28%). Student performance in identification of drug assistance programs was reported to be less than optimal (52%). A majority of preceptors report students successfully perform in APPE after completion of PBL-based curricula in the third professional year. Areas

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BACKGROUND

The use of problem-based learning (PBL) in the training of health-care professionals incorporates goals for students that are much broader than the acquisition and application of content. PBL has been described as both a curriculum and a process that demands from the learner “acquisition of critical knowledge, problem solving proficiency, self-directed learning strategies, and team participation skills. PBL is expected to influence the ‘whole’ student, or, at least, many aspects of the students’ learning experience (1).” In PBL, problems are discussed in small groups of students. In this collaborative learning environment, students learn from interacting with each other by explaining the materials to another student, by asking and answering questions and through discussion (2). The group process in PBL allows a variety of perspectives to inform and influence students regarding the problems faced and the resolution strategies considered, in the care of patients in the cases discussed, which can aid in the transition from classroom to clinical practice. Health professionals that cannot continue to direct their own learning after the classroom will not have the skills necessary to meet the challenges of the ever-changing healthcare environment and provision of patient care (3).

Currently, the University of Mississippi (UM) School of Pharmacy utilizes PBL as the sole teaching method during the third professional year to incorporate advanced therapeutics, applied pharmacokinetics, physiology, pathology, and physical assessment. A Drug Information Skills course in the fall semester and an Ethics course in the spring are also in the third professional year, which are a combination of didactic lectures and group activities. The skills obtained in the Drug Information Skills and Ethics are applied within the PBL courses. The change to the PBL format was initiated to provide students with the necessary

skills to become competent healthcare providers, to be prepared to utilize and further develop these skills in APPEs, and to facilitate becoming life-long learners. Our PBL process consists of three distinct pharmaceutical care courses: (1) Group Participation, (2) Knowledge and Comprehension, and (3) Problem-solving. Small group work has been shown to reinforce the exchange of multiple perspectives and student-led discussion increases reliance on peers' perspectives and contributions to creating knowledge (4). Within the group, students must be encouraged and constrained to substantiate opinions, ideas, and hypotheses with evidence (5). At UM, overall class size ranges from 80-90 students which are randomly assigned to a PBL group for each eight week block. Typically, courses have ten groups with eight students per group, facilitated by a pharmacy school faculty member in two to three sessions per week. Each session lasts approximately two to three hours. Groups participate in discussions regarding at least one progressive disclosure case (e.g., type 2 diabetes mellitus) each week in which individual pages are distributed so the student acquires knowledge about the patient gradually. The students also discuss topics related to mini-cases (e.g., acne) in which the topics are not as expansive as those illustrated in progressive disclosure cases and can be covered in one group meeting. These cases or problems have been referred to as the driving force behind students learning in PBL and are used to engage students' actively in their own learning. Problems are used in PBL to stimulate students to construct new knowledge actively that is linked strongly with their previously acquired knowledge (2). Each student is evaluated by the faculty facilitator on his participation in the group process in regards to knowledge acquisition, self-directed learning, and clinical reasoning.

Knowledge and Comprehension tests the students' knowledge recall through exams every four weeks testing the concepts, disease states, and medications that were covered through the PBL group sessions. The third section is Problem-solving where the students are evaluated according to Bloom's taxonomy of application, analysis, synthesis, and evaluation (6). A Problem-solving examination is administered every eight weeks where the focus of the skills being tested are directly related to application of knowledge, analysis of information, synthesis of data, and evaluation of a patient case and medication therapy, respective to progression of the eight-week examinations.

The PBL process at UM has evolved over the past nine years, with changes being implemented as the faculty became more familiar with the mechanics of the program. The process of testing and evaluation have become more organized and focused. Many of these changes were

implemented with the intent to improve the students' preparedness for performance on Advanced Pharmacy Practice Experiences (APPE). For example, the testing process has changed from one inclusive exam every eight weeks to the present policy of a Knowledge and Comprehension exam every four weeks and a separate Problem-solving exam every eight weeks. This was restructured to allow the students to be more focused in their preparation and therefore retain more of the knowledge to apply clinically in the APPE setting. The expectation is the students will be equipped with the knowledge base and skills after the third professional year to successfully complete APPE. During APPE, the expectation is that students will be directed to refine the skills consistent with professional competencies and outcomes (7).

