Development and implementation of an exam autopsy to promote metacognition at multiple programs

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BACKGROUND

The ACPE Standards encourage schools of pharmacy to provide an environment that fosters lifelong learning. Metacognitive activities allow learners the opportunity to think about what they know and how it should be applied, as well as plan strategies for learning what they do not know.[1]

The exam autopsy provides students with a formal process to practice metacognition through reflection on exam performance. Students review missed questions and categorize the rationale for missed items, identify trends in the types of questions missed and plan for future learning through reflection on their successes and opportunities for improvement.

OBJECTIVES

Primary Objective

To develop and implement a multi-campus, collaborative exam autopsy process to promote metacognitive development in students.

Secondary Objectives

To assess the effects of the exam autopsy process on students' confidence and perceived impact on learning learning.

To identify opportunities for procedural improvement prior to a quantitative investigation of the effects of exam autopsy on student performance.

METHODS

Development

- Baseline characteristics

Location	Enrolled students, no.	Professional year, course
NU-SOP	139	P2, Comprehensive Disease Management course
UAMS	113	P2, Pharmacology II
ULM	97	P2, Integrated module
URI	132	P1, Integrated course

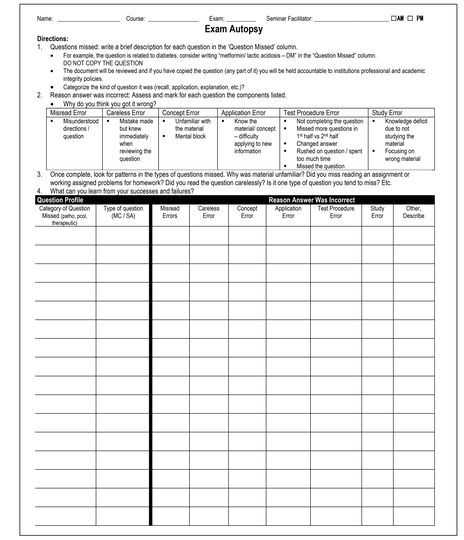
- Exams administered through ExamSoft®
- Exam review utilizing missed item report
- Exam autopsy form provided for voluntary participation
  - Mandatory participation for exam score < 73% at NU-SOP
- Post-exam self-assessment (PESA) survey administered through Google Forms after each exam
- End of semester perception survey administered through Qualtrics™

Implementation

- Presentation to introduce metacognition theory and connect exam autopsy process with how students learn
- Modeled the practice of how to use exam autopsy with participating students
  - Introduced six types of test-taking errors[2]
- Exam review conducted within 10 days of exam

Location	Exams, no.	Exam autopsies, no.
NU-SOP	3	2
UAMS	5	4
ULM	4	3
URI	6	4

- Exam autopsy form completed during review after each exam
- PESA results re-distributed to participating students using mail merge for students to use in preparation for following exam



Name: _____ Course: _____ Exam: _____ Seminar Facilitator: _____ ☐AM ☐ PM

Exam Autopsy

Directions:

1. Questions missed: write a brief description for each question in the 'Question Missed' column.
   - For example, the question is related to diabetes, consider writing "metformin/ lactic acidosis – DM" in the "Question Missed" column.
   - DO NOT COPY THE QUESTION
   - The document will be reviewed and if you have copied the question (any part of it) you will be held accountable to institutions professional and academic integrity policies.
   - Categorize the kind of question it was (recall, application, explanation, etc.)?
2. Reason answer was incorrect: Assess and mark for each question the components listed.
   - Why do you think you got it wrong?

Misread Error	Careless Error	Concept Error	Application Error	Test Procedure Error	Study Error
• Misunderstood directions / question	• Mistake made but knew immediately when reviewing the question	• Unfamiliar with the material • Mental block	• Knew the material/ concept – difficulty applying to new information	• Not completing the question • Missed more questions in 1st half vs 2nd half • Changed answer • Rushed on question / spent too much time • Missed the question	• Knowledge deficit due to not studying the material • Focusing on wrong material

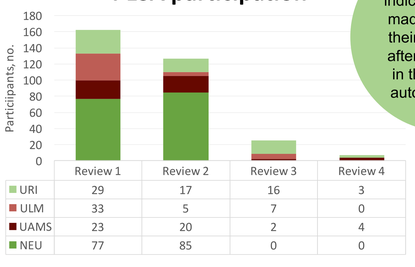
3. Once complete, look for patterns in the types of questions missed. Why was material unfamiliar? Did you miss reading an assignment or working assigned problems for homework? Did you read the question carelessly? Is it one type of question you tend to miss? Etc.
4. What can you learn from your successes and failures?

