

# **Study strategy workshops to enhance student learning**

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## GENERAL OBJECTIVES:

1. Establish study strategy intervention workshops that can be used across science disciplines.
2. Provide a study strategies framework for low-performing students through peer discussion and group work.
3. Obtain feedback and suggestions from students about possible improvements and future directions for the study strategy workshops.

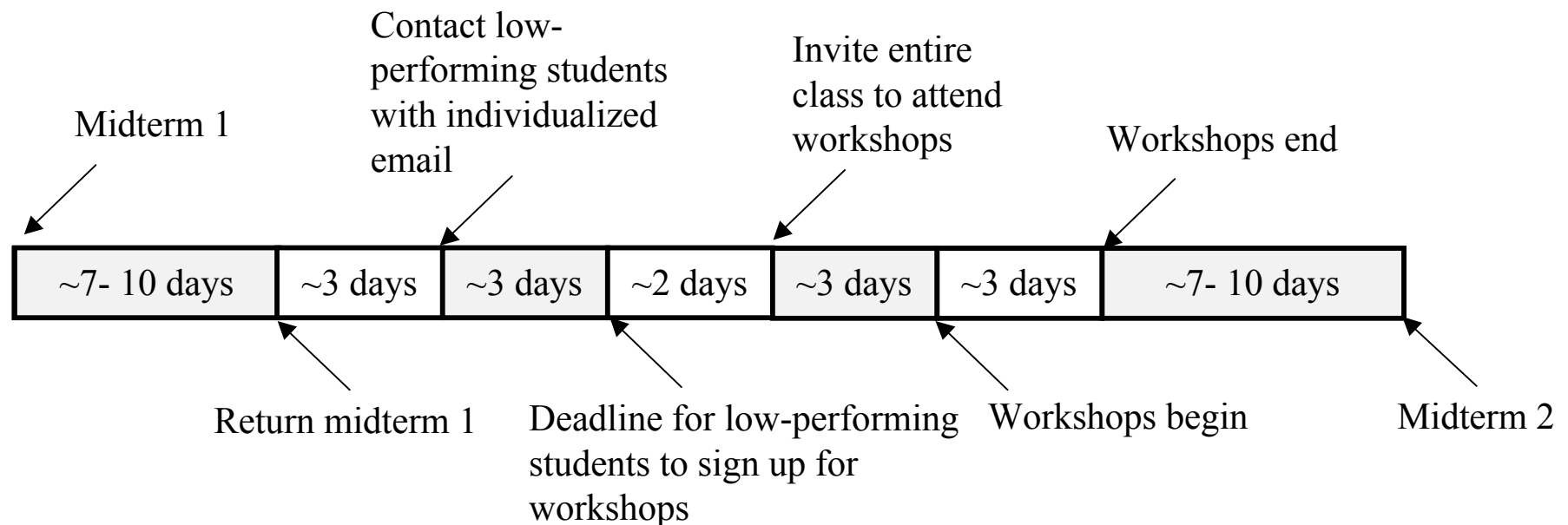
These workshops were run in four classes across four different science departments: EOSC 112, CHEM 233, BIOL 121 and MATH 102

# METHODOLOGY

Workshops were targeted toward low-performing students based on the results of the first midterm.

