

Early Identification and Intervention using Student Performance in Organic Chemistry II

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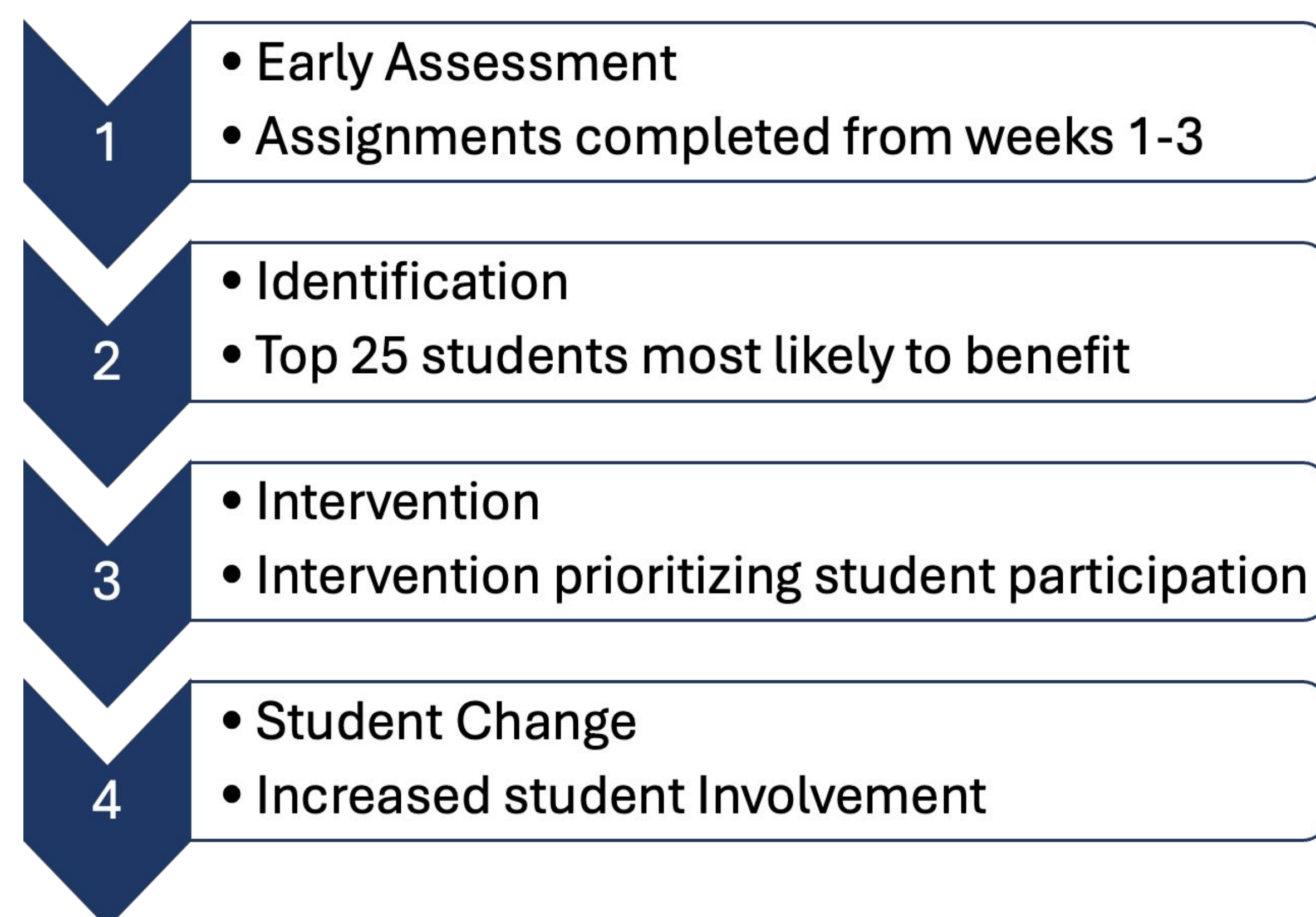


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Overview

Organic Chemistry II, CHEM 262, is the second course in a two-semester sequence which builds upon fundamental concepts learned in each of the preceding chemistry courses, and has a total of 800 students per year. The academic and personal background of students in this course are very diverse, since it fulfills multiple majors and professional school admission requirements. CHEM 262 is a content-heavy and fast paced course, covering a variety of reactions and techniques. Accordingly, student behaviors and habits formed in the beginning of the course can have a large impact on the overall success of a student. Because of these characteristics, it is critical for instructors to evaluate student performance starting from an early stage. We seek to identify possible signs for academic difficulties early in the semester, and implement targeted interventions to help students recover from early setbacks.

