Using ExamSoft to Improve Major and Program Learning Outcomes in Biology

4th Annual Assessment Symposium, Friday March 16, 2018

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Boston University
Biology

Biology Department by the numbers

- Approximately 900 major students
- Average 225 per graduating class
- 51 faculty engaged in teaching
- 69 open-enrollment courses dedicated to our majors

Biology Major Learning Outcomes

content

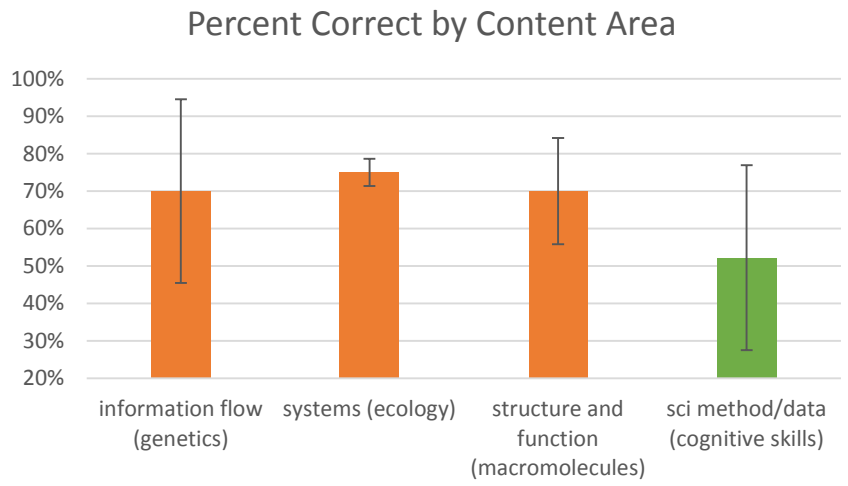
- *Demonstrate knowledge of fundamental principles spanning the breadth of biology.*
- *Demonstrate expertise in the scientific method, including experimental design, critical assessment of the scientific literature, and an understanding of the principles and best practices for the ethical conduct of research.*
- *Attain the technical and/or analytical skills required for employment or post-graduate education in biology or biology-related careers, including professional careers and science education.*

Cognitive skills

Lab skills

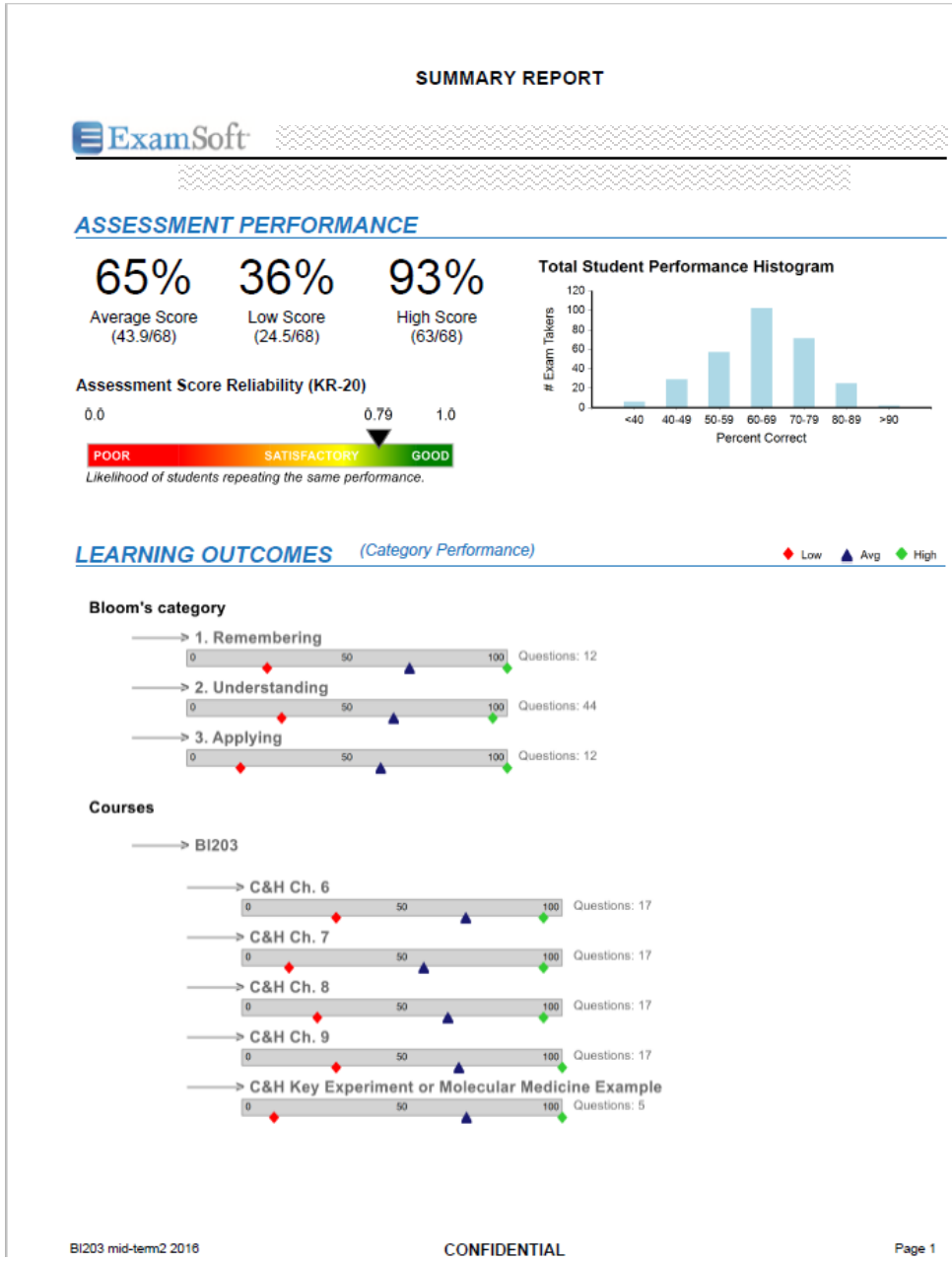
Current means of assessment

- Incentivized, optional senior survey
  - 3 questions on cognitive skills (data analysis & scientific method)
  - 11 questions spanning 4 biology content areas
  - 8 questions of self-assessed competency in cognitive and lab skills