It was the intent of this program evaluation to assess student preparedness for APPE as determined by the preceptors in the fourth professional year. Data had not been collected from preceptors as to their perception of student preparedness at anytime prior to this evaluation. The goal of this evaluation was to identify potential areas of instruction in the third professional year that are adequately preparing students, as well as those areas in need of modification based on preceptors' perceptions.

DESIGN

A questionnaire was used to collect data from UM's preceptors as to the perceptions of students' level of preparedness for APPE in the last year of pharmacy school. Preceptors at UM include voluntary faculty (preceptors), adjunct faculty (paid, part-time faculty) as well as full-time faculty, both tenure and non-tenure track. All preceptors of pharmacy students in their last year of pharmacy school were invited to participate in this anonymous questionnaire as a part of the annual UM Preceptors Conference in March 2004 and March 2005. It was believed that a better response rate would be achieved through active data collection than if the questionnaire had been mailed to the preceptors. A global assessment of all students precepted during the reporting time was requested, not a specific evaluation of any student; therefore the use of preceptor's records maintained at the practice sites was not necessary. Participation was voluntary and those who agreed to participate were asked to specifically evaluate only those students in the 2004 and 2005 graduating classes as to their abilities throughout the course of the APPE. There had been no changes to the first or second professional

year's curriculum for these students that could have affected their preparedness for APPE.

The PBL assessment committee comprised of UM faculty members developed the questionnaire utilizing the currently used evaluation tool at UM to assess group performance during the third professional year. The tool includes student learning outcome objectives in the areas of knowledge acquisition, self-directed learning, clinical reasoning, and communication, which were directly reflected in the questionnaire. Committee members did not participate in the questionnaire regarding their interactions with and perceptions of students. The 17-item questionnaire was then transferred to scantron readable format for manual completion. A Likert scale of 1 - 5 was utilized with 1 = very well prepared and 5 = very poorly prepared.

RESULTS

Data collected from each year of the assessments (2004 and 2005) were combined for the conclusions in this report. The percentages reported are a compilation of all responses for both years and are a percentage of preceptors who responded with each choice, not a mean or median. Seventy-one of 141 current preceptors (50%) attended the 2004 annual UM Preceptors Conference and participated in answering the questionnaire; 51% in 2005. The pharmacists who participated had precepted students in a variety of APPE settings including institutional, community practice, and ambulatory care; the average number of students per preceptor per year was three (range: 1- 14). These preceptors represented a cross-section of those who had precepted students for many years as well as those with 2 years experience or less. There was no advanced notice of this questionnaire so participants relied on memory, not written records of student performance. With the anonymous questionnaire, preceptors were asked to make a global assessment of student performance, not individual evaluations.

The results of the questionnaire items have been organized into five different categories: knowledge acquisition, self-directed learning, clinical reasoning, communication, and miscellaneous and are presented in Tables 1, 2, 3, 4, and 5. A response of very well or well was considered optimal; a response of somewhat was considered average; and poor or very poor was considered less than optimal.

TABLE 1. Preceptor responses for items related to Knowledge Acquisition (%)