Flowchart



Early Intervention

1. End-of-Week Assignments (EOWs) predicts the overall performance of students.

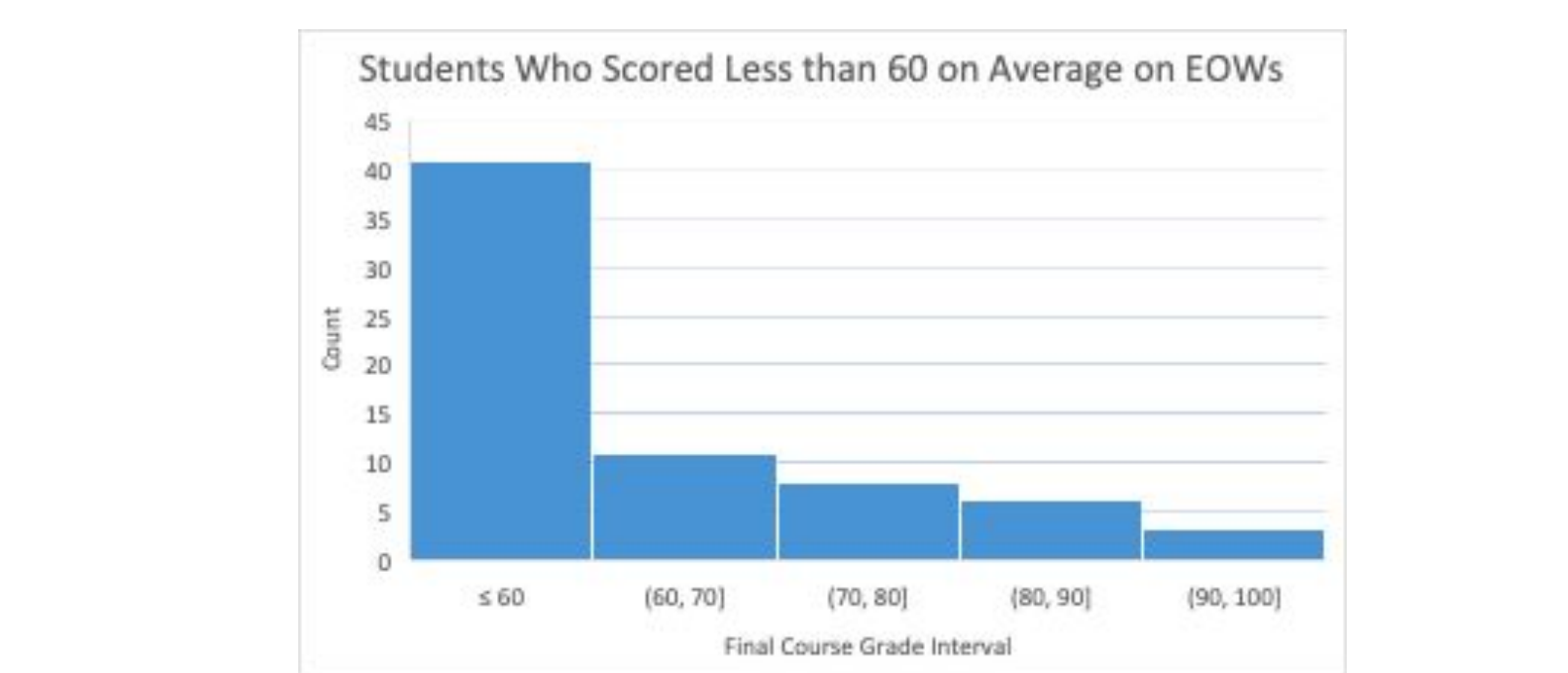
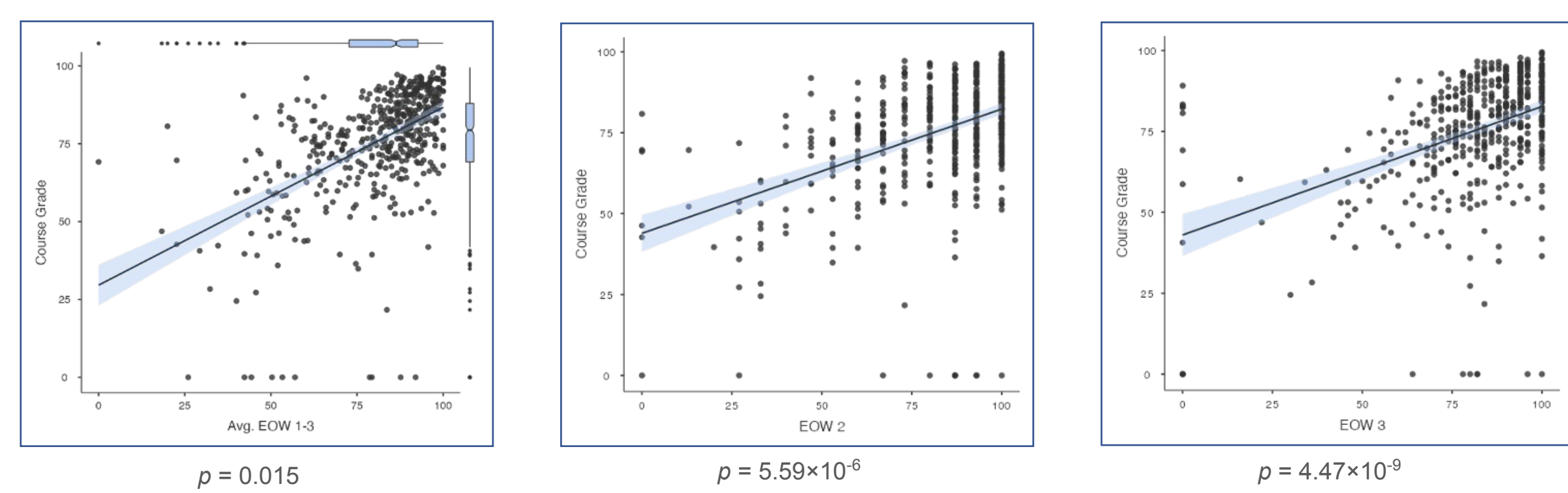