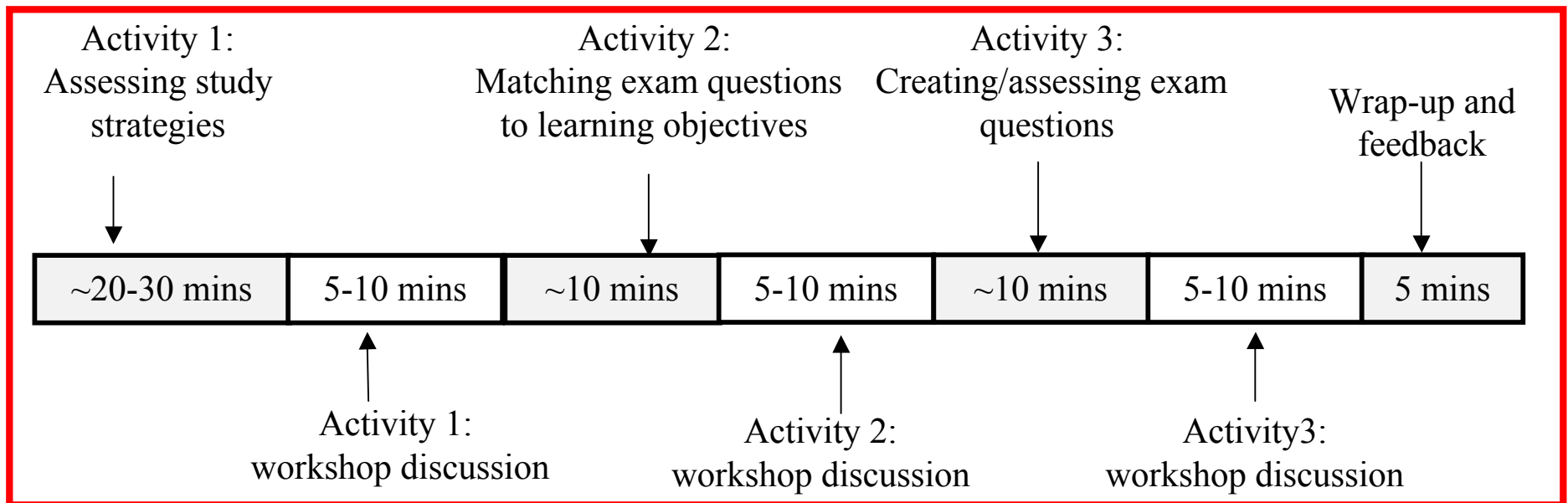
To encourage attendance, low-performing students were sent individualized emails from their instructors inviting them to attend the workshop.