Challenges

- Limitations of data
- Tiny portion of the breadth of biology assessed
  - Small details within
  - Low response rate (35%)
  - Low question number, may bias data
  - Creation and analysis takes time
- Self-reporting can be flawed
- Must keep survey short to encourage participation



SUMMARY REPORT

ExamSoft

ASSESSMENT PERFORMANCE

65% Average Score (43.9/68)

36% Low Score (24.5/68)

93% High Score (63/68)

Total Student Performance Histogram

Exam Takers: 120, 100, 80, 60, 40, 20, 0

<40 40-49 50-59 60-69 70-79 80-89 >90

Percent Correct

Assessment Score Reliability (KR-20)

0.0 0.79 1.0

POOR SATISFACTORY GOOD

Likelihood of students repeating the same performance.

LEARNING OUTCOMES (Category Performance)

Low Avg High

Bloom's category

1. Remembering — Questions: 12
2. Understanding — Questions: 44
3. Applying — Questions: 12

Courses

BI203

- C&H Ch. 6 — Questions: 17
- C&H Ch. 7 — Questions: 17
- C&H Ch. 8 — Questions: 17
- C&H Ch. 9 — Questions: 17
- C&H Key Experiment or Molecular Medicine Example — Questions: 5

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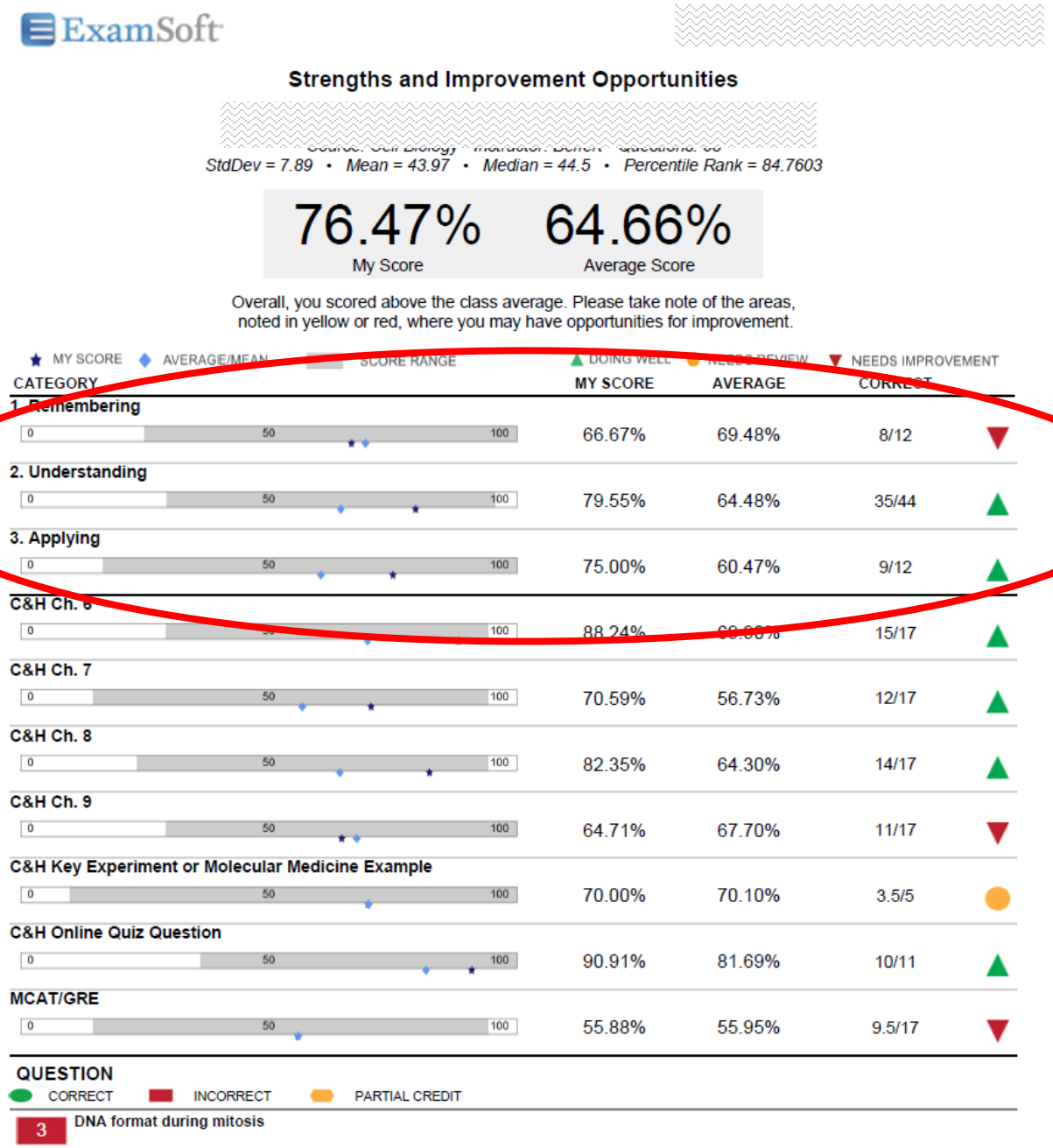
ExamSoft Software

Online exam-taking software that delivers exams electronically and prevents cheating by “locking down” and securing students’ computers from other programs.