Figure. Students who scored an average of less than 60 on first four EOW and their course grades.

2. Early intervention helps improve student performance.

Intervention Types:

Task value & Framing.

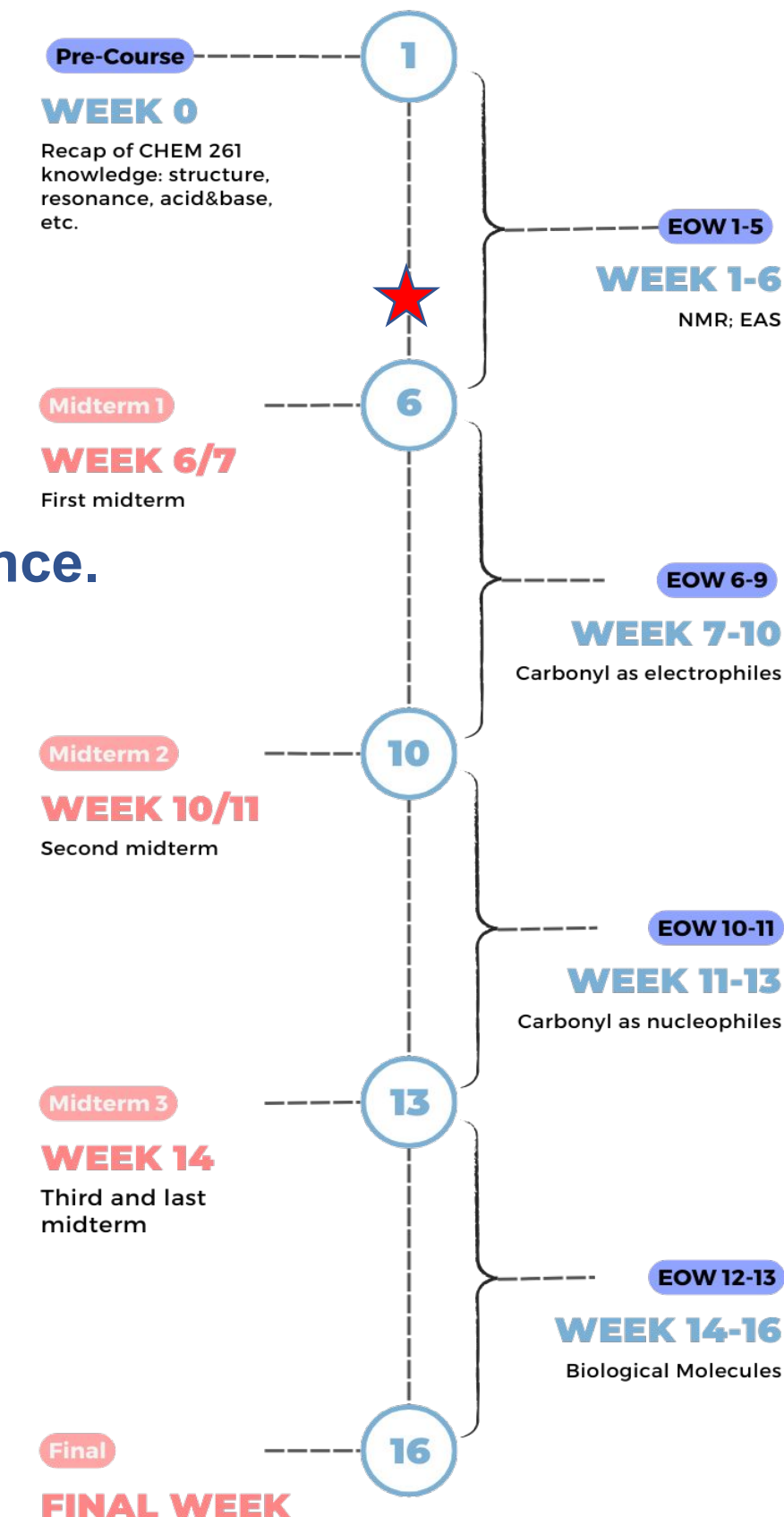
Outcome levels:

Course specific:

Increased course performance for all students and particularly for first-generation underrepresented minority students. (Harackiewicz et al., 2016)

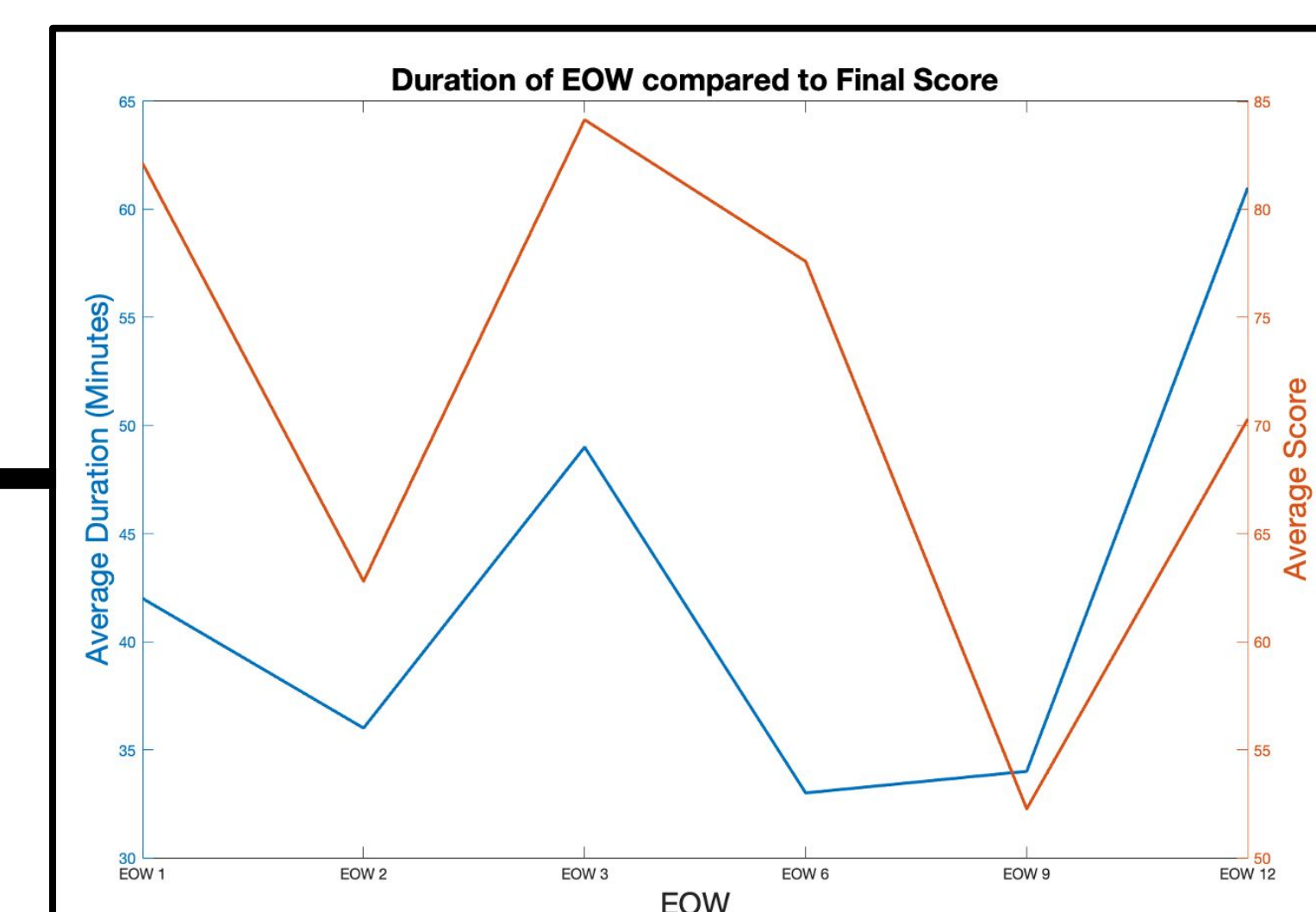
