Keep Your Students Engaged!

-using clickers in freshmen math courses-

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Summary:

- What is the FYS program at MSU Denver?
- Build a good database of clicker questions.
  - Samples of my class questions
  - My criteria for writing clicker questions
- Exit Survey Results:
  - *MTH 1310 (Finite Mathematics), Fall 2013 – FYS course*
  - *MTH 1310 (Finite Mathematics), Fall 2011*
  - *MTH 1110 (College Algebra), Fall 2012*
- Class logistics:
  - Lesson plan for a clickers course
  - How to incorporate Clickers into your grading scheme
- Conclusion

Testing …

Have you ever used clickers in your classroom?
(don't forget to turn on your clicker!)

A. Yes, I use clickers often in my classes.

B. Yes, but just a couple of times.

C. Not yet, but I am planning to.

D. No, and I am not sure I would like to use them.

E. None of the above.

Testing ...

Are you a MSU Denver faculty?

A. Yes, and I have taught a FYS course at Metro.

B. Yes, but I don't know much about the FYS program.

C. No, but my own campus is similar to Metro (commuter campus)

D. No, and I teach in a traditional institution.

E. None of the above.

MSU Denver FYS Program

- FYS (First-Year Success) started in Fall 2009
- This year more than 85% of the first-time-to-college students at Metro are enrolled in a FYS course, even though this is a **voluntary program.**
- FYS courses are paired up – to help build a community feel for our freshmen students.
- My course (*Finite Mathematics*) is paired with a Recitation section for the same topic.
- Each FYS section is limited to 24 students.
- Each class has a SI (*supplemental instruction*) leader; this is a Metro student that was successful in the class in a previous semester.

Goals of the First-Year-Success Program

- Increase the retention rates for our freshmen courses.
- Help freshmen students succeed in their first semesters in college.
- Create a strong student community, even on a commuter campus.

About my own FYS Section

Information from the first day of classes:

- **Fresh out of high-school**: 96%. (Out of 23 students that started the course 22 just graduated from high-school.)
- **Business Majors**: 82% (Business Management, Finance, Accounting, Marketing)
- **Continue into MTH 1320**: 77%

About my own FYS Section

After 10 weeks of classes:

- **Retention**: 91% in week 10. (Out of 23 students that started the course 21 are still enrolled.)
- **Success Rate**: 90% passing rate. (Out of the 21 students still enrolled, 3 are in danger of failing the course.)
- **Attendance**: higher than in many math classes:

Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9
95.5%	93.5%	97.5%	86%	exam	91%	91%	86%	exam

Clicker Questions

My criteria for building a good set of questions:

- Start with a question that builds confidence.
- Word the questions in a familiar form.
- Include a question that will spark a discussion in the classroom.

How do clicker questions benefit my students?

- They get an instant comparison with their colleagues.
- They give me anonymous feedback on how well my class mastered a new topic.
- **They are introduced to common mistakes and (hopefully) how to avoid them.**

How to Write Clicker Questions

- Be **consistent** – have at least a couple of questions for each lecture.
- Sometime the wrong question is the **right question to ask**.
- **Balance** computational/mechanical questions with theoretical ones.
- If possible, include a (GOOD!) **conceptual** question.
- Difficult questions help students more, but easier questions build confidence.
- Don't be afraid to use the "**Question on the fly**" option on your clickers.
- We are all human – include a *"None of the Above"* option.