Questions are categorized using Bloom’s taxonomy, textbook chapter, or program assessment outcome

Student Feedback



ExamSoft

Strengths and Improvement Opportunities

StdDev = 7.89 • Mean = 43.97 • Median = 44.5 • Percentile Rank = 84.7603

76.47%	64.66%
My Score	Average Score

Overall, you scored above the class average. Please take note of the areas, noted in yellow or red, where you may have opportunities for improvement.

MY SCORE | AVERAGE/MEAN | SCORE RANGE | DOING WELL | NEEDS REVIEW | NEEDS IMPROVEMENT

CATEGORY	MY SCORE	AVERAGE	CORRECT
1. Remembering	66.67%	69.48%	8/12
2. Understanding	79.55%	64.48%	35/44
3. Applying	75.00%	60.47%	9/12
C&H Ch. 6	88.24%	[illegible]	15/17
C&H Ch. 7	70.59%	56.73%	12/17
C&H Ch. 8	82.35%	64.30%	14/17
C&H Ch. 9	64.71%	67.70%	11/17
C&H Key Experiment or Molecular Medicine Example	70.00%	70.10%	3.5/5
C&H Online Quiz Question	90.91%	81.69%	10/11
MCAT/GRE	55.88%	55.95%	9.5/17

QUESTION

CORRECT | INCORRECT | PARTIAL CREDIT

3 DNA format during mitosis

- Rapidly generates customizable personalized reports for each student
  - especially useful for large classes
- detailed feedback and identifies areas of improvement
- Data-driven conversation about learning strategies

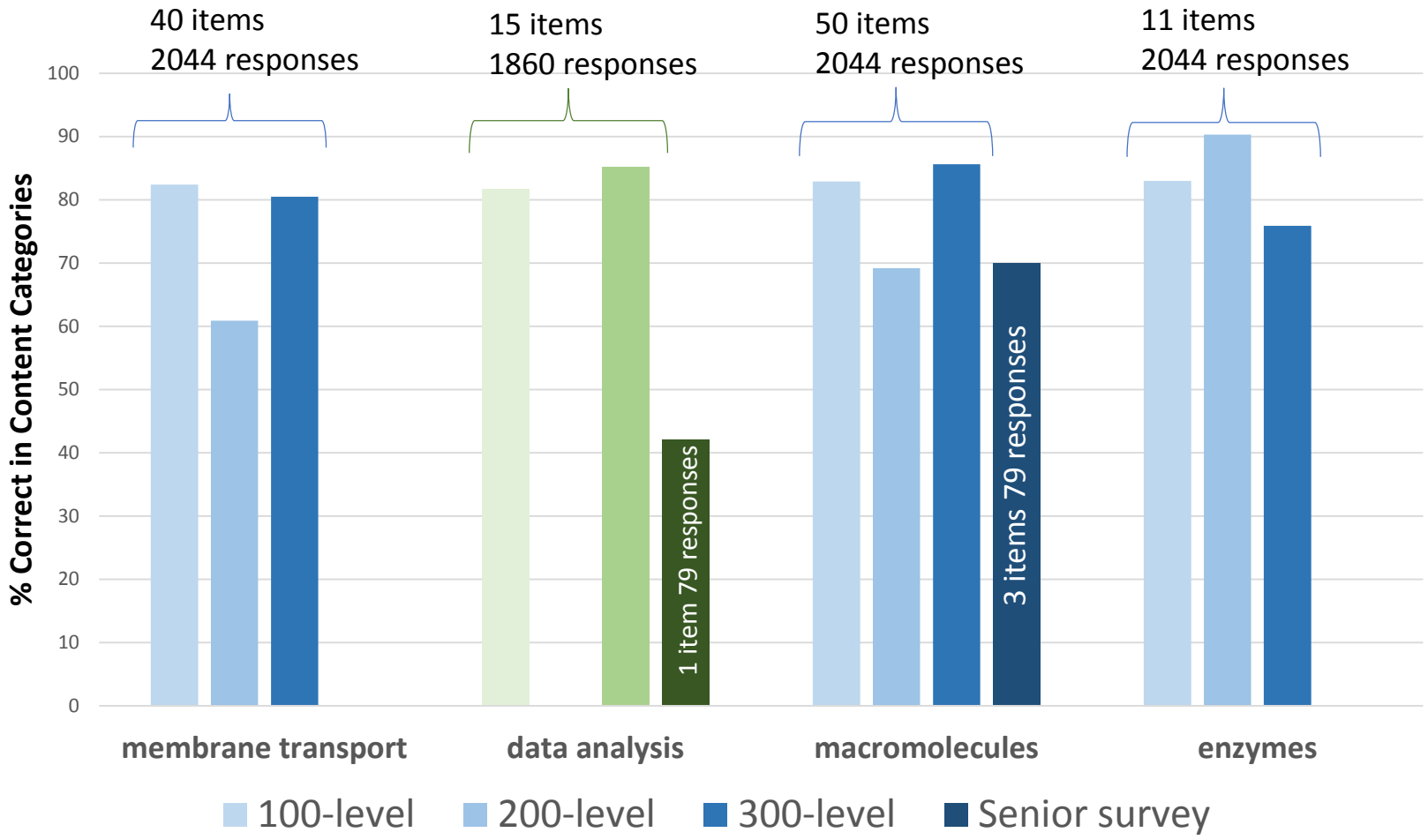
Multi-Year Analysis

- The students and faculty can track performance over multiple classes and from one semester to another.

