

RESEARCH ARTICLE

# Developing a rubric for the assessment of student performance in compounding and dispensing practical

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## Abstract

**Objectives:** To study the impact of assessment using a scoring rubric on the compounding and dispensing skills of the students. **Methods:** A rubric was prepared to evaluate the students' psychomotor performance and attitude in compounding and dispensing. The rubric was applied by the teacher, the students themselves, and their classmates instead of the earlier used dichotomous checklist. Scores were compared pre- and post-implementation of the rubric. The students' learning experience and outcomes were assessed through regular course evaluation surveys. **Results:** Student performance was improved from the baseline to the mid and end of term. The number of harmful scorings was reduced, and the number of admissible scorings was increased. **Conclusion:** The pharmaceutical compounding rubric showed to be a quantitative evaluation instrument for teachers. It also helped identify the challenging areas. The implementation of the rubric helped minimise errors.

## Introduction

Assessment is an essential part of education. It is imperative to assess the psychomotor skills in actual practice simulated conditions in medical education (Swanson *et al.*, 1995). Objective structured clinical examinations (OSCEs) is one of the methods followed to assess psychomotor skills (Harden *et al.*, 1975), which highly weighs in medical studies (Howley *et al.*, 2004). Following authentic assessment methods in pharmacy curricula will ensure pharmacist performance in actual practice (Romanelli *et al.*, 2010). Attempts in medical education should be made to reduce the unreliability of high-stakes evaluations (Fleming *et al.*, 1974). Compounding preparations for oral and external use is an integral part of the pharmacist's job. The preparation of oral and external use products in practical settings needs attention in teaching and assessing product preparation in the pharmaceuticals practical. The students' practical includes various components such as preparation, calculation, personal preparation, quality assurance,

among others. However, there should be a special focus on the development of personal and product preparation skills. In this work, the authors tried to develop an optimal assessment instrument, which can efficiently provide both formative and summative feedback to a group of learners in a short time and track areas requiring improvement rather than using the rating of either skilled or unskilled. Consequently, a compounding and dispensing scoring rubric was prepared and used for practical evaluation. Several studies reported the successful use of rubrics to improve student learning outcomes (Michael *et al.*, 2006; Catherine *et al.*, 2008; Michael *et al.*, 2010) and the importance of rubric-based evaluations of students in curricular enhancement (Hernic *et al.*, 2016). Schellhase and colleagues in 2013 and Gillette and colleagues in 2017 have emphasised the role of rubrics in preparing students for advanced pharmacy practice. Yasuhara and colleagues in 2015 have developed and used rubrics for the extracting concept in graduate research. The present work was undertaken to explore the effectiveness of the rubric in enhancing student

performance within an academic year and uncover the areas requiring more focus in teaching and learning. It also aimed to reveal areas that are challenging for students. Ethics approval was not needed for this study as per the institute's research guidelines.

## Methods

The Pharm.D. curriculum of Ibn Sina National College consists of ten terms; the first year is the preparatory year. Pharmacy-related courses start from the third term and continue to the tenth term, followed by one-year field experience in the pharmacy setup of various hospitals with ten rotations to build student pharmacy practice skills. Each term is completed within 15 weeks, and for each credit hour, 30 contact hours are assigned for the practical. There are four pharmaceuticals courses with practical. The main area of focus is non-sterile compounding and sterile compounding. Non-sterile product compounding activities are presented in Table I. Care was taken to cover the lectures and practicals of the same topics simultaneously. The Saudi pharmacy licensure examination brings together a panel of Saudi

pharmacists to define acceptable sterile and non-sterile compounding levels. Regular feedback from the students through course evaluation surveys and the concern of course instructors and coordinators to improve student performance in compounding and dispensing helped provide a coherent set of criteria to evaluate student performance.

A compounding technique scoring rubric (Table I) was developed by the learning, teaching, and assessment (LTA) unit upon prior consultation with the preceptors at the training sites and the course coordinators to evaluate compounding and dispensing skills. The rubric was developed in alignment with targeted learning outcomes and competencies; the core competency was compounding skills, whereas the auxiliary were knowledge, professionalism, and ethics. The rubric measured six skill development components. In each of these six components, student performance was graded as specified in Table I. The total score was calculated by summing all the points then it was converted into marks. A score of 60% was considered acceptable. This score affected the students' semester results as for each course, the assessment for practical components accounted for 30%.