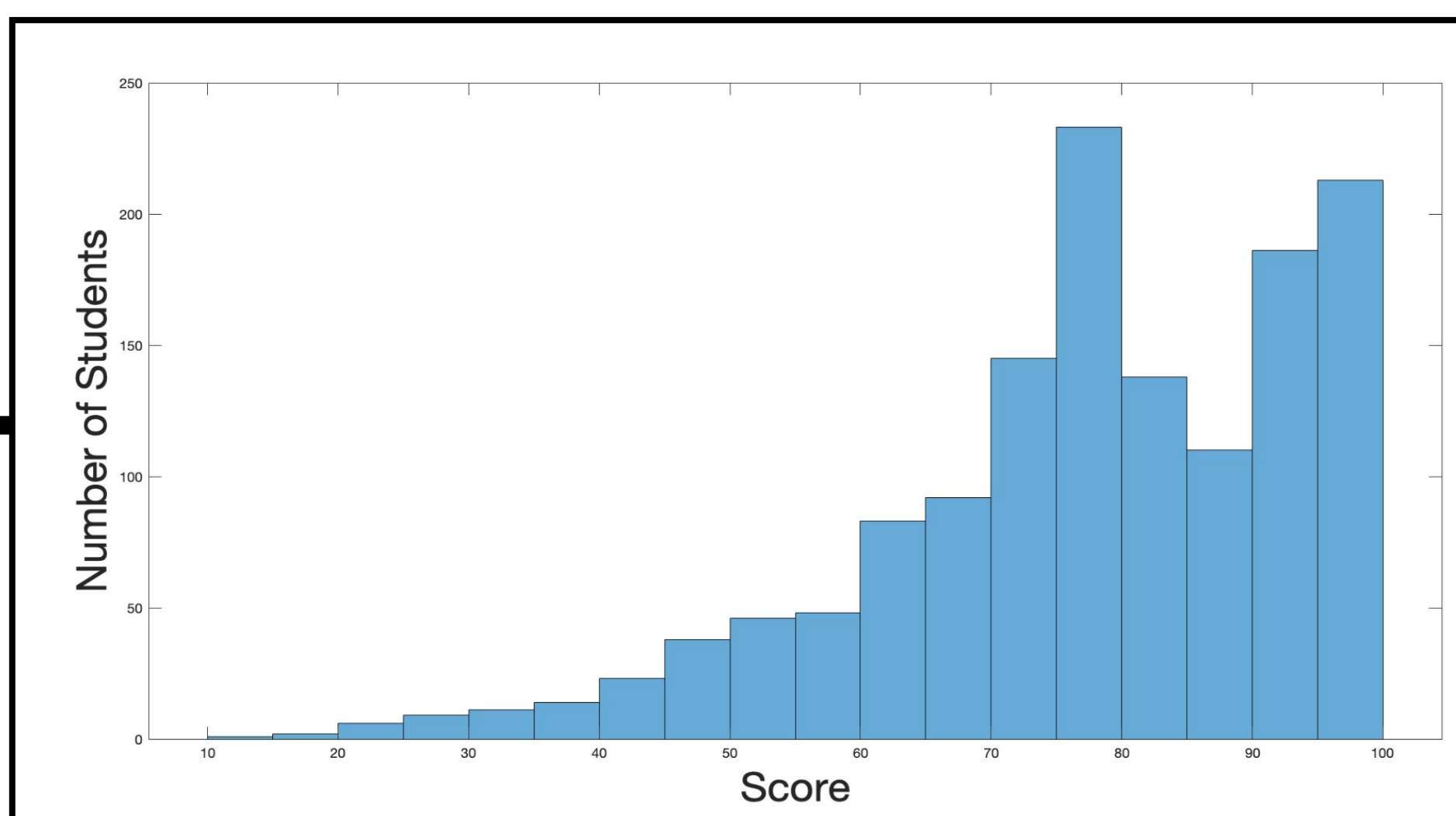
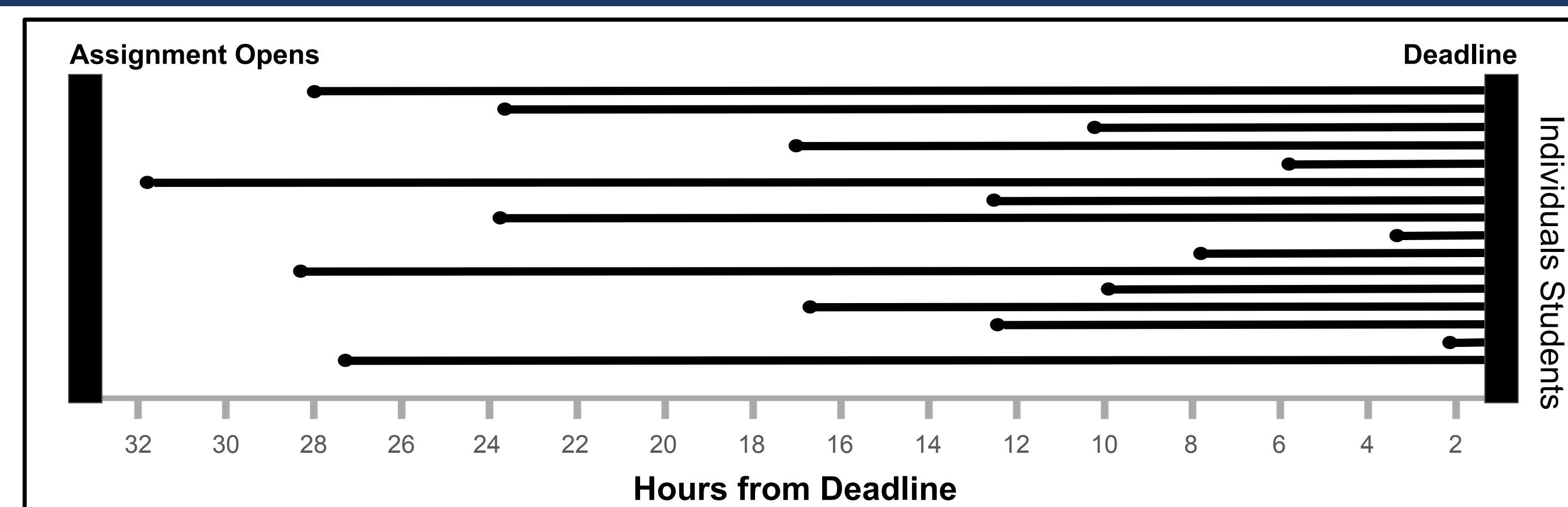
Field specific: Increased interest in pursuing a career in biomedical research. (Brown et al., 2015)