- 2017: funding to test ExamSoft
  - **program assessment**
  - **enhance metacognition** in our students

Thanks to CAS, CTL, and The Office of the Provost

ExamSoft Program Assessment Data



- Seniors are under performing on survey (or forgetting?)
- We can see where we need to increase skill-based content
- Data are far more robust
- Easy to target areas of missing data

Use by Bloom's Level Across the Department

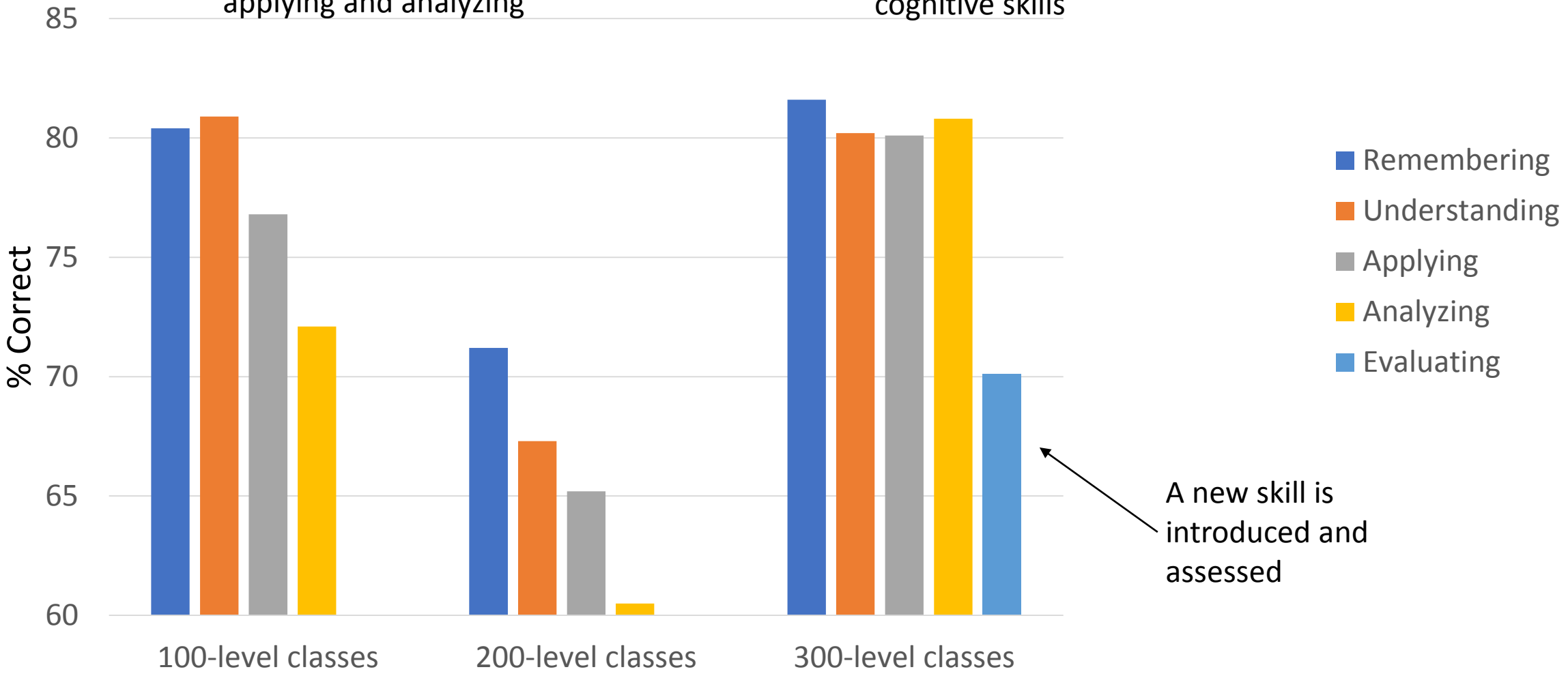
100-level: 2 classes, 7 faculty

200-level: 1 class, 1 faculty

300-level: 1 class, 2 faculty

Lower-level courses focus on remembering and understanding, while providing practice on applying and analyzing

At the 300-level, assessment is equally spread among higher and lower-order cognitive skills



Metacognition: awareness and understanding of one's own thought processes

- **Procedural knowledge**: There are different study strategies that can be used
- **Conditional knowledge**: Knowledge about when and why to use learning strategies
- **Information management strategies**: Ability to organize, summarize, compartmentalize information learned
- **Comprehension monitoring**: What are learning strategies, are you progressing in your learning?
- **Evaluation**: Did the strategies used help you succeed at a task (exam)?

Metacognition Study

- Recent research indicates that metacognitively aware learners are **more strategic and perform better** than unaware learners
  - plan, sequence, and monitor learning in a way that directly improves performance

- Our study
  - Pre- and Post-course survey after 1 semester with ExamSoft
  - Used a single course without ExamSoft as a control
- Metacognitive Awareness Survey: 52 True/false statements such as
  - I am aware of what strategies I use when I study.
  - I know when each strategy I use will be most effective.
  - I ask myself how well I accomplish my goals once I'm finished.

