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# RESEARCH ARTICLES

## Multiple Rubric-based Assessments of Student Case Presentations

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**Objectives.** To evaluate a rubric-based method of assessing pharmacy students' case presentations in the recitation component of a therapeutics course.

**Methods.** A rubric was developed to assess knowledge, skills, and professional behavior. The rubric was used for instructor, student peer, and student self-assessment of case presentations. Rubric-based composite scores were compared to the previous dichotomous checklist-based scores.

**Results.** Rubric-based instructor scores were significantly lower and had a broader score distribution than those resulting from the checklist method. Spring 2007 rubric-based composite scores from instructors and peers were significantly lower than those from the pilot study results, but self-assessment composite scores were not significantly different.

**Conclusions.** Successful development and implementation of a grading rubric facilitated evaluation of knowledge, skills, and professional behavior from the viewpoints of instructor, peer, and self in a didactic course.

**Key words:** rubric, pharmacy, peer assessment, self-assessment, assessment

## INTRODUCTION

The Accreditation Council for Pharmacy Education (ACPE) Standards 2007 encourage the multidimensional assessment of knowledge, skills, and behaviors.[1] While knowledge and skills are the focus of our assessment efforts in the didactic coursework, the evaluation of professional behavior has been lacking. The recitation component of a *Therapeutics I* course offered an ideal environment for formally assessing each of the 3 dimensions because of its small group setting and emphasis on the application of material presented in the didactic component of the course. A method of multidimensional assessment was developed that would provide students with an opportunity to reflect upon and provide feedback regarding their own performances and that of their peers.

We describe a pilot study and implementation of a grading rubric that facilitates assessment of student case presentations from 3 sources: instructors, peers, and self. The objectives of the pilot study were to (1) determine the difference between checklist and rubric-based instructor scores; (2) determine the difference between composite instructor, peer, and self-assessments using the rubric; and (3) determine the difference between instructor, peer, and self-assessments for each dimension (knowledge, skills, and behavior) of the rubric. We also describe our experience with implementation of the rubric as the formal grading method in the subsequent academic year.

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## METHODS

Approval was obtained from the Institutional Review Board (IRB) at the University of Arkansas for Medical Sciences to conduct the study. A waiver of written informed consent was granted and students indicated consent by participating in the study. All second year (P2) pharmacy students who were enrolled in the spring 2006 *Therapeutics I* course were invited to participate.

Recitation is a weekly 2-hour practical case-based portion of the *Therapeutics I* course for P2 pharmacy students at the University of Arkansas for Medical Sciences College of Pharmacy, Little Rock. It is facilitated by pharmacy residents and fellows who have clinical instructor appointments with the College of Pharmacy. In spring 2006, students were assigned to 1 of 6 sections, which were further divided into 4 small groups of 3-4 students each. During the first hour of recitation, students worked in small groups to review therapy recommendations for the case and prepare presentations; instructors provided guidance during this hour. All students received the same 4 cases each week and each was expected to prepare for all cases before the recitation session. Cases closely parallel the lectures presented in the didactic portion of the course. The second hour was devoted to case presentations, with 1 student per small group presenting a patient case. As there

were 4 small groups per section, each small group presented a different case. After each case presentation, the instructor asked a series of questions to further measure the student's knowledge base and ability to defend the recommendations. Other small group members were encouraged to answer questions if the presenter was having difficulty, but the case presentation grade was assigned to the presenter only. Prior to this study, the presentations were graded solely by the instructor with a case-specific dichotomous checklist that assessed the student's therapeutic recommendations and presentation style (Figure 1). Instructors were trained in this grading method and overseen by the course coordinator. The checklist grade was calculated by the percentage of items that received a "pass," resulting in possible scores ranging from 0 to 100%. This was sometimes accompanied by constructive criticism offered by the instructor.