★ = the ideal time for intervention in CHEM 262



Harackiewicz, J. M. (2018). Improving Student Outcomes in Higher Education: The Science of Targeted Intervention. Annual review of psychology, 69, 409-435.

Identification

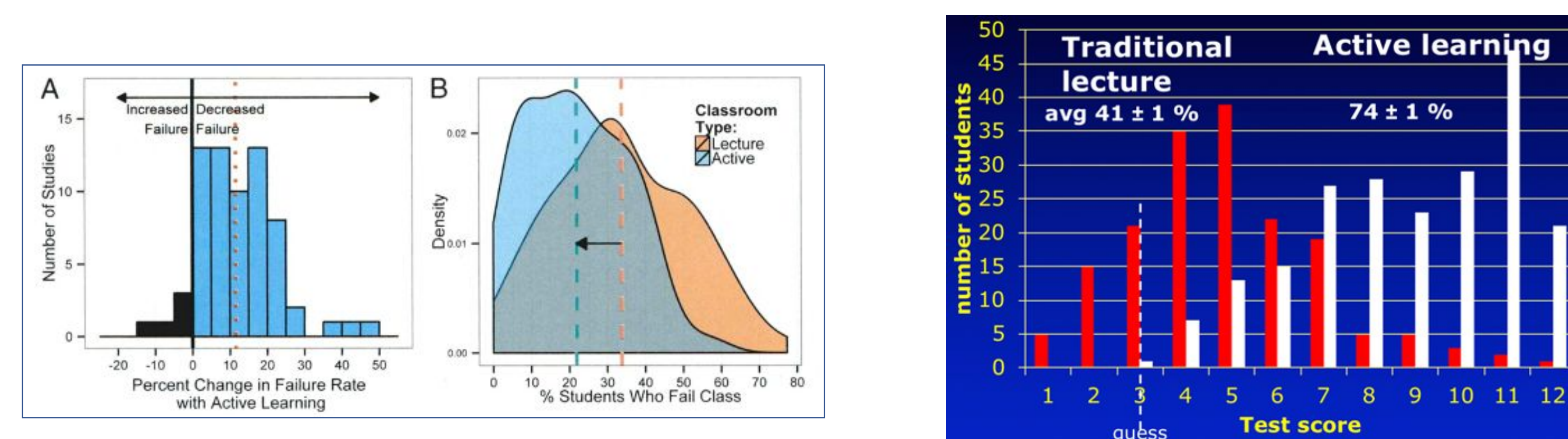


	Predicted Students	Not-predicted Students
C- or below	24 96%	161 34.9%
C+ or above	1 4%	300 65.1%

Accuracy: 96%

Intervention

Active Learning improves student performance.