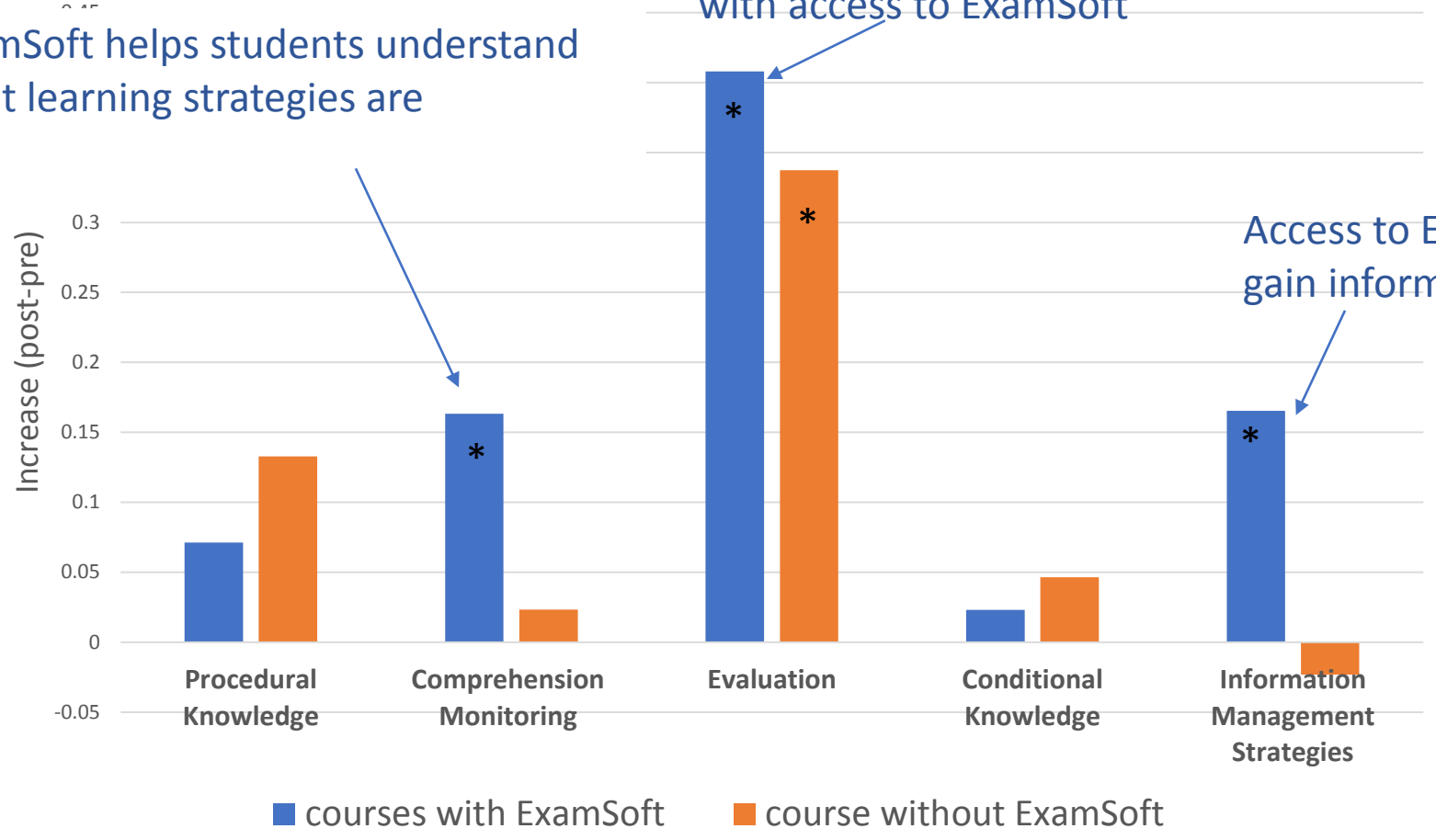
IRB protocol 4627X

ExamSoft Significantly Accelerates Metacognitive Gains

All students learn which strategies help the during exams, but students have more improvement with access to ExamSoft