Incorporate knowledge from all academic disciplines when discussing a patient problem						
	Very Well	Well	Average	Poorly	Very Poorly	NA
2004 (n=70)	18.6	45.7	31.4	1.4	1.4	1.4
2005 (n=73)	8.3	58.3	23.6	6.9	0.0	2.8
Overall	13.4	52.1	27.5	4.2	0.7	2.1
Discuss disease states and drug therapies at the basic science level						
	Very Well	Well	Average	Poorly	Very Poorly	NA
2004 (n=71)	22.5	46.5	28.2	1.4	0.0	1.4
2005 (n=72)	26.4	51.4	16.7	4.2	1.4	0.0
Overall	24.5	49.0	22.4	2.8	0.7	0.7
Accurately perform pharmaceutical calculations						
	Very Well	Well	Average	Poorly	Very Poorly	NA
2004 (n=71)	26.8	38.0	22.5	8.5	0.0	4.2
2005 (n=73)	17.8	49.3	24.7	1.4	2.7	4.1
Overall	22.2	44.8	23.6	4.9	1.4	4.2
Research reputable and pertinent primary literature to enhance patient care decisions						
	Very Well	Well	Average	Poorly	Very Poorly	NA
2004 (n=71)	47.9	42.3	8.5	1.4	0.0	0.0
2005 (n=73)	31.5	58.9	6.9	1.4	0.0	1.4
Overall	39.6	50.6	7.6	1.4	0.0	0.7
Effectively critique the merits of primary and tertiary literature						
	Very Well	Well	Average	Poorly	Very Poorly	NA
2004 (n=69)	13.0	60.9	18.8	0.0	2.9	4.4
2005 (n=71)	16.9	49.3	29.6	0.0	1.4	2.8
Overall	15.0	55.0	24.3	0.0	2.1	3.6
Efficiently retrieve appropriate current medical information						
	Very Well	Well	Average	Poorly	Very Poorly	NA
2004 (n=71)	54.9	38.0	5.6	0.0	0.0	1.4
2005 (n=72)	54.2	40.3	5.6	0.0	0.0	0.0
Overall	54.6	39.2	5.6	0.0	0.0	0.7

Knowledge Acquisition

Thirteen percent of preceptors rated students' incorporation of knowledge from all academic disciplines when discussing a patient problem as very well, 52% well, and 28% average. When asked to discuss disease states and drug therapies at the basic science level, 25% of preceptors viewed students' ability as very well, 49% well, and 22% av-

TABLE 2. Preceptor responses for items related to Self-Directed Learning (%)

Avoid plagiarism in written assignments

	Very Well	Well	Average	Poorly	Very Poorly	NA
2004 (n=70)	24.3	34.3	11.4	0.0	1.4	28.6
2005 (n=72)	34.7	34.7	11.1	1.4	0.0	18.1
Overall	29.6	34.5	11.3	0.7	0.7	23.2

TABLE 3. Preceptor responses for items related to Clinical Reasoning (%)

	Very Well	Well	Average	Poorly	Very Poorly	NA
2004 (n=71)	25.4	52.1	15.5	2.8	1.4	2.8
2005 (n=72)	13.9	54.2	25.0	1.4	4.2	1.4
Overall	19.6	53.2	20.3	2.1	2.8	2.1

Evaluate the appropriateness of a drug therapy regimen based on the patient problem

	Very Well	Well	Average	Poorly	Very Poorly	NA
2004 (n=71)	23.9	52.1	21.1	0.0	0.0	2.8
2005 (n=73)	15.1	64.4	12.3	5.5	0.0	2.7
Overall	19.4	58.3	16.7	2.8	0.0	2.8

Evaluate the appropriateness of a drug therapy regimen based on patient information

	Very Well	Well	Average	Poorly	Very Poorly	NA
2004 (n=71)	25.4	47.9	22.5	1.4	0.0	2.8
2005 (n=72)	15.3	61.1	16.7	2.8	1.4	2.8
Overall	20.3	54.6	19.6	2.1	0.7	2.8

Evaluate drug therapy regimen based on characteristics of agents within a drug class

	Very Well	Well	Average	Poorly	Very Poorly	NA
2004 (n=71)	19.7	45.1	26.8	5.6	0.0	2.8
2005 (n=72)	13.9	55.6	22.2	5.6	0.0	2.8
Overall	16.8	50.4	24.5	5.6	0.0	2.8