## GENERAL TIMING OF WORKSHOPS AND MIDTERM EXAMS



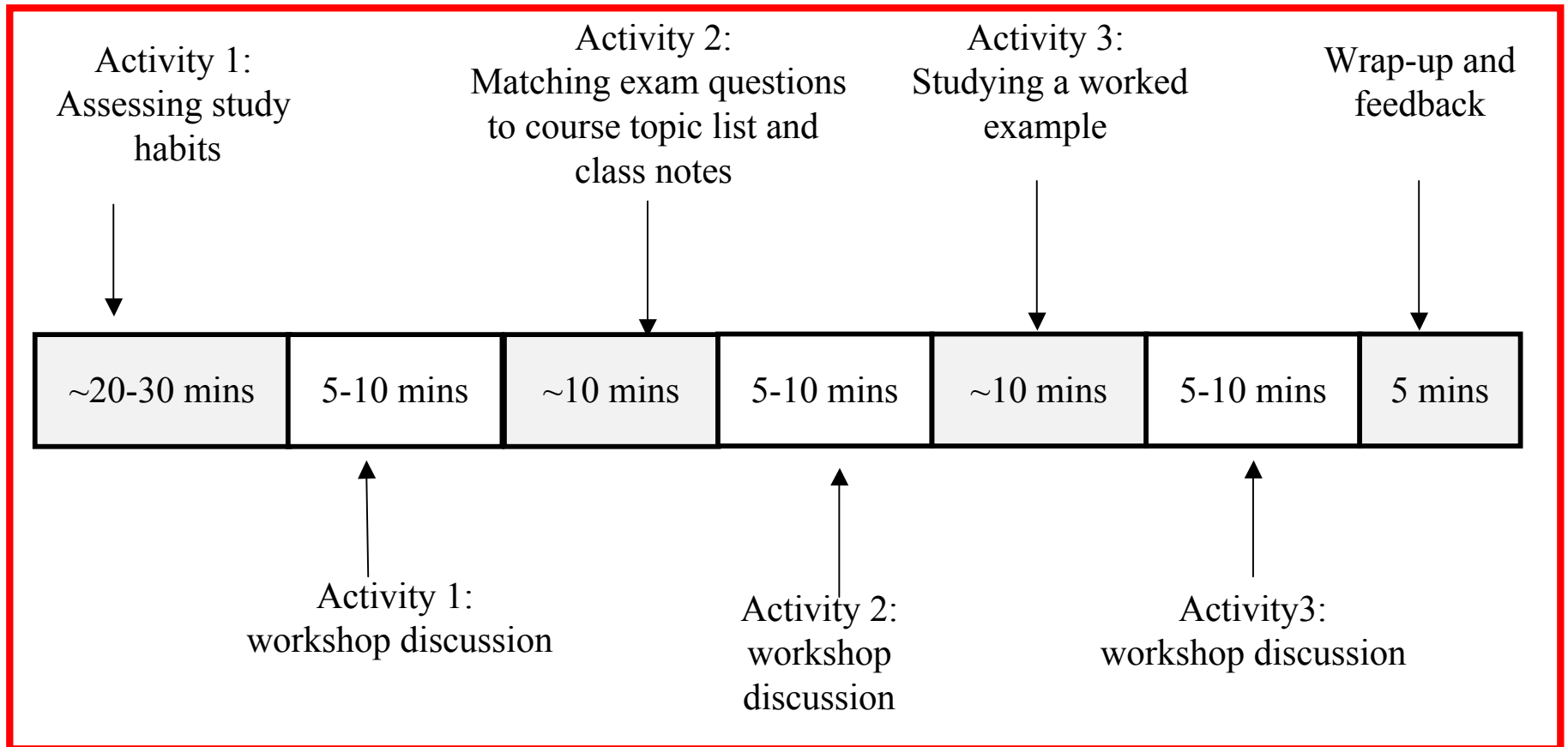
# WORKSHOP STRUCTURE

All workshops followed a similar structure, but activities in the MATH workshop differed from the other departments (see information below). The duration of workshops was 60-90 minutes, with three activities done in peer groups of 3-4 students, followed by whole workshop discussion. The timeline below shows the structure for EOSC, CHEM and BIOL workshops.



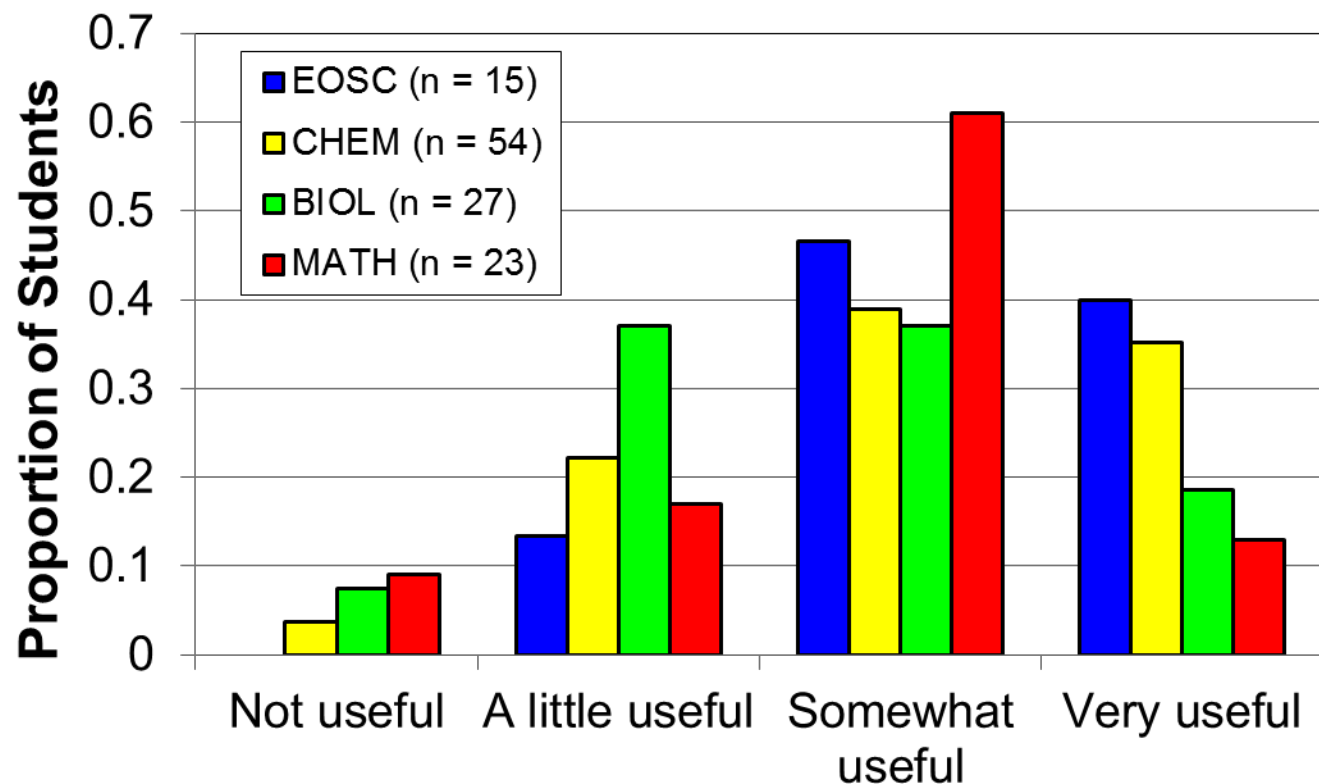
# MATH WORKSHOP STRUCTURE

The Math workshops followed the same timeline and group work structure, but the activities were slightly modified. In particular, Activity 3 involved a reflective exercise based on a typical worked example from the course notes.