Question Profile		Reason Answer Was Incorrect							
Category of Question Missed (patho, pcol, therapeutic)	Type of question (MC / SA)	Misread Errors	Careless Error	Concept Error	Application Error	Test Procedure Error	Study Error	Other, Describe

RESULTS

Post-exam self-assessment survey

PESA participation



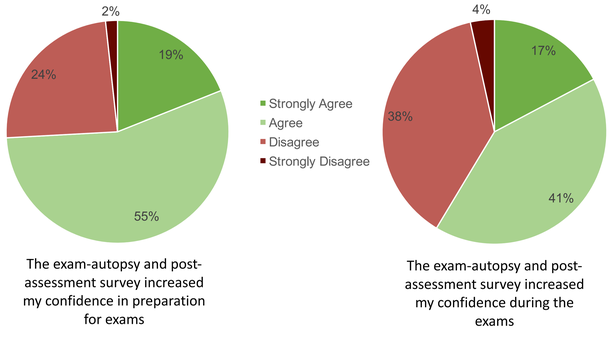
	Review 1	Review 2	Review 3	Review 4
URI	29	17	16	3
ULM	33	5	7	0
UAMS	23	20	2	4
NEU	77	85	0	0

44% of students indicated that they made changes in their study habits after participation in the first exam autopsy process

Mean number of days studied decreased from 7.12 to 6.13 (p=0.01) with participation in at least one exam review

End of semester perception survey

Effect of exam autopsy process on confidence



The exam-autopsy and post-assessment survey increased my confidence in preparation for exams

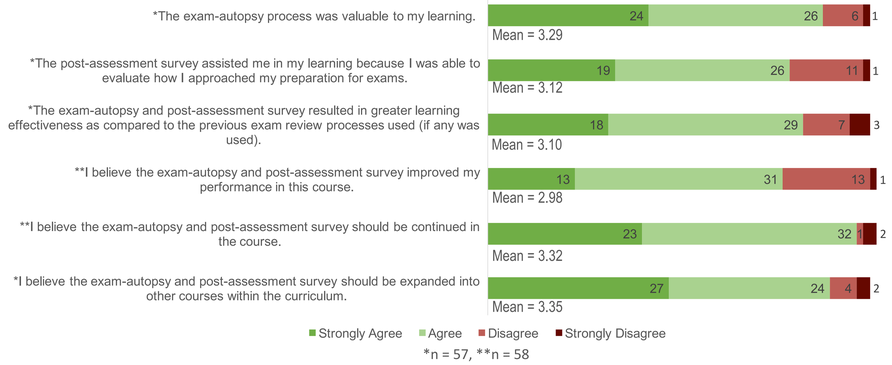
The exam-autopsy and post-assessment survey increased my confidence during the exams

Effect of exam autopsy process on study techniques

Types of study techniques	Baseline	After exam review	Difference
Rereading/reviewing class notes	94.8%	92.2%	-2.5%
Repeating concepts for memorization	76.7%	72.1%	-4.7%
Rewriting concepts or rephrasing ideas in your own words	69.2%	62.8%	-6.4%
Summarizing/synthesizing material by making study aids	67.4%	58.1%	-9.3%
Watching or listening to class recordings or podcasts	50.6%	47.3%	-3.3%
Sharing ideas/explaining concepts to others	51.2%	45.0%	-6.2%
Working through problems or cases provided in class	50.6%	45.0%	-5.6%
Relating/applying new material to things you already knew	43.0%	41.9%	-1.2%
Transcribing lectures	37.8%	38.8%	**1.0%**
Narrative responses to lecture-level learning objectives	26.2%	21.7%	-4.5%
Solving new or harder problems/cases for practice	18.6%	16.3%	-2.3%
Reading clinical practice guidelines/review articles	12.8%	11.6%	-1.2%
Rereading/highlighting textbook	11.0%	8.5%	-2.5%
Reading textbook for the first time	4.1%	5.4%	**1.4%**
Other	2.3%	1.6%	-0.8%

Student-perceived value of exam autopsy

Mean response on Likert scale 1 to 4



*n = 57, **n = 58

DISCUSSION

Successes

- Positive feedback from students at all schools
- Scheduled exam review sessions saved faculty time in team-taught courses by eliminating multiple one-on-one meetings during office hours
- Enhanced collaboration among faculty disciplines in team-taught courses

Challenges

- Some students and faculty members did not see the value or purpose of using the exam autopsy process over the ExamSoft® Strengths and Opportunities Report
- Students felt that the information from the exam autopsy was useful, but struggled with how to apply the newly learned information to their learning
- Student participation in post-exam self-assessment surveys decreased over the duration of the semester initial use of exam autopsy
- Exam autopsy form was time-intensive, as students were unfamiliar with the process

Future Directions

- Implement a metacognition inventory to assess impact of exam autopsy process on metacognitive development
- Encourage faculty to reference learning strategies that may help students to apply information gathered during the exam autopsy process

REFERENCES

1. Schneider EF, et al. Pharmacy students' ability to think about thinking. Am J Pharm Ed. 2014;78(8):Article 148.
2. Nolting PD. Winning at Math, Your Guide to Learning Mathematics Through Successful Study Skills. Bradenton, Fla : Academic Success Press, 1997.