ExamSoft helps students understand what learning strategies are

Access to ExamSoft helps students gain information organizing skills

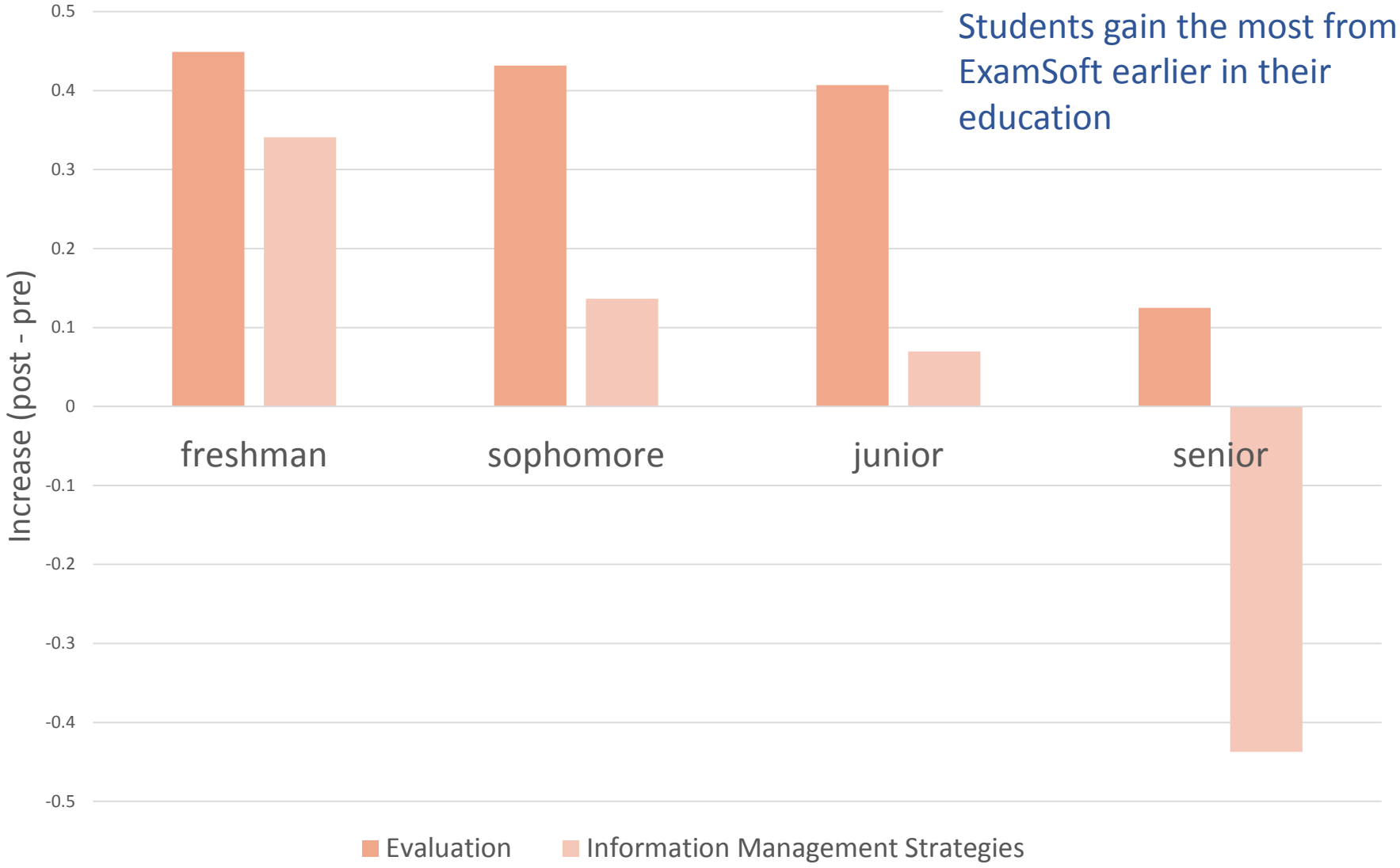


* Denotes statistical significance between pre and post scores within the category

Is there are “right time” for metacognitive gains?

Gains in comprehension monitoring did not show differences across class year

n	
176	freshman
175	sophomore
86	junior
32	senior



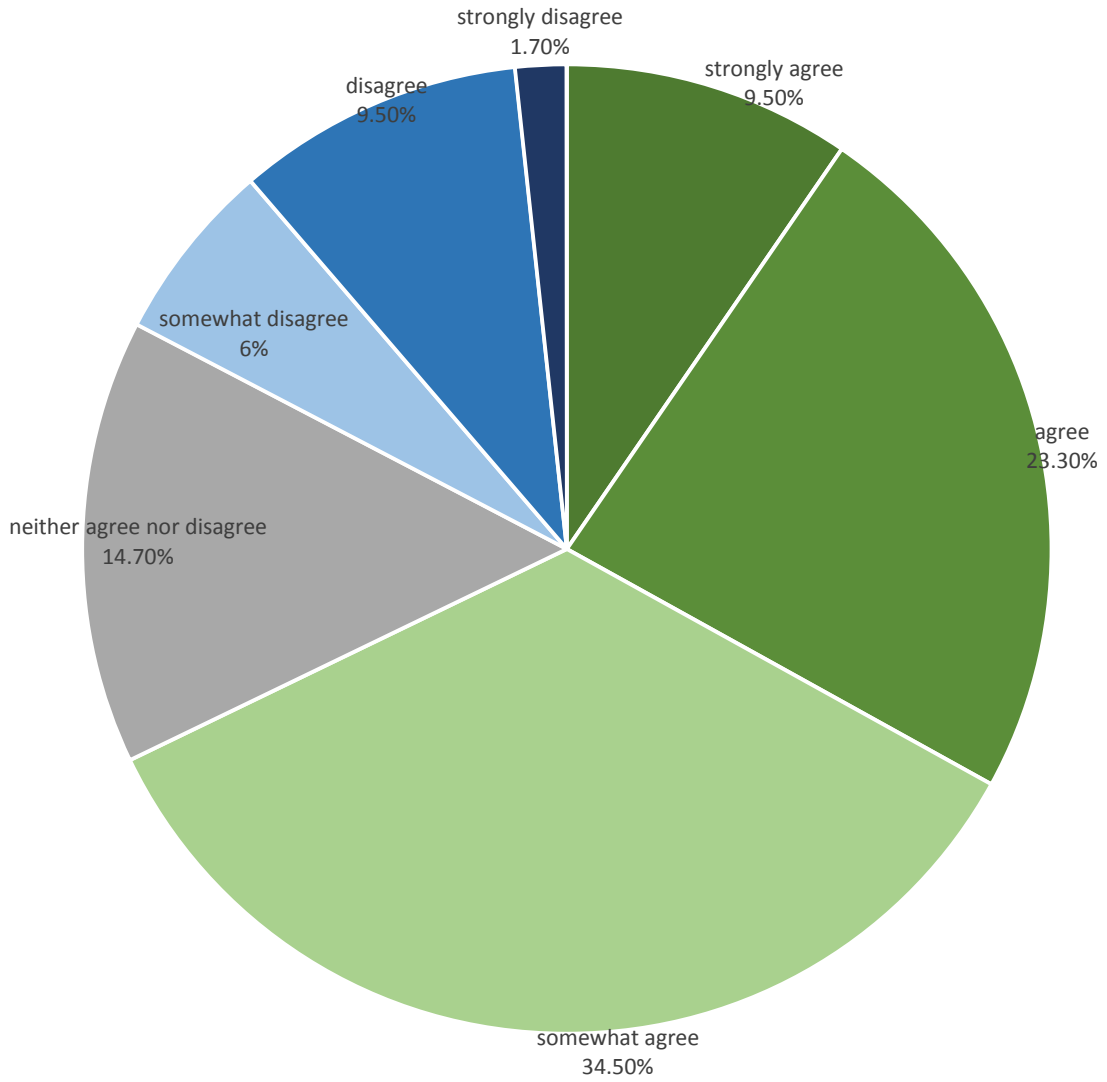
Current and future directions

- Refine program assessment learning outcomes based on these data and data from faculty survey on classroom practices
- Begin data-driven conversations among departmental faculty
- Further statistical and longitudinal data analysis—data collection continues through ’18-’19 academic year
- Development of Hub categories within ExamSoft
- Cost/benefit analysis and sustainability