Identify clinically significant drug interactions

	Very Well	Well	Average	Poorly	Very Poorly	NA
2004 (n=71)	25.4	28.2	42.3	1.4	0.0	2.8
2005 (n=72)	16.7	48.6	23.6	6.9	1.4	2.8
Overall	21.0	38.5	33.0	4.2	0.7	2.8

TABLE 4. Preceptor responses for items related to Communication (%)

Effectively communicate verbally with other healthcare professionals						
	Very Well	Well	Average	Poorly	Very Poorly	NA
2004 (n=71)	31.0	35.2	25.4	8.5	0.0	0.0
2005 (n=72)	25.0	52.8	16.7	2.8	2.8	0.0
Overall	28.0	44.1	21.0	5.6	1.4	0.0
Effectively communicate in writing with other healthcare professionals						
	Very Well	Well	Average	Poorly	Very Poorly	NA
2004 (n=71)	21.1	32.4	28.2	1.4	1.4	14.1
2005 (n=73)	13.7	42.5	21.9	11.0	4.1	6.9
Overall	17.4	37.5	25.0	6.3	2.8	10.4
Effectively communicate verbally with patients about medications and disease states						
	Very Well	Well	Average	Poorly	Very Poorly	NA
2004 (n=71)	21.1	45.1	25.4	1.4	0.0	7.0
2005 (n=72)	13.9	59.7	18.1	2.8	0.0	5.6
Overall	17.5	52.5	21.7	2.1	0.0	6.3

TABLE 5. Preceptor responses for miscellaneous items (%)

Accurately and completely process a prescription or hospital order to dispense medications						
	Very Well	Well	Average	Poorly	Very Poorly	NA
2004 (n=69)	26.1	33.3	20.3	5.8	1.5	13.0
2005 (n=72)	25.0	26.4	16.7	2.8	1.4	27.8
Overall	25.5	29.9	18.4	4.3	1.4	20.6
Identify and utilize State and National drug assistance programs						
	Very Well	Well	Average	Poorly	Very Poorly	NA
2004 (n=71)	11.3	15.5	29.6	21.1	2.8	19.7
2005 (n=71)	4.2	16.9	36.6	12.7	1.4	28.2
Overall	7.8	16.2	33.1	16.9	2.1	23.9

erage. Accurately performing pharmaceutical calculations was ranked as 22% very well, 45% well, 24% average, and 5% poor.

Self-Directed Learning

Forty percent of preceptors viewed students' ability to research reputable and pertinent primary literature to enhance patient care decisions

as very well, 51% well, and 8% average. Students' skill to effectively critique the merits of primary and tertiary literature was rated as 15% very well, 55% well, and 24% average, while 2% rated students as very poorly prepared. Fifty-five percent of preceptors evaluated students' proficiency to efficiently retrieve appropriate current medical information as very well, 39% well, and 6% average. Students' competence in avoiding plagiarism in written assignments was observed by 30% of preceptors as very well, 35% well, 11% average, and 23% omitted the question.

Clinical Reasoning

Twenty percent of preceptors thought the students incorporated primary literature into patient care decisions very well, 53% well, 20% average, and 3% poorly. Evaluation of the appropriateness of a drug therapy regimen based on the patient problem was ranked as 19% very well, 58% well, and 17% average. Evaluating the appropriateness of a drug therapy regimen based on patient specific information was evaluated as 20% very well, 55% well, and 20% average. The preceptors viewed the students' ability to evaluate the appropriateness of a drug therapy regimen based on the specific characteristics of agents within a drug class as 17% very well, 50% well, 25% average, and 6% poor. The students' ability to identify clinical significant drug interactions was rated as 21% very well, 39% well, and 33% average.

Communication

Twenty-eight percent of preceptors observed that students could effectively communicate verbally with other healthcare providers very well, 44% well, 21% average, and 6% poorly. Effective communication in writing with other healthcare professionals was viewed as 17% very well, 38% well, 25% average, and 10% omitted the question. The students' skill to effectively communicate with patients about medications and disease states was rated as 18% very well, 53% well, 22% average, and 6% omitted the question.