For the purpose of this pilot study, a rubric was developed by the investigators to assess 3 dimensions of performance: knowledge, skills, and professional behavior. When determining which dimensions should be included and the content for each, we sought to mirror the recommendations from both the ACPE Standards 2007[1] and the Center for the Advancement of Pharmaceutical Education (CAPE) Educational Outcomes[2] to ensure content validity. The resulting rubric was reviewed and revised by the investigators multiple times, and feedback was provided by non-investigator instructors. The knowledge dimension of the rubric contained 2 assessment items and the skills and behavior dimensions each contained 4 assessment items. Three levels of competency were described for each assessment item (Figure 2), and instructors and students were asked to circle the description that best represented each presenter's performance. A numerical composite score was calculated from each completed rubric by using the following conversion for each item: lowest level of performance = 5 points, middle level of performance = 7.5 points, and highest level of performance = 10 points. Possible scores ranged from 50 to 100 points. Scores for the knowledge, skills, and behavior dimensions were calculated by adding only the points for the items within each dimension. Students and instructors were not informed of this conversion method.

Students and recitation instructors were educated regarding the application of the rubric by an investigator. The different dimensions of the rubric were explained and students and instructors were given the opportunity to ask questions. Further clarification was provided during the semester when requested. The rubric was used for instructor, peer, and self-assessments of all presentations for the pilot study. Peers were defined as the non-presenting members of each recitation section (13-15 students). All students participated each week by completing self-assessments when presenting and peer assessments when not presenting. Instructors completed the dichotomous checklist and rubric for each student presentation. Students and instructors had several minutes immediately following each presentation to complete the assessments.

| **Skill Checklist** | **PASS** | **FAIL** |
|---|---|---|
| 1. Student recognizes that DR has Stage 1 HTN and that her goal BP is less than 130/80 because she has diabetes. | O | O |
| 2. Student describes proper way to measure BP (patient sitting for at least 5 minutes, feet flat on the floor, cuff level with heart and properly sized, patient ideally has not smoked or ingested caffeine 30 minutes prior to measurement) | O | O |
| 3. Student states appropriate counseling for lisinopril including adverse effects (must at least include cough and angioedema), and monitoring (BP, K+, renal function). | O | O |
| 4. Student stresses importance of a low salt diet (patient likes potato chips) | O | O |
| 5. Student recommends other lifestyle modifications including DASH diet, weight loss if necessary, alcohol in moderation, exercise. | O | O |
| 6. Student counsels patient on benefits of treating hypertension (reduced risk of stroke, cardiovascular disease, kidney damage) | O | O |
| 7. Student counsels that ACE-I's are renoprotective in diabetic patients | O | O |
| 8. Student counsels that hypertension is usually asymptomatic | O | O |
| 9. Student recognizes that DR's cough may be due to the ACE-I and counsels patient appropriately. | O | O |
| | | |
| **Communication Checklist** | | |
| 1. Introduces self. | O | O |
| 2. Follows required format. | O | O |
| 1. Voice clear and audible and talks at a reasonable pace. | O | O |
| 2. Good presentation style (provides information with confidence, no distracting mannerisms) | O | O |
| 3. Asks if audience has questions and repeats questions when asked. | O | O |

Figure 1. Example checklist used to assess pharmacy students' case presentations.

*Please circle the best description for each item.*

*Knowledge*

| | | | |
|---|---|---|---|
| **Knowledge of Disease State** | Makes mistakes when presenting case-specific information about the disease state. | States correct information and recognizes signs, symptoms, & normal/abnormal lab values associated with the disease state. | Demonstrates in-depth understanding of the disease state. Discusses expected signs, symptoms, & lab values even if not indicated in this case. |
| **Knowledge of Drug Therapy** | Makes mistakes when presenting case-specific information about drug therapy. | States correct information and answers questions regarding the specific drugs listed in the case (MOA, dose, indication, etc.). | Demonstrates in-depth understanding of the drug classes in the case. Recognizes alternative therapies for specific disease state. |