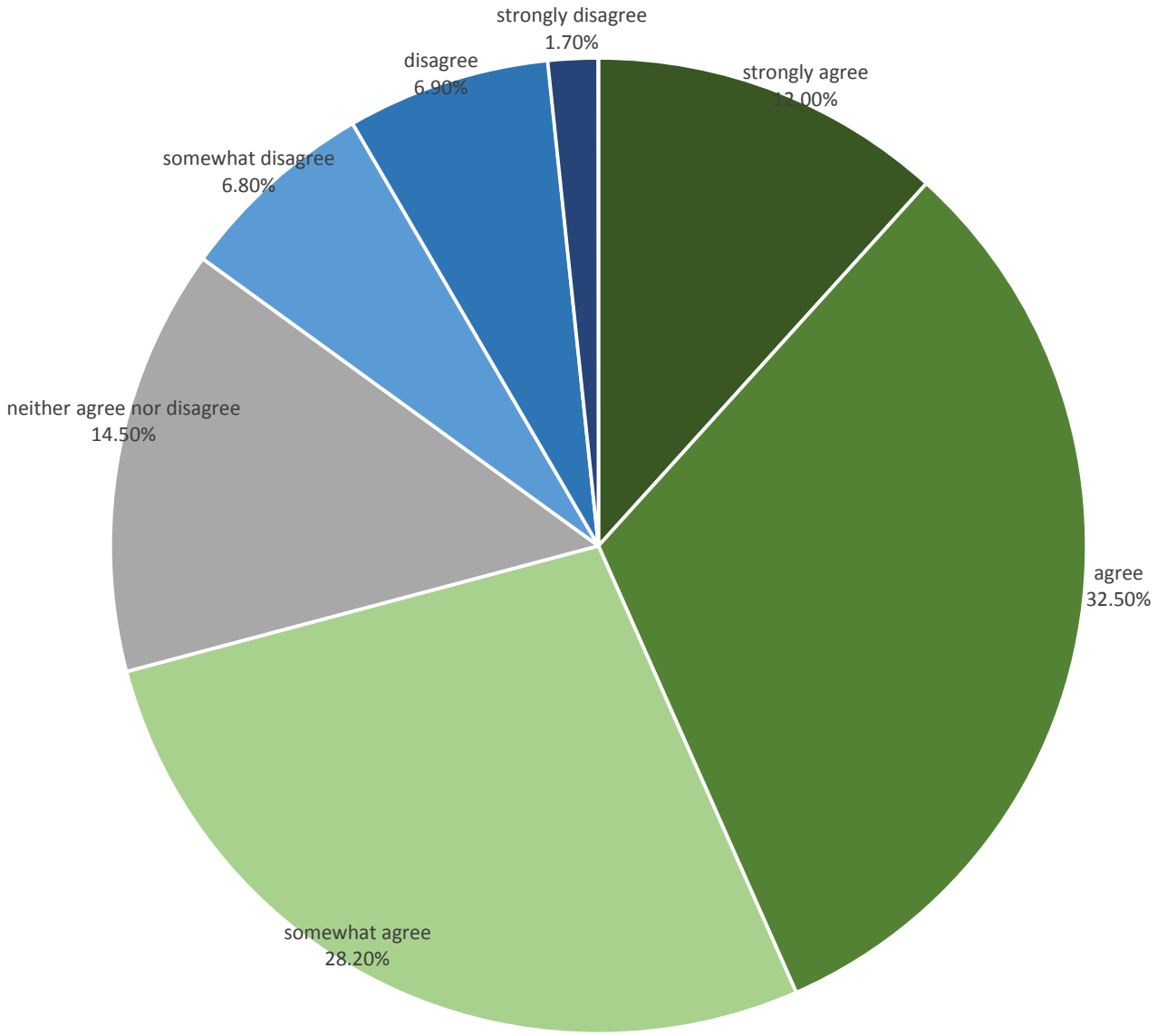
Student Attitudes toward ExamSoft

- Students were taught about Bloom's taxonomy
- Presented with analyses of their exam performance after every exam
- Class exam data was presented and reflected on in lecture after every exam
- Students were given study method suggestions from published educational literature for improving their learning in Bloom's categories

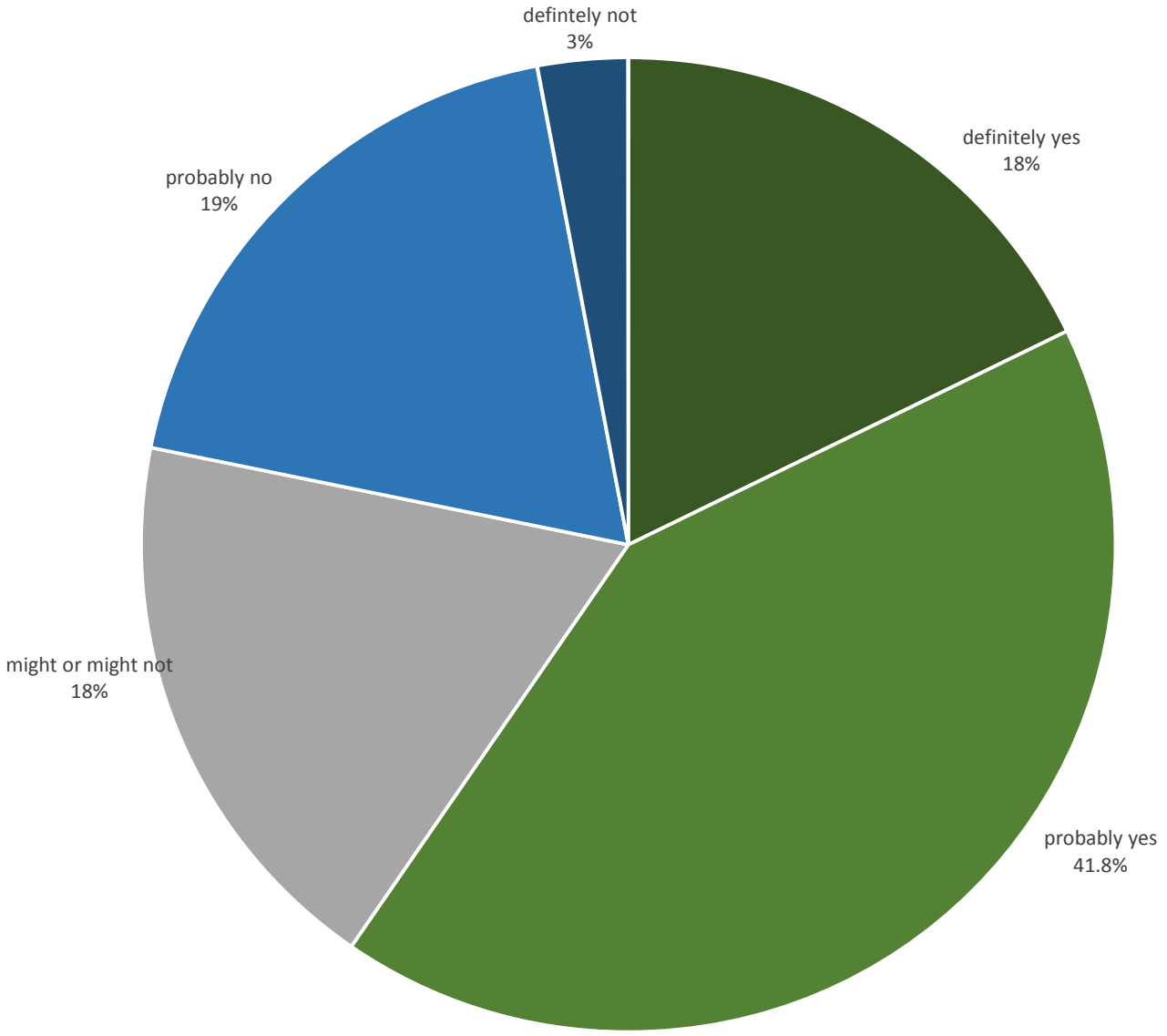
Do you agree or disagree with this statement: Examination of my "strengths and opportunities report" helped me to refine my study habits/techniques?