Miscellaneous

Twenty-six percent rated students' ability to accurately and completely process a prescription or hospital order to dispense medications as very well, 27% well, 18% average, 4% poorly, and 21% omitted the

question. Students' identification and utilization of State and National drug assistance programs was viewed as 8% very well, 16% well, 33% average, 17% poor, 2% very poor, and 24% omitted the question.

DISCUSSION

Assessment of student learning is an important component of program evaluation as defined by the Accreditation Council for Pharmacy Education (ACPE) Accreditation Standards and Guidelines for the Professional Program in Pharmacy Leading to the Doctor of Pharmacy Standard No. 15: Assessment and Evaluation of Student Learning and Curricular Effectiveness (7). The expectation is that the school must develop and carry out assessment activities to collect information about the attainment of desired student learning outcomes. Our questionnaire was conducted to obtain an additional preceptor perspective, other than APPE grades, regarding the achievement of professional competencies. The specific desired student learning outcomes or competencies from the third professional year PBL-based curricula were incorporated into the questionnaire development to determine students' performance in APPE based on the preceptors' perception.

The results compiled from the questionnaire provided areas of strength of the students' performance, as well as areas for improvement from the preceptors' perceptions. Seventy-five percent or greater combined response of very well and well was considered an area of strength. Greater than 30% combined response of average, poor and very poor was considered to be an area for evaluation to determine the need for improvement.

In the area of knowledge acquisition, preceptors viewed that students had optimal performance when incorporating knowledge from all academic disciplines when discussing a patient problem (65%), discussing disease states and drug therapies at basic science levels (77%), and accurately performing pharmaceutical calculations (67%). Average or less than optimal student performances were reported approximately 30% in these three categories (32%, 26%, and 30%, respectively). The item regarding incorporation of knowledge from all academic disciplines did not outline the specific disciplines that students focus on during the PBL process (e.g., physiology, pathology, pharmacotherapy, pharmacokinetics). This item may have been open for interpretation by the preceptor, as it did not specify which academic disciplines to consider. In regards to pharmaceutical calculations, there is not a direct em-

phasis on calculations during the PBL curricula because this skill is taught earlier in the program. However, pharmaceutical calculations is regarded as an important factor in patient care as it has been reported that as many as 13% of reported medication errors were related to miscalculation (8). The aim for upcoming classes will be to focus on opportunities that exist for students to review these previously taught skills during PBL progressive disclosure cases.

In the area of self-directed learning, preceptors reported that students gave optimal performance when researching reputable and pertinent primary literature (90%), efficiently retrieving current medical information (94%), and effectively critiquing the merits of primary and tertiary literature (70%). With the abundance of medical information resources available, students must acquire the skill of identifying appropriate sources, and become proficient in incorporating the information into their written and verbal communications. Searching the literature has been identified as one of the most difficult skills to achieve as it requires students to learn about databases, develop search strategies relevant to learning objectives, and to use critical appraisal strategies to select literature (9).

Although only 64% of preceptors responded very well or well regarding avoidance of plagiarism in written assignments, 23% respondents did not feel this question was applicable to their APPE specific competencies (i.e., did not require written research assignments). Of the preceptors who viewed this question as applicable (2004 $n = 50$, 2005 $n = 59$), 84% reported students' performance was optimal. We consider this area of self-directed learning to be a strength of the PBL process. Continual reinforcement of the unacceptability of plagiarism and the importance of acknowledging authorship of sources is essential, especially in the medical community, as the internet makes plagiarism easy, but its detection difficult (10).

In the area of clinical reasoning, preceptors responded that students performed optimally when incorporating primary literature into patient care decisions (73%); evaluating the appropriateness of a drug therapy regimen based on the patient problem (78%), and based on patient specific information (75%). Only sixty percent of preceptors reported that students identified clinically significant drug interactions optimally and 39% reported average or less than optimal. Specific emphasis is placed on recognizing drug interactions during the PBL process and this area for improvement will be brought to the attention of the faculty for evaluation and suggestions for modification. However, this weakness may be

attributed to the challenges of transitioning from the classroom to clinical practice.

