



A Novel Process for Guiding Student Critical Reflection on Learning Habits Through Exam Performance Analysis

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Background:

- Metacognition is an essential skill for pharmacy students and emphasized in ACPE standards.
- ACPE Standard 2016 learning outcomes include student ability “to examine and reflect on personal knowledge, skills, abilities, beliefs, biases, motivation, and emotions that could enhance or limit personal and professional growth” (Standard 4.1).
- Guiding student reflection on learning is one method of metacognition and has been shown to help improve study skills and performance.
- While there is some guidance in the pharmacy literature on methods to incorporate student reflection on learning habits, limited data examines the impact of teaching metacognitive skills to pharmacy student to improve course performance.

Objectives: To develop and assess a novel process for fostering student metacognition, study skill development, and learning through analysis and critical reflection of exam performance.

Methods:

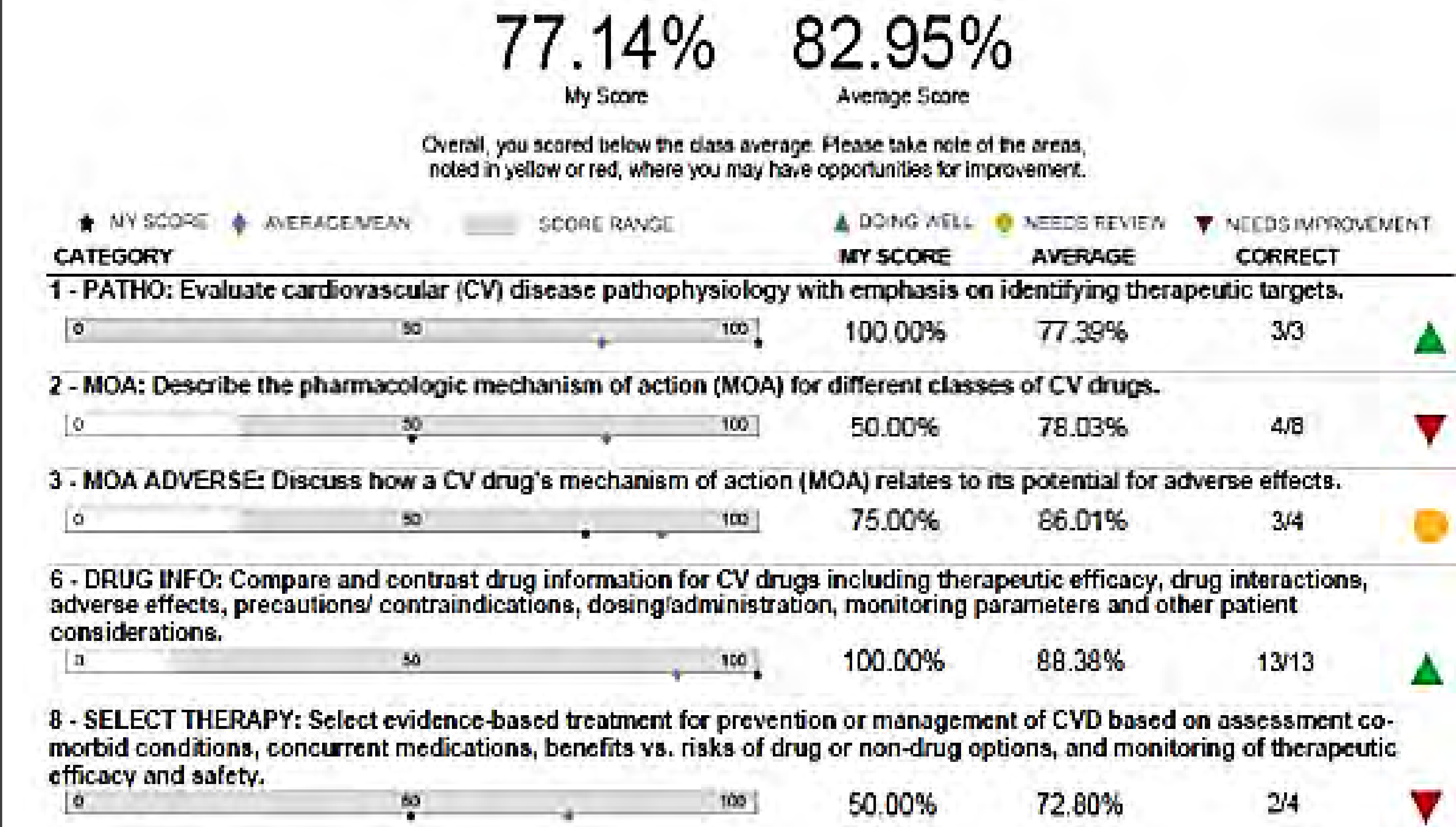
- Investigators created process for students to access, interpret, and reflect on Strength and Opportunity (S&O) exam performance reports available with Examsoft for a 4-credit required Cardiovascular Pathophysiology, Therapeutic, Pharmacology, Medicinal Chemistry course taught to over 200 students across two campuses.
- Course objectives were updated (see **Figure 1.**) to include key words and scaffolding.
- Figure 2.** shows the guide and process for students to reflect on exam performance.
- Written instruction guide and related video tutorial was shared with students and tutors
- Bonus assignment was developed to motivate students to complete post-exam reflection and document self-directed plans to improve learning habits.
- Students could earn up to 3 bonus points added on the final course grade for completion of the reflection assignments, including 0.5 point earned for reflection after 3 exams and an additional 0.5 point earned if the next exam grade improved. The assignment was administered in the LMS using questions from the process in **Figure 2.**
- Exam grades were used to assess impact on subsequent course exam performance.
- Students and peer tutors were surveyed near the end of the course to assess perspectives regarding the process and value of accessing S&O reports in the exam system.