Intervention example:

- Chemical Structures in NMR: 14B, 14C, 14D, 14E.
- Nucleophilic Reactions of Carbonyls: 17D, 17F, 17G.
- Acid-Base: 8D, 8E, 11B, 17A, 17B, 18B, 19C.

Instruction philosophy: student-centered; activity-oriented; actively engaged.

Audience: open to everyone, with special invitations sent to students identified through predictive models.

Goals: to systematically revisit and organize important concepts through actively learning within 90-120 mins.

Deslauriers, L. et al.; Measuring actual learning versus feeling of learning in response to being actively engaged in the classroom. PNAS, Vol. 116, No. 39 (September 24, 2019), pp. 19251-19257

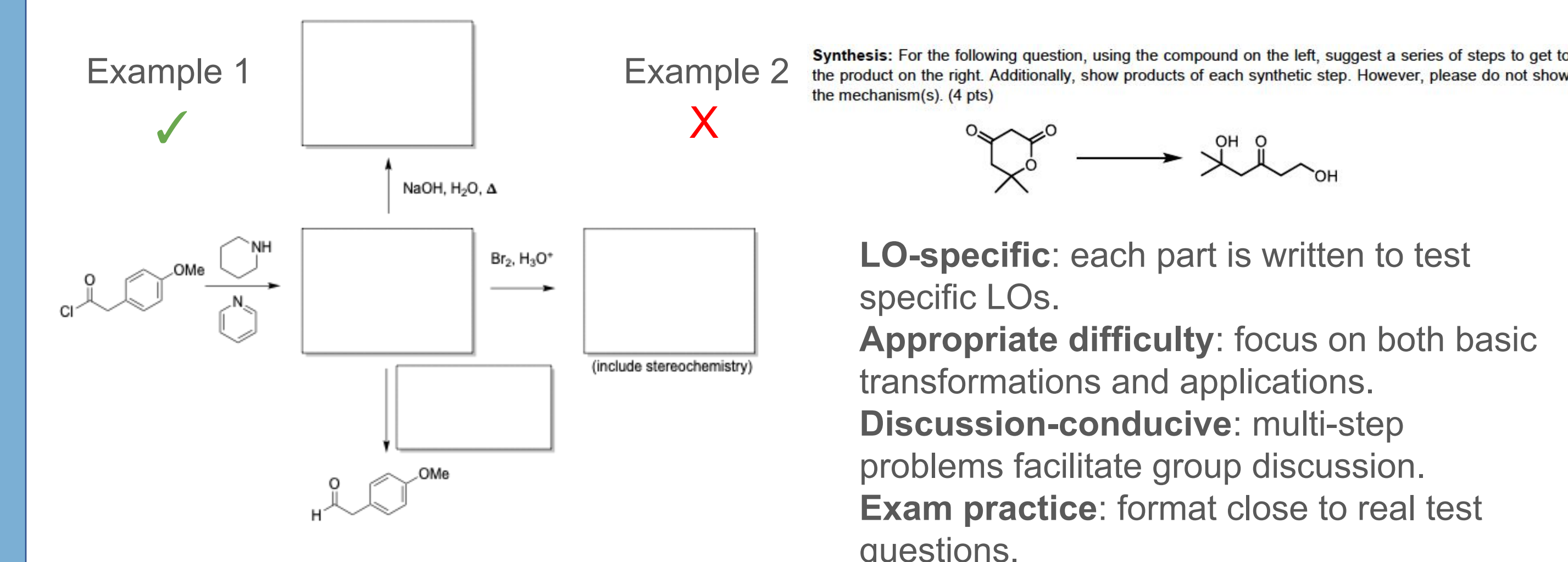
Student Change

Modifying current weekly LA review sessions to incorporate active learning.