# ACTIVITY: ASSESSING STUDY STRATEGIES

How useful was reviewing and assessing study techniques?



71% of students found this activity somewhat or very useful, while only 5% did not find it useful.

*“(I liked) Discussing techniques that work well, and the ones which don't. It makes me realize that the less useful techniques are the 'easy way out' I use too often.”*

CHEM 233 student

# ACTIVITY: ASSESSING STUDY STRATEGIES

**OBJECTIVE:** List study strategies used for the midterm exam and assess the effectiveness of different strategies.

**APPROACH:** Both individually and in small groups of 3-4, students list and share strategies for studying and assess which were **most** and **least** useful.

## EXAMPLES OF STUDY STRATEGIES:

### **Most useful**

Write practice midterms  
Study learning objectives  
Do practice problems

### **Least useful**

Re-read notes or textbook  
Do textbook problems  
Re-write notes

# ACTIVITY: MATCHING EXAM QUESTIONS

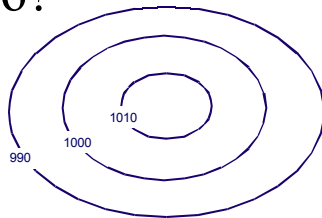
**OBJECTIVE:** Match exam questions from the first midterm with associated learning objectives or practice problems from the first part of the course.

**APPROACH:** Small groups of 3-4 students worked together to match exam questions with learning objectives

## **SAMPLE EXAM QUESTION:**

Scenario: Geostrophic flow in the **Southern Hemisphere**. What direction does the **horizontal pressure gradient force** act in this scenario?

- a) Clockwise
- b) Counter-clockwise
- c) In toward the centre
- d) Out toward the edges



## **SAMPLE LEARNING OBJECTIVES:**

**PREDICT** atmospheric circulation, location of cloud formation and precipitation for today's Earth with continents

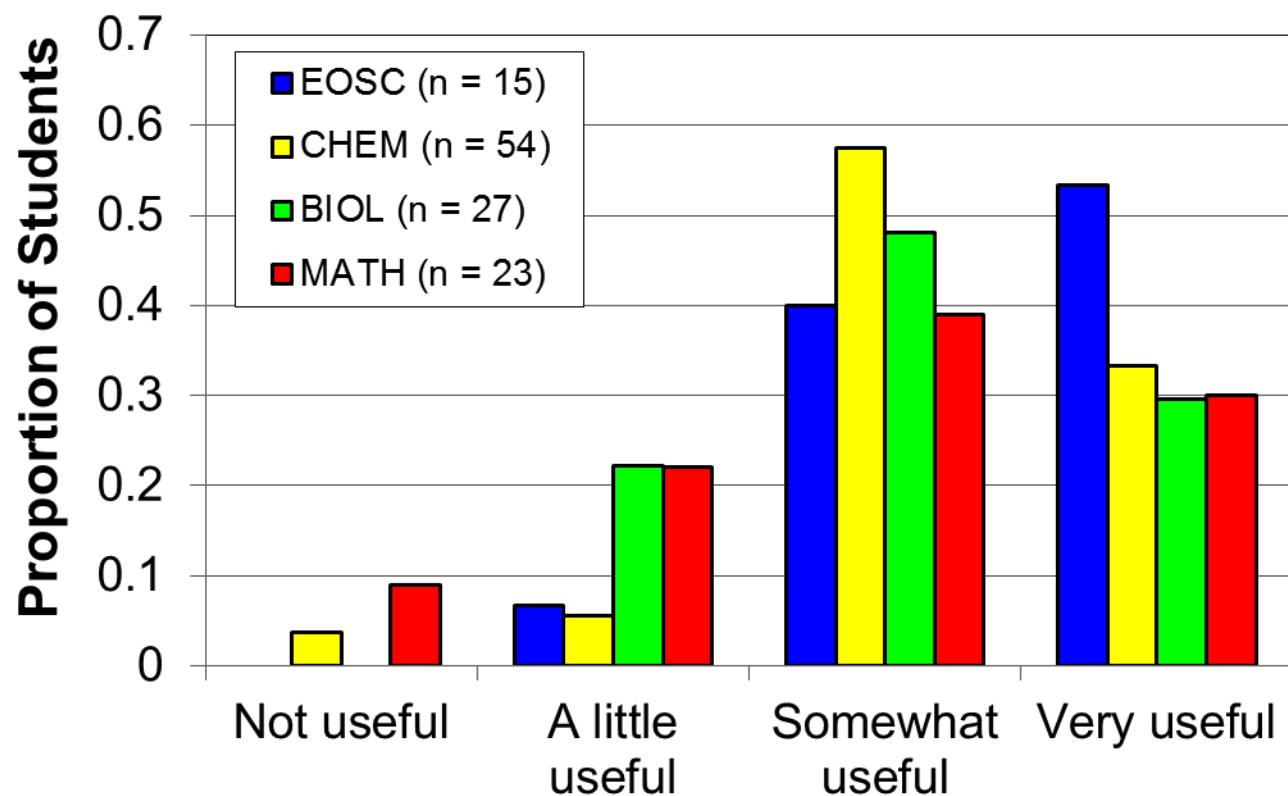
**EXPLAIN** how a balance between atmospheric pressure differences and Coriolis results in geostrophic winds