**Table I: Scoring rubric for compounding and dispensing**

Dimensions	0 Point Likely harmful	1 Point Needs improvement	2 Points Acceptable	Points scored
<b>Preparation of ingredients</b>	Calculation is wrong, Weighing inaccurate	Calculation is correct, Weighing inaccurate	Calculation is correct, Weighing accurate	
<b>Procedure</b>	Do not use clean spatula Used same spatula	Used clean spatula Used same spatula	Used clean spatula Used separate spatula	
<b>Product specifications</b>	Colour, texture, and odour are not achieved	Colour and odour are achieved but not texture	Colour, texture, and odour are achieved as per standard	
<b>Labelling</b>	As per instructions, no information present	As per instructions, few information present	As per instructions information present	
<b>Selection of container</b>	Not clean, Not of right size, specification	Either clean or of right size, specification	Clean and of right size, specification	
<b>Participation</b>	Not answerd question	Engage in answering	Answers correctly	
<b>Professional Ethics</b>	Not punctual Disturbs other students Do not follow lab. instructions	Come late Concentrate well Follow lab. instructions	Punctual Active engagement Follow lab. instructions	

The rubric was embedded in the students' laboratory manual. Two pharmaceuticals instructors served as evaluators. Four evaluators were selected from the pharmaceuticals department and were trained on the use of the scoring rubrics by the LTA unit of the college. Evaluators used the rubric on three instances during the usual practical sessions, in the mid and end of term assessments (Table I). Prior training to students was

given by the evaluators on how to use the scoring rubrics. Practical was conducted in a group of two students, where they had to give scores to each other as per the rubrics, which were used as means of formative feedback. The scores, along with the comments of the evaluators, served as a means of learning for the students to improve further. The overall intended outcome was to reduce errors and

enhance good practice, resulting in no or minimum deleterious effect.

The Mc Nemar test was applied to compare the results between baseline to mid-term and baseline to end of term, setting the alpha values at 0.05. Other data were analysed with descriptive statistics.

### Results

The results of 120 third academic year students who passed the second academic year were considered for the analyses. The percentage of students who got admissible scores for each component at the baseline (the first two non-assessed practicals), mid, and end-of-term examinations is depicted in Figure 1.

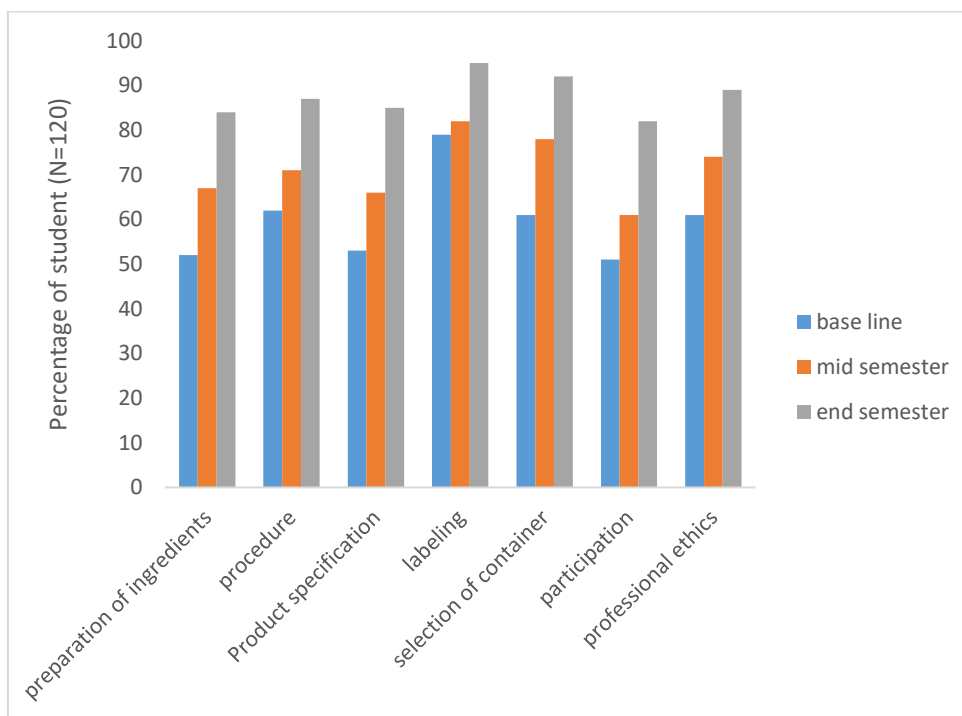


Figure 1: Percentage of students receiving admissible scorings at baseline, mid, and end-of-term assessments