*Skills*

| | | | |
|---|---|---|---|
| **Patient Assessment** | Can not form a problem list for patient. Can not determine desired and undesired therapeutic outcomes. | Identifies some (not all) therapeutic problems. Determines either desired or undesired therapeutic outcomes, but not both. | Identifies therapeutic problems without including unnecessary information. Determines both desired and undesired therapeutic outcomes. |
| **Therapeutic Plan Development** | Can not formulate (or provides incorrect) pharmacy-specific therapeutic plan. | Develops a therapeutic plan that includes a change in therapy (addition, deletion, or modification of therapy) without recommending adequate monitoring. | Develops a therapeutic plan that includes a change in therapy (addition, deletion, or modification of therapy). Provides adequate monitoring recommendations. |
| **Communication with Small Group** | Does not communicate well with group members. Can not offer and/or justify prepared answers to the case. | Inconsistent communication with small group. May/may not be able to offer and/or justify prepared answers to the case. | Communicates well with the group. Consistently offers and/or justifies prepared answers to the case. |
| **Presentation Style** | Speaks too quickly or too slowly. Displays distracting mannerisms. Relies on small group to answer questions related to presentation. | Almost always speaks at proper pace with few distracting mannerisms. Attempts to answer questions before deferring to small group for assistance. | Speaks at a proper pace with no distracting mannerisms. Displays enthusiasm. Maintains good eye-contact. Seldom relies on small group to answer questions related to presentation. |

*Attitude* *

| | | | |
|---|---|---|---|
| **Professional Attire/Appearance** | Inappropriately dressed. Does not wear name tag and white coat or wears dirty coat. | Wears name tag and white coat. Appearance is disheveled or wears an inappropriate article of clothing (e.g. jeans, flip-flops, cropped or low-cut top, etc). | Dressed appropriately and wears name tag and clean white coat. |
| **Respectful Interactions** | Does not demonstrate respect for group members. Consistently offers little or no assistance to group members. | Usually respectful in interactions with small group, but contributes less to the group when not selected as the presenter. | Is respectful to group members and always contributes to the small group effort even if not selected as the presenter. |
| **Professional Approach** | Demonstrates no desire to participate. Ignores and/or disrespects the instructor. | Speaks, interacts, & contributes meaningful input to the group. Questions about the case are directed toward the faculty rather than the recitation instructor. | Speaks, interacts, & provides meaningful input to the group. Asks questions/seeks input from the recitation instructor before directing questions toward the faculty. |
| **Preparedness** | Does not work on cases before recitation. Unprepared to contribute to the group. | Works some, but not all, cases prior to recitation and is usually prepared to contribute to small group discussion. | Works all cases prior to recitation & actively contributes to the discussion of the small group every week. |

*The rubric has been modified to reflect the assessment of professional behaviors rather than attitudes. The third dimension's current subtitle is "Behaviors".

Figure 2. Rubric for assessing pharmacy students' case presentations based on knowledge, skills and behaviors.

During the pilot study, the dichotomous checklist used by instructors continued to be the formal grading method for all presentations.

Rubric-based composite scores were calculated for instructor, peer, and self-assessments. Instructor composite scores resulting from the rubric-based method were compared to the dichotomous checklist scores using a 2-tailed *t* test. Rubric-based composite scores for instructor, peer, and self-assessments were compared using a one-way analysis of variance (ANOVA). Scores for individual dimensions (knowledge, skills, behavior) were calculated for instructor, peer, and self-assessments using ANOVA. *P* values less than 0.05 were considered significant in all analyses.

Following the results of the pilot study, the grading methodology for *Therapeutics I* recitation was redesigned, with the rubric-based method of assessment used as the sole grading mechanism for case presentations. In spring 2007, students and instructors were oriented to the rubric in the same manner as described in the methods for the pilot study. Implementation of the rubric-based assessments during spring 2007 incorporated a few changes from the methods described in the pilot study. First, only the 3-4 students within the presenter's small group were asked to provide a peer assessment of the case presentation. This decision was made after reviewing the peer assessments from the pilot study, where only 43.7% of the peer assessment rubrics were fully completed. Further review revealed that more rubrics were completed by student peers within the small group than by other student peers outside the small group, indicating that these students were more comfortable assessing their small group peers' presentations. Second, students completed the rubric-based self- and peer assessments online using WebCT rather than using a paper rubric, thus allowing more time for reflection and assessment. Students and instructors had up to 1 week following the presentation to complete the assessments. The self-assessment comprised 25% of the student's final presentation score, and instructor assessments comprised the remaining 75% of

the score. Although peer assessment scores were not used in calculating the presentation scores, students were required to complete peer assessments to receive participation credit in recitation. Comments from the peer assessments were used to supply additional feedback for improvement.

