Assessments of the impact that new teaching strategies have on pharmacy students’ professional practice abilities are limited. This study compared an active learning, case-based, student-centered teaching approach (class of 1998) to a lecture-based approach (class of 1997) for a therapeutic course sequence. An assigned case write-up on clerkship provided a course-removed ability assessment. A primary-trait scoring rubric was developed and used by clinicians and non-clinicians to score 120 random sampled, blinded cases. A significant improvement in overall score, organization and persuasiveness traits was found for cases written by students in the intervention group. Trends to improvement were seen among this group in readability, tone and clinical accuracy. Student performance on a professional practice-based task improved following a format change in a therapeutics course sequence.

INTRODUCTION

Reflecting change across North American general and professional postsecondary education(1-4), the pharmacy education community acknowledges the need to use teaching methods that help students develop the abilities they need to practice pharmacy(5-8). To develop their critical thinking, complex problem solving, and communication abilities the educational community recognizes that students need active engagement in their learning. The literature on active learning is conclusive: students learn more in classroom settings that use active learning strategies(9-11). As a result, increasing numbers of pharmacy educators report modifying the traditional lecture format with methods such as problem-based and collaborative learning, case-based education, and combinations of classroom assessment techniques designed to actively engage students in the learning process(12-16). Few studies in the pharmacy education literature, however, have assessed the outcomes of active learning(12,15).

Practicing pharmacists confront complex problem-solving tasks as an on-going part of their daily practice, activities that course-embedded assessments rarely address. A gap exists between the abilities assessed in the classroom and the abilities deemed essential for day-to-day professional practice. Student learning is almost always assessed in the short term as course-embedded assessment activity that predominantly shows what and how much course material students remember and understand. Such assessment, however, has its limitations. Course-embedded assessment often focuses primarily on lower-order student learning (e.g., the levels of basic knowledge recall, comprehension and application)(17-18), revealing little about the development of students’ critical thinking and professional problem solving and communication abilities. Yet it is these higher-order abilities that we claim our pharmacy curricula develop through the teaching methods we choose(19).

An ideal model for determining what effect a particular teaching method has on professional ability development would include a control population, be course removed, and would require students to complete a recognizable professional practice task. Many issues combine to make it difficult to conduct such assessment: control populations are not always readily available, student ability assessment may not always be an institutional priority, and tight resources must be allocated. Yet, in the midst of the types of curricular change underway across the pharmacy education community, there exists the possibility (albeit often encountered fortuitously) for such assessment activities to occur.

This article reports the results of one such assessment opportunity made possible by curricular change within a college of pharmacy that saw a mainstay element of the pharmacy curriculum, the multi-course pharmacotherapy sequence, shift from a traditional lecture format to a case-based, student-centered course format. Providing a control as well as an intervention population, this change in teaching approach allows one to test the claims about the benefits to student learning that result from the use of active, student-centered instruction.

BACKGROUND

In the fall of 1996, the three-course Clinical Pharmacotherapy sequence (CPT 1-3) (9 credits) offered to Bachelor of Pharmacy students was revised. This course was taught by full-time and adjunct faculty to approximately 130 students in a large classroom setting starting in the fall of their fourth year (professional year 2). The course had been previously taught using a teacher-centered, content-focused lecture. In the original course, students received a four hour introductory session on pharmaceutical care, were given readings prior to class, and attended a one to two hour lecture twice a week (which occa-
METHODS

Study Group and Intervention

Students from the 1997 and 1998 graduating Bachelor of Pharmacy classes participated in the study. Both groups’ undergraduate pharmacy curriculum included the three semester Clinical Pharmacotherapy (CPT) sequence, however, in different instructional models: the 1997 graduating class experienced the predominantly lecture-based, teacher-centered course, and the 1998 graduating class experienced the active-learning, case-based, student-centered course.

During postdidactic BS clerkship rotations (spring semester, fifth year), both student groups were asked to complete two two-page written summaries of patients with whom they had been clinically involved with during one of each of their clinical (usually hospital or ambulatory care based) and community clerkships. Students were requested to use a patient case write-up format that contained six sections: case description (patient summary), drug-related problem (with justification), desired therapeutic outcome, therapeutic alternatives, recommendation and a monitoring plan. Each completed patient case report was to contain enough information so that, “someone reading the report would be able to understand the case presented and the reasoning behind the clinical decisions.” Completed cases were submitted to the students’ clerkship preceptors, who forwarded them to the clerkship coordinator. Preceptors received only the information about the task provided to the students. Once received, the cases were coded and blinded for student name, year of graduation, and clerkship site.