Figure 1. Categories of Learning

Course Objectives	Levels of Learning
1 - PATHO: Evaluate cardiovascular (CV) disease pathophysiology with emphasis on identifying Therapeutic targets.	Recall, comprehension, application
2 - MOA: Describe the pharmacologic mechanism of action (MOA) for different classes of CV drugs.	Recall, comprehension
3 - MOA ADVERSE: Discuss how a CV drug’s mechanism of action (MOA) relates to its potential for adverse effects.	Recall, comprehension, application
4 - MED CHEM: Identify clinically relevant structure-activity relationships of CV drugs.	Recall, comprehension
5 - BRAND/GENERIC/CLASS: Identify brand name, generic name, and pharmacologic class for assigned CV drugs.	Recall
6 - DRUG INFO: Compare and contrast drug information for CV drugs including therapeutic efficacy, drug interactions, adverse effects, precautions/ contraindications, dosing/administration, monitoring parameters and patient considerations.	Recall, comprehension
7 - MED PROBLEMS: Identify actual or potential medication-related problems in individuals with CV diseases while integrating knowledge of pathophysiology, pharmacology, medicinal chemistry and evidence-based therapeutics.	Recall, comprehension, application
8 - SELECT THERAPY: Select evidence-based treatment regimens for prevention and management of CVD based on assessment of patient factors (e.g., co-morbid conditions, concurrent medications), benefits vs. risks of drug or non-drug options, and monitoring of therapeutic efficacy and safety.	Recall, comprehension, application, analysis
9 - JUSTIFY THERAPY: Justify selection of evidence-based treatment regimens for prevention and management of CV diseases for implementation consistent with the Joint Commission of Pharmacy Practitioners Pharmacist Patient Care Process.	Recall, comprehension, application, analysis

Figure 2: Instruction Guide

Step 1: ACCESS your Strength & Opportunity (S&O) Report in ExamSoft. Click [here](#) for instructions from ExamSoft. Actual exam questions/ answers do not appear on *S&O Reports*. *See sample below.*



Step 2: IDENTIFY your categories of strength vs. areas for improvement using your Report. First, list all categories where you are DOING WELL (green triangle). Next, list all categories that NEED IMPROVEMENT (red triangle). If your Report has no green and/or red triangles, substitute categories that NEEDS REVIEW (yellow circle). *Categories are course objectives tested on the exam (from syllabus).*

Step 3: CONNECT your learning approach with exam performance using your Report. First, describe your learning approach for categories where you are DOING WELL (green triangle). Next, describe your learning approach for categories that NEED IMPROVEMENT (red triangle). If your Report has no green and/or no red triangles, substitute categories that NEED REVIEW (yellow circle).