IRB approval was obtained to compare scores from Spring 2007 to those from the pilot study. Rubric-based composite instructor scores from Spring 2007 and the pilot study were compared using a 2-tailed *t* test. Scores generated from peer and self-assessments were analyzed in the same manner. Additionally, rubric-based composite scores for instructor, peer, and self-assessments during the spring 2007 implementation were compared using a one-way ANOVA. *P* values less than 0.05 were considered significant in all analyses.

## RESULTS

During the pilot study, 86 students were enrolled in *Therapeutics I*. Each student presented 3-4 case presentations (mean 3.3) during the semester, and each presentation was assessed using the rubric and checklist methods. Incomplete rubrics were not included in the analysis. The percentage of complete rubrics varied between evaluators, with 89.8%, 43.7%, and 97.9% of instructor, peer, and self-assessments completed. The mean instructor rubric-based composite score was significantly lower than the mean checklist-based score (94.0 $\pm$ 5.7 versus 97.7 $\pm$ 4.9, respectively, $p < 0.001$). Figure 3 demonstrates that the rubric method produced a broader distribution of scores than the checklist method. Rubric-based composite peer assessment scores were statistically higher than rubric-based instructor or self-assessment scores ($p < 0.001$ for each comparison), but there was no difference between instructor and self-assessment composite scores ($p = 0.54$, Table 1).

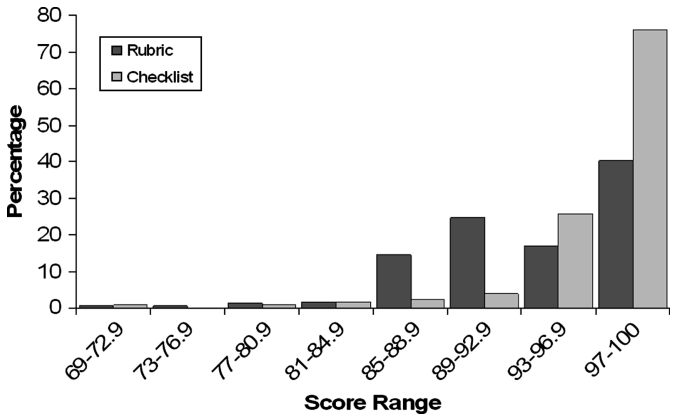


Figure 3. Frequency distributions of rubric and checklist-based recitation scores from instructors.

When scores for knowledge, skills, and behavior were analyzed (Table 1), instructor scores were significantly lower for knowledge and higher for behavior than self-assessment scores ($p < 0.001$ for each comparison). Scores for skills were not different between instructor and self-assessments ($P > 0.10$). Peer assessment scores were significantly higher for all 3 rubric dimensions than instructor or self-assessment scores ($p < 0.01$ for each comparison).

When recitation scores from the spring 2007 semester of *Therapeutics I* were analyzed (Table 2), rubric-based composite scores from instructors and peers were found to be significantly lower compared to pilot study results ($p = 0.01$ and $p < 0.001$, respectively), but self-assessment composite scores were not significantly different ($p = 0.06$). Spring 2007 instructor, peer, and self-assessment scores were compared, and the instructor composite score was significantly lower than both peer assessment and self-assessment composite scores ($p < 0.001$ for each comparison). Peer and self-assessment composite scores were not significantly different ($p = 0.18$).

## DISCUSSION

In this study, rubric-based composite scores provided a broader distribution of student presentation scores than the checklist-based method. One explanation for this increase in score distribution may be that the checklist-based method mainly assessed knowledge recall and application, which are among the lower levels of Bloom's Taxonomy,[3] while the rubric-based method allows for the assessment of higher-level educational goals such as synthesis and evaluation. Thus, the rubric-based method provides a more global assessment of performance than the checklist-based method because it allows for assessment of critical thinking and professional behavior in addition to knowledge and presentation skills. The rubric specifically evaluates professional attire, interactions with small group peers and instructors, approach to group participation, and preparedness for case presentations. This rubric is valuable in providing an assessment of professional behavior in the didactic coursework, allowing feedback to students who might not otherwise receive it.