Design of Assessment Process

Ten patient cases (five per class) were randomly selected from the 372 documents collected and used to develop a five-domain (Organization, Tone, Clinical Accuracy, Readability, Persuasiveness) primary-trait scoring rubric for assessing documents in the larger pool. The investigators refined, and tested the scoring instrument (see Appendix) using this document set, augmented by 10 documents (five randomly selected per class) from the larger pool. They developed both the scoring guidelines, as well as the orientation and training program for faculty evaluators.

The resulting block of twenty pre-scored cases also provided a “control” pool. This set contained examples of each possible score. From this set, ten documents that provided clear examples of each possible rating were used to train faculty scorers. The remaining ten documents were returned to the larger sample set selected from the overall document pool for scoring in this study. This control set often pre-scored documents consisted of two documents scored 1, three documents scored 2, three documents scored 3, and two documents scored 4.

Scorer Selection and Training

Six faculty members representing the College’s three departments, including the two investigators, served as case evaluators: three were members of the Pharmacy Practice faculty; three represented the Humanities & Social Sciences and Basic & Pharmaceutical Sciences departments. Scorer training included a 1.5 hour overview and norming session using ten “rangefinders”— pre-selected and pre-scored cases. Faculty evaluators were provided on-going training and scoring clarification as needed during the scoring process.

Scoring Process

Fifty-five documents were randomly selected from the patient cases submitted by students in each class. These 110 documents were blinded and photocopied twice. Ten pre-scored control cases (5/1997; 5/1998) were inserted into the sample pool and the resulting 120 documents were randomly sorted into six scoring groups. Each case was included in two scoring packets (240 total scores). Each participating faculty member scored 40 cases, assigning a performance level in each category of the rubric (unless they were unable to do so). They then assigned an overall performance level score. This score was not calculated from the other rubric component scores, but was the scorer’s overall assessment on a scale of 1-4.

Data Analysis

Entering fourth year GPAs and gender distribution between the two groups of students whose cases had been randomly chosen were analyzed to ensure comparability of the two groups.

Data was entered into an Access database. Mann-Whitney (rank sum) test was used to determine significance of scores between the two classes, between clinician and non-clinician
RESULTS

Kategories—tone, readability, clinical accuracy—showed trends toward improvement for the post-intervention group.

No significant difference was found with overall scores between clinical and community sites in 1997 or 1998 ($P=0.60$ and $P=0.67$ respectively). Cases received from community ($P=0.07$) or clinical ($P=0.15$) clerkships did not have significantly different overall scores between 1997 and 1998. However, for both types of clerkship a trend towards improvement was seen post-intervention.

Clinician and non-clinician faculty scorers did not score differently in overall scores ($P=0.83$) or in the organization ($P=0.96$), tone ($P=0.54$) and persuasiveness ($P=0.91$) primary traits. Clinicians gave significantly lower clinical accuracy scores and significantly higher readability scores than non-clinicians.

DISCUSSION

Student performance on a professional practice-based task improved following a format change in a therapeutics course sequence that emphasized an active learning, student-centered teaching approach. And, unlike most assessments linked to changes in teaching approach, this study focused on an outcome both removed from the course in which it was used, and recognized as important to the practice of pharmacy(19). The results of this assessment project are encouraging because they provide needed and compelling documentation to support claims that the “active” instructional approaches advocated by pharmacy education produce performance gains seen beyond the pharmacy classroom.

Various aspects of the new course format likely contributed to this positive outcome. The course uses a predefined problem-solving algorithm for every in-class case discussion. The algorithm takes students through a critical thinking process that is analogous in many respects to the information-processing, analysis, and decision-making used during on-the-job patient care. Students practiced using this algorithm 10-15 times per semester in the large classroom and they used this process to successfully complete the course exams (a percentage of exam marks were given for appropriate process use). The written examination format also gave students experience in a writing task that is closely-related, although not identical, to the patient case write-up clerkship task assessed in this project.

By the completion of the pharmacotherapeutics course sequence, students are closer to internalizing an approach to patient care that they can apply consistently. They have also practiced therapeutic problem-solving linked to real-life application of content. This access to a standardized problem-solving process was particularly helpful when students faced the more clinically complicated patients typically found on clerkship. This internalized problem-solving process allowed them to effectively organize and analyze the larger amount of data often available on these patients. As a result, the common practice task of assessing an actual patient became manageable and the written presentation of this information became more organized.

The gains seen in the 1998 class in the persuasiveness levels of their patient case write-ups are particularly important. In practice, pharmacists must often rely on others to make final decisions regarding patient care and to then implement the needed activity. As such, in their face-to-face and written interaction with patients and their care-givers, pharmacists rely heavily on their ability to persuade others to enact the desired course of action. The statistically significant improvements in
organization and persuasiveness, combined with the discernable trends toward improvement in the other assessed domains, result in documents from the 1998 graduates that are deemed more successful, at a statistically significant level overall, than were the documents written by the students in the 1997 control population.