**APPLY** geostrophic wind principles to storms and jet streams



# ACTIVITY: MATCHING EXAM QUESTIONS

How useful was matching exam questions with learning objectives/practice problems?



84% of students found this activity somewhat or very useful, while only 4% did not find it useful.

*“Showing how relevant the learning objectives are to the questions was a good reinforcement.”*

*CHEM 233 student*

# ACTIVITY: CREATING/ASSESSING QUESTIONS

**OBJECTIVE:** Create or assess exam questions given course learning objectives\*

**APPROACH:** Small groups of 3-4 of students worked together to create or assess exam-style questions

## **SAMPLE QUESTION:**

*Learning Objective:* Calculate expected frequencies in monohybrid and dihybrid crosses.

### **“Exam-style” questions:**

1. Define a dihybrid cross. How is this different from a monohybrid cross?
2. Green or yellow colour in pea seeds is determined by a single locus. In pea seeds, green colour is recessive to yellow colour. What are the expected frequencies of green and yellow pea seeds in the offspring of a mating between a plant that produces green seeds and a heterozygous individual?
3. In a dihybrid cross between two individuals, both with the genotype RrYy, how many **different** genotypes would be expected in the offspring?

*Based on the Learning Objective, which one of the three questions above is MOST SIMILAR to a question you would expect on your next midterm? \_\_\_\_\_*

\* Math workshops used a different activity. Please see the information below for details.

# MATH: ACTIVITY 3 EXAMPLE

## 6.2.1 The most wrapping paper

A box with square base and arbitrary height has string tied around each of its perimeter. The total length of string so used is 10 inches. Find the dimensions of the box with largest surface area. (That is, figure out what is the largest amount of wrapping paper needed to wrap this box.)

## 6.2.2 Solution:

The total length of string shown in Figure 6.3, consisting of three perimeters of the box is as follows:

② How did we get this equation? →  $L = 2(x + x) + 2(x + y) + 2(x + y) = 8x + 4y = 10$  What are we going to use it for? ③

This total length is to be kept constant, so the above equation is the constraint in this problem. This means that  $x$  and  $y$  are related to one another. We will use this fact to eliminate one of them from the formula for surface area.

The surface area of the box is

$$S = 4(xy) + 2x^2$$

How did we get this? ④  
Why do we want an equation like this? ⑤

since there are two faces (top and bottom) which are squares (area  $x^2$ ) and four rectangular faces with area  $xy$ . At the moment, the total area is expressed in terms of both variables.