Step 4: PLAN how to self-improve learning approaches to achieve course objectives based on what you learned from the Report. Develop at least three (3) learning approaches to continue or change in preparation for the next course exam. Consider ways to hold yourself accountable to this plan. *Refer to Categories of Learning & Learning Strategies.*

Learning Strategies*		
For RECALL and COMPREHENSION		
Utilize <u>assigned readings</u> to fill-in gaps with understanding & class notes to guide achievement of learning objectives.		
Spend <u>focused, efficient, quality time</u> reviewing & summarizing information/concepts from notes, class materials, readings, etc.		
Plan ahead to pace out study sessions and alternate topics to achieve required memorization of facts and comprehension of concepts.		
Use methods that support memorization (e.g., Quizlet®, flashcards) and concept understanding (e.g., PTPM drug information chart).		
Make connections with current or previously learned material to support understanding of facts and concepts.		
Self-test achievement of <u>knowledge-based</u> learning objectives (faculty- and self-developed practice questions).		
For APPLICATION and ANALYSIS		
Use study guides (charts, diagrams, concept maps, etc.) to develop different types of scenarios where knowledge can be applied.		
Practice comparing/contrasting concepts, problems, or situations with examples, asking questions with changing variables (“what if...?”).		
Share thought processes with peers (and/or course tutors) & ask questions (e.g., on discussion board, in class) to solidify learning.		
Self-test achievement of <u>skill-based</u> learning objectives (faculty- and self-developed practice questions).		
Plan to revisit knowledge development (memorize facts; comprehend concepts) to support skill development (applying/analyzing).		
Before Class	During Class	After Class
Read learning objectives	Arrive on time with class materials	Review/summarize/read -see approaches above
Scan class materials	Turn off distractions	Complete readings - connect to class notes
Scan readings – focus on key concepts, tables/figures (see learning objectives)	Take good notes (e.g., Cornell method- not a transcript of class)	Develop required knowledge and skills – see course objectives below (& topic objectives**)
Complete assigned homework tasks	Engage during class (ask questions)	Self-test – see approaches above
Develop questions for understanding	Make connections with pre-class scan of materials, readings, homework, etc.	Reflect on learning – seek assistance (e.g., from the ACPHS Center for Student Success)

Results:

- More than 85% of students completed the reflection assignment after each exam.
- Table 1** shows how mean exam scores compared for students who did vs. did not reflect on exam performance.
- Paired analysis of subsequent exam scores revealed a trend for decreased performance for students who did not complete the reflection from exam 1 to exam 2 (p=0.052) and from exam 2 to exam 3 (p=0.012). Neither group demonstrated any difference in performance from exam 3 to exam 4.
- Table 2** summarizes feedback on the student survey (41% response rate).

Table 1. Comparison of Mean Exam Grades between Cohorts

	Completed Reflection	No Reflection	Exam Score difference*	p-value
Exam 2 (post-Exam 1 Reflection)	79% (n=202 students)	77% (n=20 students)	+3%	p=0.16 (NS)
Exam 3 (post-Exam 2 Reflection)	84% (n=200 students)	79% (n=22 students)	+5%	p=0.025
Exam 4 (post-Exam 3 Reflection)	79% (n=191 students)	74% (n=31 students)	+5%	p=0.042

Table 2. Student Perception of Exam Performance Report Utility

	Strongly Agree or Agree	Undecided	Disagree or Strongly Disagree
The report(s) helped me to improve my study approach for the next PTP440 course exam.	59 (64%)	18 (20%)	14 (15%)
The report(s) should be made available for all course exams using Examsoft at ACPHS.	80 (88%)	9 (10%)	2 (2%)

Implications:

- Critical reflection of exam performance using S&O reports fosters student metacognition and study skill development and appears to improve student exam performance.
- This process connects the process of critical reflection to improvements in student performance on exams testing critical domains of pharmaceutical and clinical science.
- The process can be readily reproduced at other institutions who use electronic examination system with exam performance reports (e.g., Examsoft® S&O reports).

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