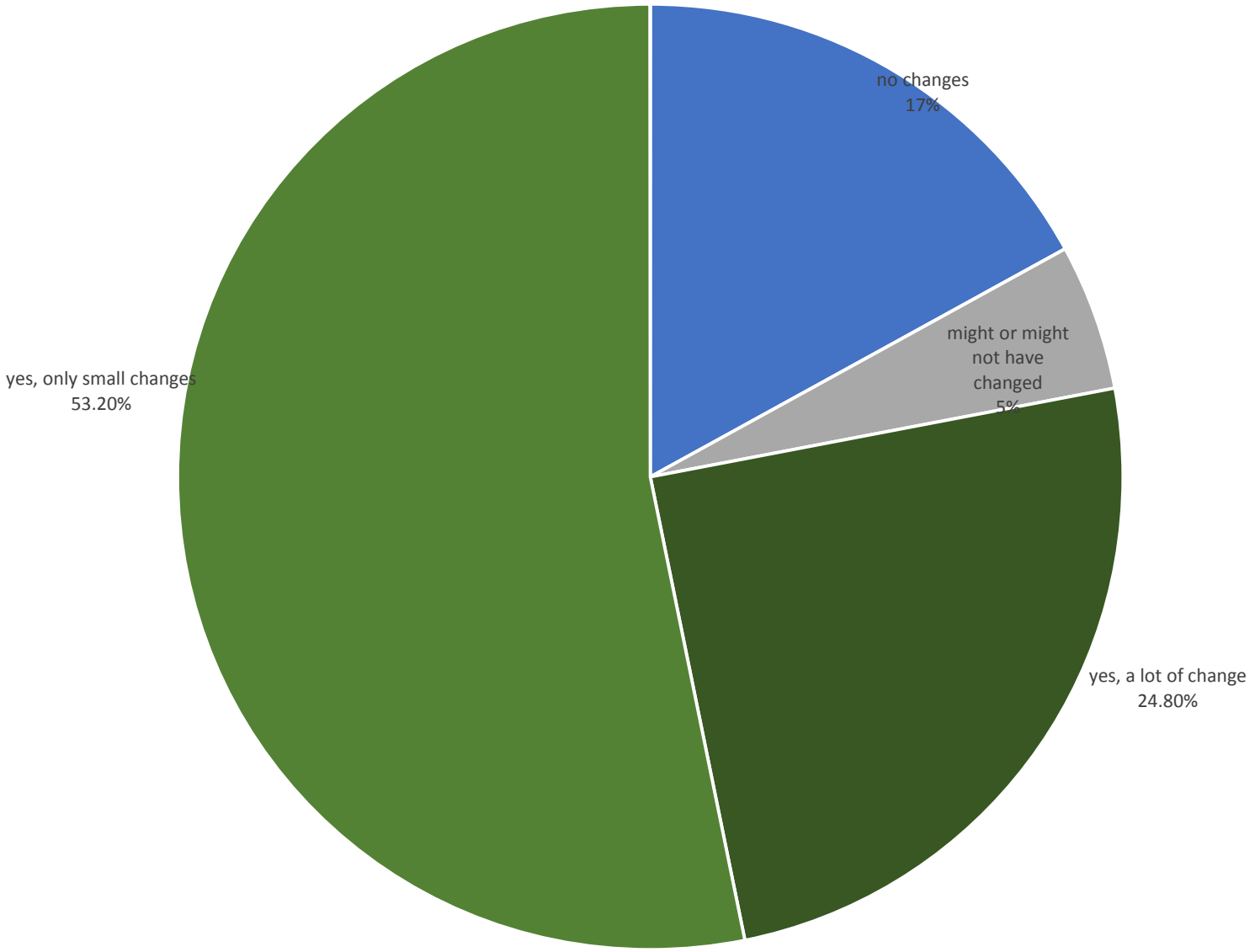
Do you agree or disagree with this statement: Over this semester or semesters of taking exams using examsoft, I have learned about myself as a learner.



Did Examsoft contribute to your understanding of different question types (i.e. Remembering vs Application).



Did you change your study habits over the course of this semester?



Do you prefer taking exams by examsoft or on paper & scantron form?