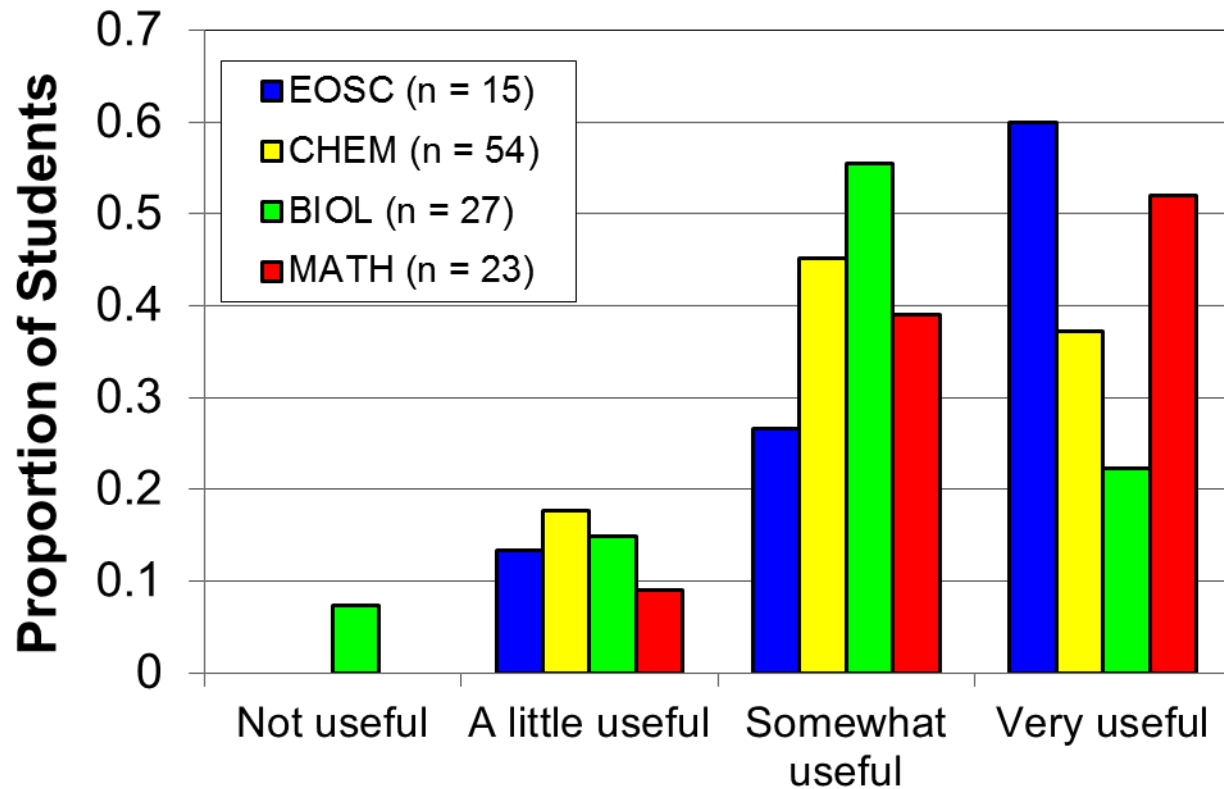
## Examples of Student Answers to (3):

*“Use it as a constraint. This stays constant, use it as a known.”*

*“To isolate the equation for one variable → constraint equation.”*

# ACTIVITY: CREATING/ASSESSING EXAM QUESTIONS

How useful was writing/choosing questions related to learning objectives?



84% of students found this activity somewhat or very useful, while only 2% did not find it useful.

*“I liked picking the exam-style questions, really showed me what I was doing wrong.”*

*BIOL 121 student*

## GENERAL OBSERVATIONS

Larger workshops (>20 students) resulted in more discussion within small groups.

Students tended to work individually to match learning goals to exam questions before discussing as a group.

Writing exam questions based on learning goals was the most difficult task in the EOSC and CHEM workshops. To account for this, the BIOL workshop included an activity where students were provided with a list of questions and asked which one they would likely see on an exam.

## STUDENT FEEDBACK

Student feedback about the workshop format was generally positive, based on responses to the following survey question:

**Would you have preferred an individual meeting with the instructor?**

**YES (37%)**

Most students (63%) who would prefer an individual meeting cited help with specific course content as the reason.

*“Yes because I can over specifically what I got wrong.”*

*CHEM 233 Student*

**NO (63%)**

Most students (63%) who would not have preferred an individual meeting indicated that working in groups was useful.

*“No, because workshop format allows me to interact with my peers in cooperative learning rather than ‘regurgitated’ answers.”*

*EOSC 112 Student*

## FUTURE CONSIDERATIONS

Student feedback about possible improvements indicated that more in-depth study or problem-solving strategies would be helpful

Future workshops should include follow-up to check in with students who attended the workshops and ask them about their study strategies.

Modifications to more difficult activities such as writing exam questions should be made to provide guidance for the students about what constitutes a good exam-style question for their own studying.