The results from spring 2007, although similar to the pilot study, had important differences. For example, the peer assessment scores for the spring 2007 semester were lower than peer assessment scores from the pilot study. This difference may have resulted from the provision of peer assessments by students within the presenter's small group and not from the entire recitation section. This was expected because the procedural change resulted in peer assessments from students with direct interaction versus those peripheral to the small group. The mean difference in instructor assessments, although small, was statistically

Table 1. Rubric-based Scores for Instructor, Peer, and Self-Assessments[a]

| Section | Instructor, Mean (SD) | Peer, Mean (SD) | Self, Mean (SD) | *P* Values | | |
|---|---|---|---|---|---|---|
| | | | | Instructor vs Peers | Instructor vs Self | Peer vs Self |
| Composite | 94.0 (5.7) | 99.1 (3.2) | 94.4 (8.6) | <0.001 | 0.54 | <0.001 |
| Knowledge | 17.2 (2.5) | 19.6 (1.4) | 17.9 (2.5) | <0.001 | <0.001 | <0.001 |
| Skills | 37.3 (3.4) | 39.6 (1.6) | 37.8 (3.7) | <0.001 | 0.10 | <0.001 |
| Behavior | 39.5 (1.6) | 39.8 (1.4) | 38.6 (3.4) | 0.004 | <0.001 | <0.001 |

[a]Scoring: composite = maximum 100 points; knowledge = maximum 20 points; skills = maximum 40 points; behavior = maximum 40 points

significant between the spring 2007 and pilot study results. This is surprising, since the spring 2007 rubric-based scores were used as the official grades for students, whereas the pilot study scores did not impact students' grades. Notably, the spring 2007 self-assessment scores did not differ significantly from those in the pilot study. When the rubric-based method was formally implemented in spring 2007, the contribution of students' self-assessments carried an inherent risk of score inflation. However, this risk may have been minimized by limiting the contribution of the self-assessments to only 25% of the presentation scores.

The conversion to a numerical score introduces a possible limitation. The method of conversion was based on the logic that the highest level of performance deserved full credit, middle level of performance deserved the equivalent of a letter grade of C, and the lowest level of performance deserved a failing grade, but not a zero. As a result, the possible rubric-based scores ranged from 50-100 points. Although the rubric was converted to a numerical score, its use resulted in a broader distribution of grades than the checklist method.

This rubric allows facilitation of assessment from 3 sources: instructors, peers, and self. The importance of self-assessment exercises for students in health care professions is widely recognized, as evidenced by their inclusion in accreditation standards for colleges of pharmacy[1] as well as colleges of medicine.[4] Most research on student self-assessments in the health sciences has been conducted among medical students, and the data are conflicting regarding the accuracy of the self-assessment.[5-10] Student self-assessment accuracy is most commonly measured by comparison to faculty assessments and differences are assumed to be indicative of inaccurate student self-assessments resulting from lack of clear assessment method or guidelines, limited self-assessment experience, or assessment of effort rather than performance.[5-10] Interestingly, self-assessments are most valuable when accompanied by assessments from instructors and/or peers.[11]

In the literature, peer assessment is usually conducted anonymously and generally includes assessment of observed tasks as well as professionalism. Several studies have shown that peer assessment is accepted and valued by students and residents.[12-14] However, other studies show that students have concerns about its validity[15] and its contribution to course grades.[16] An expected additional benefit of the peer assessment process is that as students assess each other, they may gain valuable experience in the process of assessment.[17] The ideal situation would be one which combines instructor, peer, and self-assessments for the same observed task. These multiple points of view are useful because peers observe a different set of skills than do instructors.[18] It also allows for the comparison of self-assessments to assessments from others, thereby enabling continued improvement of self-assessment skills.[8,11]