In the area of communication, preceptors observed that students had optimal verbal communication with other healthcare professionals (72%) as well as optimal communication with patients about medications and disease states (70%). It is acknowledged, however, that preceptors reported average or suboptimal communication 28%, and 24%, in these areas, respectively. Sixty-one percent of the preceptors that required written communication in their APPE (2004 $n = 61$, 2005 $n = 68$) viewed students' communication in writing with other healthcare professionals (e.g., progress notes) as optimal. This is an interesting finding since verbal and written communications are integral parts of the PBL process and students are directly evaluated weekly in the third professional year regarding their communication with peers and faculty. It is acknowledged that communication is an evolving process and students can pass through different stages of development and refinement as they transition into professionals. Four stages have been identified in the process of student communication: affirming the self, engaging the patient, communication breakdown, and refining the repertoire (11). Refinement occurs when the student has a variety of communication experiences and personal style has been developed. This process could be applied to all levels of communication and could continue to develop as the student transitions from school to practice. From the academic standpoint, the PBL group performance evaluation tool will be reviewed to ensure clarity of specific evaluation of communication with both healthcare professionals and patients.

Another area for improvement that was acknowledged was identifying and utilizing state and national drug assistance programs. Fifty-two percent of preceptors reported that students had average or less than optimal preparation in this area. This is not a concept that is specifically addressed in the PBL process. However, seminars have been scheduled to introduce and educate the students on the utilization of these programs.

Since there had not been an evaluation of preceptors' perceptions of student preparedness for APPE prior to initiation of PBL at UM, we are unable to compare previous students' preparation from a didactic curriculum with students completing the PBL-based instruction. In a study by Nii and Chin, grade point average (GPA) in APPE was used as a measure of practice capability to compare students who were taught using PBL versus didactic lecture in their third professional year. In both required APPE (acute care medicine, ambulatory care, psychopharmacy

and community pharmacy) and elective APPE, the GPA for students in the PBL group was significantly higher than the GPA in the didactic lecture group. The authors concluded that students who received PBL in their third year have better performance in APPE as evidenced by GPA (12). In a study by Ives, Deloatch, and Ishaq, preceptors indicated via a survey that pharmacy students' abilities improved in the areas of problem-solving and interactions with patients and healthcare providers after PBL curricula was introduced in the second and third professional years (4).

A limitation of the evaluation might be the preceptor's ability to recall information about all students from the past year, merge them all together in an equally weighted fashion, and then respond to the questionnaire. It could make a difference in the response if the preceptor had two students in the course of a year compared to the preceptor who worked with 14 students. Additionally, the preceptors were surveyed in March of each year at the annual Preceptor's Conference and it is possible that the preceptor could have additional students from March to May, which could not be factored into their response.

Student performance on specific APPE (i.e., community practice, ambulatory care, adult medicine, institutional) could not be reported, which is another potential limitation. For future initiatives, data will be collected and analyzed to determine if the PBL-based curricula prepare students adequately for different types of APPE and an expanded comparison study of UM PBL prepared students and students from another school of pharmacy using a didactic curriculum will be pursued.

Since this was an anonymous questionnaire with global assessment of performance, each student's academic record cannot be compared with the preceptors' comments and evaluation. Another focus for the future will be to determine the amount of direct face-to-face interaction time the preceptor has with the student, and compare with the evaluation of students' performance to determine if a relationship exists between quantity of time spent with a student and perception of performance.

CONCLUSION

There is no guarantee that students who learn to work successfully as a group in the PBL context will be able to transfer that success to participation on healthcare teams in clinical pharmacy practice. Our data show that a majority of preceptors report students were adequately prepared

for APPE in most of the areas included in knowledge acquisition, self-directed learning, clinical reasoning, and communication after completion of PBL-based curricula. However, areas in need of further evaluation of preparation such as pharmaceutical calculations, clinically significant drug interactions, and patient assistance programs have been identified and will be addressed through curricular changes.

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