Improvements in student performance in terms of admissible, requiring improvement, and possible harmful scores are presented in Table II. The total compiled score was 720 for the 120 students who completed the course. The results suggest that students improved although they had scores of at least one compiled (requiring improvement and possibly

harmful) score. By the end of the term, the students showed improvement in all the components. All the students scored above the acceptable score of 60%; however, 6.6% of students had a marginal score between 60-70%. Students scored the least in product specification, whereas all the students scored 100% in the preparation of ingredients and labelling.

Table II. Performance of students in terms of admissible, requiring improvement, and possible harmful scores.

	Baseline (B)	Mid Semester (MS)	End semester (ES)	Mc Nemar test (p value)	
				B vs MS	B vs ES
Students got admissible scores on all 6 components	1 (0.83%)	33 (27.5%)	51 (42.5%)	0.024	0.016
Students got one or more compiled (requiring improvement and possibly harmful) scores	89 (74.1%)	26 (21.6%)	19 (15.8%)	0.034	0.024
Total compiled (requiring improvement and possibly harmful)	193 (26.8%)	29 (4.02%)	22 (3.05%)	0.014	0.012
Mean number of compiled (requiring improvement and possibly harmful) scores per student	1.6	0.24	0.18	-	-

## Discussion

The calculation and labelling of the compounded products could be learned during the didactic lectures, whereas other components like the preparation of ingredients, procedure, container selection, and participation are acquired and improved only during practical sessions. The skill develops upon repetition of activities, where students can cope with the challenges further. Students carried out many learning activities related to the preparation of internal and external use solid, semi-solid, and liquid preparations. It was not easy to uncover the specific areas where students needed improvement and whether they were learning from their mistakes; however, this study provided an overall picture of progress in their skills. The application of the scoring rubric solved the above-raised concerns to a great extent; the continuous feedback received through the rubric helped students correct their mistakes, which is consistent with the findings found from Horton and colleagues (2013).

The areas requiring improvement were identified easily (Figure 1). Terms that can affect the patient, such as possibly harmful, have been used to clarify for students the desired performance during their practice (Bresciani *et al.*, 2004; Michael *et al.*, 2006). However, the implementation of the rubric posed some challenges like enhanced training, manpower requirement, and coordination during the evaluation of the practical sessions. Within a year of using the rubric, the areas requiring improvement could be traced, which helped enhance student performance, which support the finding from the earlier study by Michael and colleagues (2006). The students scored the least in the product specification due to the non-compliance to the process parameters during compounding.

Instructors identified critical parameters, like temperature and mixing time, that affected the specification. During the demonstration, instructors emphasised the need to adhere to such instructions to improve product specifications. Dialogues with students revealed the acceptance of the rubric as a reliable tool for assessment which is in congruence with the earlier studies by Allen and colleagues (2006) and Peeters and colleagues (2010). In the regular course evaluation survey by the students rated on a 5-point scale, the response to the question “to what extent the desired outcome is achieved in compounding preparations” increased from 3.7 to 4.2, indicating a correlation between the direct and indirect achievement of the outcomes in the assessment.

## Conclusion

The pharmaceutical compounding scoring rubric showed to be an effective assessment instrument for the teachers to enhance student compounding skills. It also helped identify the challenging areas. The implementation of the rubric helped minimise errors.

Here are some of the recommended lessons for practice:

- Assessment aligned to the learning outcome is an integral part of education.
- The scoring rubric is an effective assessment tool for the psychomotor performance of the students in compounding and dispensing practical.
- The use of a scoring rubric in the assessment can help identify areas for improvement, minimise errors, and enhance the overall performance of the students.

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