This study demonstrates that even with a tangible decrease in therapeutic content, students did not demonstrate less clinical accuracy in comparison to their fellow students who “covered” more material in class. In fact, these students’ patient case write-ups demonstrate a discernable trend toward increased levels of clinical accuracy.

Faculty are often reluctant to use teaching formats that encourage more student discussion and require engaged critical thinking. A principle reservation is based on the accurate perception that the in-class time devoted to these activities reduces the amount of content that the faculty can “cover” in comparison to the traditional lecture(9,10) even though research effectively demonstrates that the traditional lecture does not increase student learning. Information density in most college classroom lectures is two to three times that which most individuals can process effectively and then retain for long periods(21). When the new approach was introduced in the therapeutics course, content coverage decreased by approximately 30-40 percent, with priority given to keeping topics considered essential to the entry-level pharmacist. For example, the headache section in the revised CPT course focuses on the management of migraines (treatment and prevention) and does not deal extensively with management of tension and eliminated the management of cluster headaches.

The improvement witnessed in professional tone and readability is not statistically significant. Two factors potentially explain the discernable trend towards the more professional tone used by members of the 1998 BS class (the post-intervention group). Because students in the revised course had many more opportunities to hear and use professional discourse in the classroom and on examinations, they had more practice using this type of specific language. Students become more comfortable with and confident in their ability to use medical terminology when they have practiced it in a low-risk learning environment. This increased practice should bolster their confidence in their ability to use this terminology in situations where doing so gains them recognition as health care professionals.

Readability as a primary trait showed a trend (not statistically significant) toward improvement between the pre- and post-intervention groups. This finding is not surprising for the following reasons. This domain in the rubric was created to assess such factors as students’ ability to create written documents that conform to the standards of edited English. As such, issues considered in the scoring of these documents included how careful edited and proofread the submitted documents. The yardstick used in this assessment did not assume perfectly “clean” documents, just documents for which existing typographical, mechanical, and grammatical errors did not significantly affect a reader’s ability to read the document smoothly. Yet, it must be noted that because the assignment directions did not stipulate that the patient case write-ups were to be considered formal writing assignments, students were probably not necessarily inclined to devote the attention to this stage of the writing process needed to ensure “clean” final documents. Likewise, the materials provided to students did not indicate that the activity would be part of their clerkship assessment.

Limitations
This study’s findings should be considered in light of the following limitations. Students submitted self-selected cases and not all students completed the assignment. As a result, there is no guarantee that the documents submitted represent these students’ best work. This particular selection bias should have had little effect on study results, however, because the assignment was the same for both groups of students and any bias would have affected both groups equally. Additionally, the scoring rubric was not validated.

Implications
On-going auricular change in pharmacy education offers useful assessment opportunities. Particularly important are the opportunities that exist in many experiential components of the curriculum to assess student ability development removed from the didactic components of the curriculum. Assessments such as the one described in this article present pharmacy educators much needed feedback on what students are able to do with the knowledge, skills and attitudes that the pharmacy curriculum is designed to develop.

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(16) Zlatic, T., Developing Thinking Abilities within Pharmacy Education: A Sourcebook, St. Louis College of Pharmacy and American Association of Colleges of Pharmacy, St. Louis MO (1995).
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APPENDIX. SCORING RUBRIC FOR CASES

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<th>Case #:__________</th>
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<tr>
<th>Score</th>
<th>Organization</th>
<th>A1</th>
<th>Follows directions; adheres to format requested</th>
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<tr>
<td></td>
<td>A2</td>
<td>Patient history is thorough and relevant</td>
<td>Does not follow directions completely; required elements missing</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>A3</td>
<td>Organization of information is logical and efficient; organization aids</td>
<td>Follows directions minimally; if at all</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Tone</td>
<td>B1</td>
<td>Tone is professional; Author comes across as Confident and competent</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tone shifts within document</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tone is not confident—that of a Novice</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Clinical Accuracy</td>
<td>C1</td>
<td>Drug and disease state information is accurate</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C2</td>
<td>Assessments link clearly to patients history</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C3</td>
<td>Assessment and recommendations demonstrate student's mastery of material</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Readability</td>
<td>D1</td>
<td>Surface-level distractions (misspellings/typos, grammatical, mechanical problems) are few, if any</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Persuasiveness</td>
<td>E1</td>
<td>*Document is designed to be persuasive—to convince a reader to do something Specific</td>
<td>4</td>
</tr>
</tbody>
</table>

*This element is apparent only in the most superlative documents. Rhetorical sophistication is a skill not considered fully developed at this point in a student's professional development.

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<th>Page(s)</th>
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American Journal of Pharmaceutical Education Vol. 65, Summer 2001

163