Summarized in Table 3 are several studies addressing the assessment of pharmacy, nursing, or medical students in problem-based learning courses or courses with group projects.[7,9,14,16,19-27] Our study is similar to these studies in that student assessments were of a task that required the practical application of knowledge. While most of these studies utilized peer and/or self-assessments in addition to instructor assessments, only a few comprehensively evaluated knowledge, skills, and professional behavior. Our method combines assessment of knowledge, skills, and professional behavior from all 3 sources: instructors, peers, and self. It is novel because it uses a rubric,

Table 2. Comparison of Pilot Study Rubric Composite Scores to Spring 2007 Rubric Composite Scores[a]

| Assessor | Pilot Study Composite Scores, Mean (SD) | Spring 2007 Composite Scores, Mean (SD) | *P* |
|---|---|---|---|
| Instructor | 94.0 (5.7) | 92.3 (8.0) | 0.01 |
| Peer | 99.1 (3.2) | 96.1 (3.7) | <0.001 |
| Self | 94.4 (8.6) | 95.7 (3.9) | 0.06 |

[a]Scoring: composite = maximum 100 points; knowledge = maximum 20 points; skills = maximum 40 points; behavior = maximum 40 points

Table 3. Literature Summary for Student Assessment in Problem-Based Learning or Group Projects

| Reference | Setting and Population to be Assessed | Assessment Method | Items Assessed | | | Assessor | | |
|---|---|---|---|---|---|---|---|---|
| | | | Professional Behavior | Performance of task (skills) | Knowledge | Instructor | Peer | Self |
| Krause et al[16] | Pharmacy students in a pharmacy practice course | Likert scale and written comments | Yes | No | No | No | Yes | Yes |
| Malcolmson et al[19] | Pharmacy students in a pharmaceutics course | Likert scale and written comments | Yes | No | No | No | Yes | Yes |
| Webster et al[20] | Pharmacy students in a PBL[a] medicinal chemistry course | Traditional examination | No | No | Yes | Yes | No | No |
| Cuddy et al[14] | Medical students in a pharmacology course | Likert scale and written comments | Yes | Yes | No | No | Yes | No |
| Cottrell et al[21] | Medical students in a PBL group | Bipolar Likert scale[b] with anchors[c] | Yes | No | No | No | Yes | No |
| Langendyk[7] | Medical students in a PBL group | Likert scale | No | Yes | Yes | Yes | Yes | Yes |
| Sullivan et al[9] | Medical students in a PBL group | Likert scale | No | Yes | No | Yes | Yes | Yes |
| Reiter et al[22] | Medical students in a PBL group | Relative ranking | Yes | Yes | Yes | Yes | Yes | Yes |
| Papinczak et al[23] | Medical students in a PBL group | Likert scale | Yes | Yes | Yes | Yes | Yes | Yes |
| Sim et al[24] | Medical students in a PBL group | Likert scale | Yes | Yes | Yes | Yes | No | No |
| Valle et al[25] | Medical students in a PBL group | Likert scale | Yes | Yes | No | Yes | No | No |
| Chen et al[26] | Medical students in a PBL group | Likert scale | Yes | Yes | No | Yes | Yes | Yes |
| Ladouceur et al[27] | Nursing students in a PBL group | Likert scale | Yes | Yes | Yes | Yes | Yes | Yes |

[a]Problem-based learning
[b]Likert scale in which the middle of the scale represents the best performance and the ends of the scale represent opposite extremes
[c]Written descriptions of the lowest, middle, and highest numbers on the Likert scale

providing both presenters and evaluators with specific expectations for performance.

## CONCLUSIONS

This study describes the successful development and implementation of a grading rubric that facilitates the evaluation of knowledge, skills, and professional behavior from the viewpoints of instructor, peer, and self-assessments in a didactic course. The rubric serves as a guide for students to appreciate the desired performance outcomes and to facilitate the provision of constructive feedback. The use of this rubric was the first step in attempting to achieve a recitation grading mechanism that complemented the knowledge and skill assessment achieved by the examinations in the didactic portion of the *Therapeutics I* course.

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