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. 
• APPE Standard 2016 learning outcomes include student ability “to examine and reflect on personal knowledge, skills, abilities, 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 habits 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 assignments 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

Table 1. Comparison of Mean Exam Grades between Cohorts

Table 2. Student Perception of Exam Performance Report Utility

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 2: Instruction Guide

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 where you are NEED IMPROVEMENT (red triangles). If your Report has no green and/or no red triangles, substitute categories that NEED REVIEW (yellow circle). Categories are course objectives tested on the exam (from Table 3).

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, develop your learning approach for categories where you are NEED IMPROVEMENT (red triangles). 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.

Steps 1-3 were administered intervention that guides self-directed plans to improve learning.

Learning Strategies:

For RECALL & COMPREHENSION

Use study guide (tests, diagrams, correct wrong, etc.) to develop different study methods on relevant content or applied. Pass along study contraband concept, strategies, or tips, or come up with study tips that reflect on exam performance. Share thought processes with peers and/or course tutorial and practice questions on discussion board, in small or large learning group. Self-assessment of skill-based learning approaches (feedback and self-developed practice questions).

For APPLIED AND ANALYSIS

Use study guide (tests, diagrams, correct wrong, etc.) to develop different study methods on relevant content or applied. Pass along study contraband concept, strategies, or tips, or come up with study tips that reflect on exam performance. Share thought processes with peers and/or course tutorial and practice questions on discussion board, in small or large learning group. Self-assessment of skill-based learning approaches (feedback and self-developed practice questions).

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Bibliography:
1. Accreditation standards and key elements for the professional program in pharmacy leading to the doctor of pharmacy degree (Standards 2016). In: Accreditation Council for Pharmacy Education; 2015.
3. Medina MS, Castleberry AN, Persky AM. Strategies for improving learner metacognition in health professional education. APRIL 2017;8(1).

6. Examsoft.com

Figure 1. Categories of Learning

- PHYS: Evaluate cardiovascular (CV) disease pathophysiology with emphasis on identifying Therapeutic targets.
- MDA: Describe the pharmacologic mechanism of action (MOA) for different classes of CV drugs.
- MOA ADVERSE: Discuss how a CV drug’s mechanism of action (MOA) relates to potential for adverse effects.
- MED CHRN: Identify clinically relevant structure-activity relationships of CV drugs.
- BRAND/GENERIC/CLASS: Identify brand name, generic name, and pharmacological class for assigned CV drugs.
- DRUG INFO: Compare and contrast drug information for CV drugs including therapeutic effects, adverse effects, precautions/contraindications, dosing/administration, monitoring parameters and patient considerations.
- MED PREDICTIONS: Identify actual or potential medications-related problems in individuals with CV diseases while integrating knowledge of pathophysiology, pharmacology, medicinal chemistry and evidence-based therapeutics.
- SELECT THERAPY: Select evidence-based treatment regimens for prevention and management of CV diseases based on assessment of patient factors (e.g., comorbid conditions, concurrent medications), benefits vs. risks of drug or non-drug options, and integrating of therapeutic efficacy, drug interactions, adverse effects, precautions/contraindications, dosing/administration, monitoring parameters and patient considerations.
- JUSTIFY THERAPY: Justify regression of evidence-based treatment regimens for prevention and management of CV diseases for implementation consistent with the joint Commission of Pharmacy Practitioners-Patient Patient Care Process.

Table 1. Comparison of Mean Exam Grades between Cohorts

Table 2. Student Perception of Exam Performance Report Utility

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Discussion

1. The report(s) helped me to improve my study approach for the next CPF440 exam course.
2. The report(s) should be made available for all course exams using Examsoft at ACPHS.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Undecided</th>
<th>Disagree or Strongly Disagree</th>
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<tbody>
<tr>
<td>59 (64%)</td>
<td>18 (20%)</td>
<td>14 (15%)</td>
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<td>80 (88%)</td>
<td>9 (10%)</td>
<td>2 (2%)</td>
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<tr>
<td>79%</td>
<td>77%</td>
<td>+3%</td>
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<td>84%</td>
<td>79%</td>
<td>+5%</td>
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<tr>
<td>79%</td>
<td>74%</td>
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