Time	Old		New		
	Task	Format	Task	Format	
0					
5	Worksheet	Individual	Worksheet	Individual (Strictly close-book and close-note, no collaboration allowed; LAs should only answer clarification questions.)	
10					
15	Worksheet Analysis	LAs walk through how to solve each problem, while students sit and listen on their own for the majority of time. When LAs finish explaining a question, students ask questions about it.	Group discussion (2-4 students)	Students break into small groups and compare their answers and discuss disparities in their answers to come up with a consensus.	
20				Presentation (In groups)	Each group will come to the front and walk others through how they reach their "group answer." One member of the group will be the main "lecturer", while others will be responsible for any questions that comes up.
25					
30					
35					
40					
45					
50					
55	Free Q&A	Students ask LAs questions one at a time; not an efficient time-usage for other students.			
60					

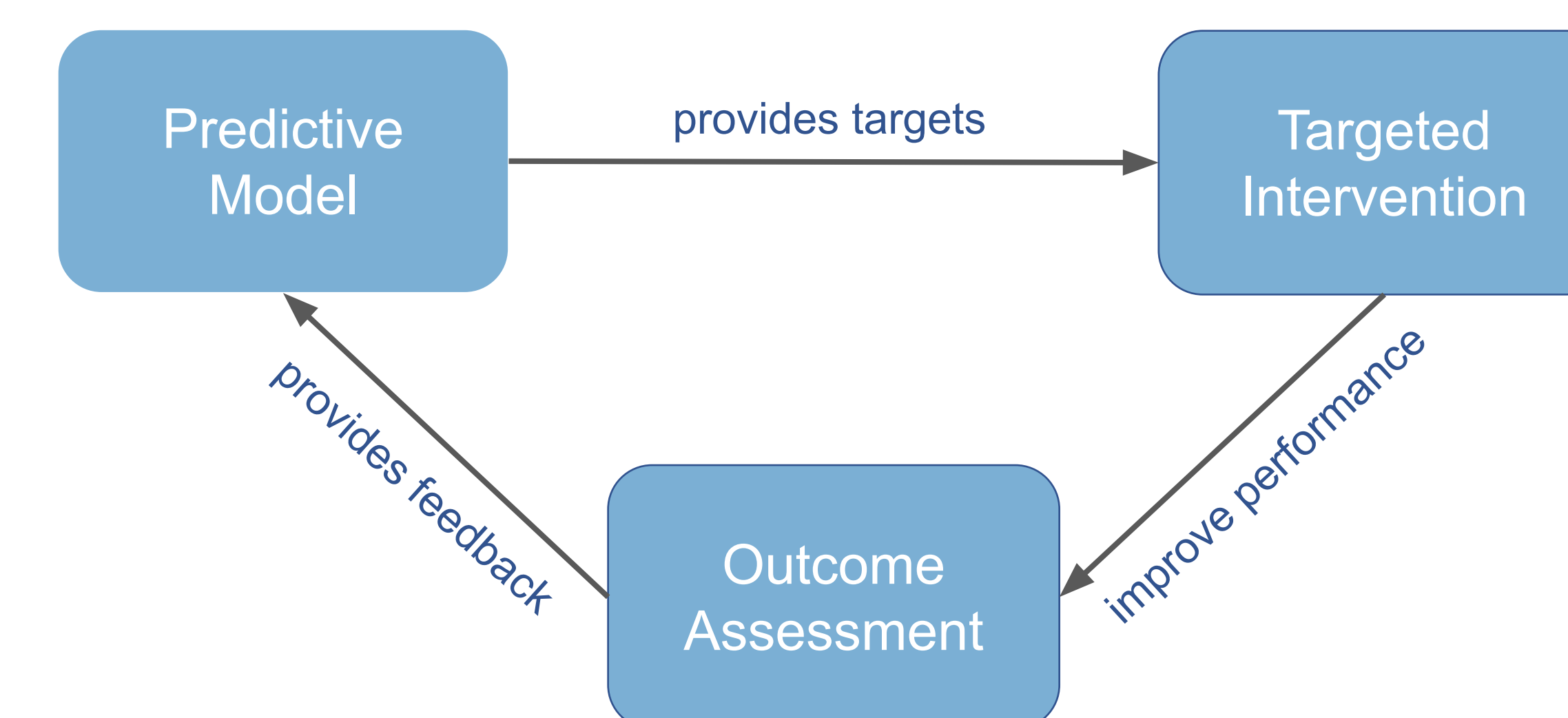
Legend:
■ = passive learning
■ = active learning
Average Students Engaging Time: 9 mins (Old) → 30 mins (New) **233% Increase**

Designing LO-specific questions to be used in workshop sessions.



Conclusion/Future Steps

We have successfully developed a preliminary model to identify students who may substantially benefit from targeted interventions at an early stage in a semester. We were able to achieve an accuracy of 96% through the current model, which is based on analysis of multiple metrics, including assignment submission time, score, and consistency. Efforts were also made to develop an effective format for future targeted intervention. A restructuring of current LA sessions increased students' actively learning time by 233%.



Acknowledgements

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- Special appreciation to Spring 2024 CHEM 262 LAs for supporting intervention methods study.
- All Results above are unpublished.