Lecture Question: Building Confidence

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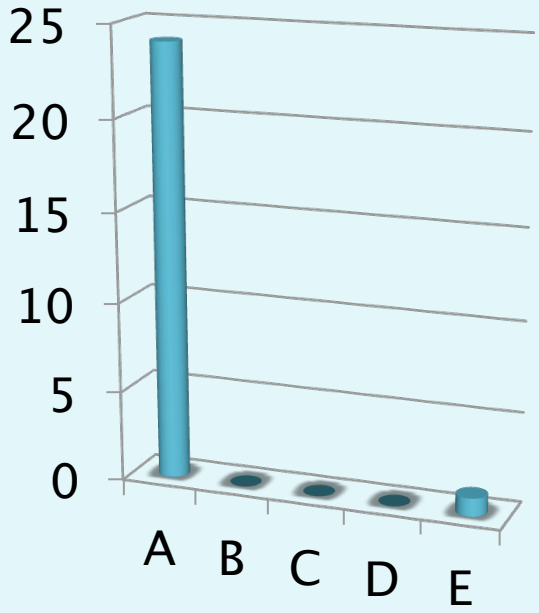
If money is invested at a rate *r*, compounded monthly, the balance of the account after *t* years is given by:

$$S=P(1+r/12)^{12t}$$

Suppose $2,000 is invested at an interest rate of 9% per year, compounded monthly. How long will it be before the balance of this account reaches $3,200?

A. 5.242 years **(CORRECT)**	C. 6.944 years
B. 0.454 years	D. 5.444 years
	E. None of the above.

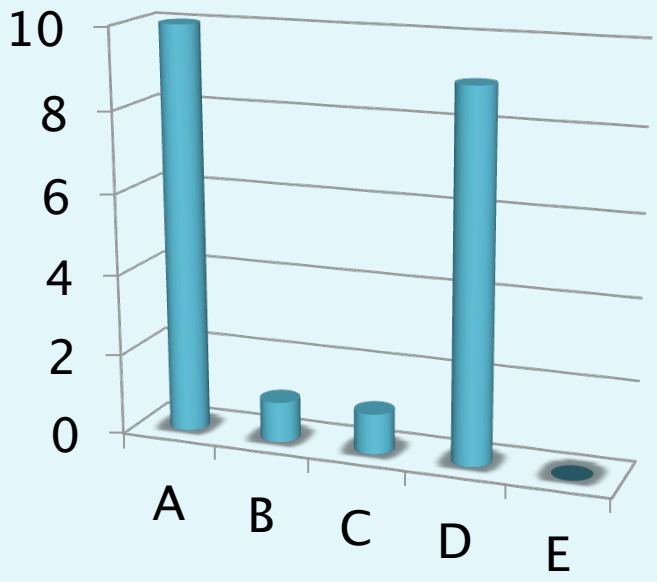


Lecture Question: Common Errors

The cost (in millions of $) to produce x (thousands) cars is given by: $C(x) = 3x^2 - 18x + 63$

Find the level of production that minimizes cost:

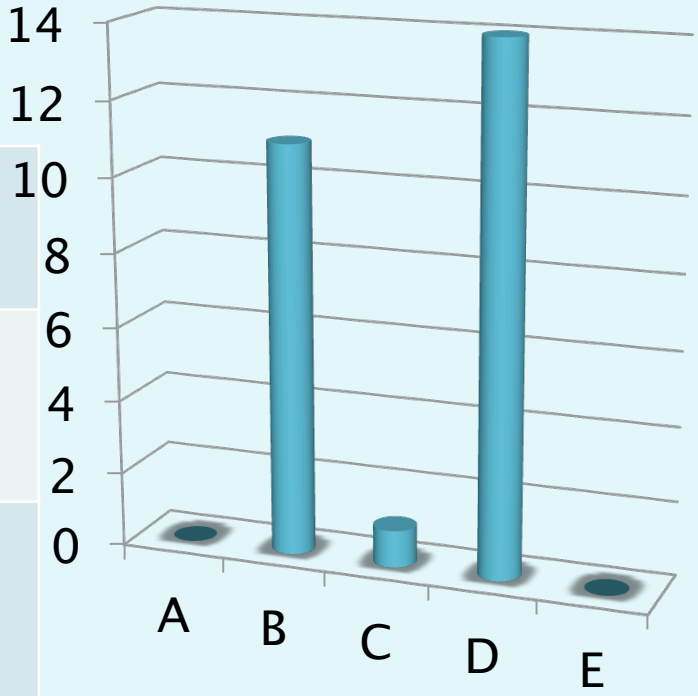
- *A. 3 thousand cars (CORRECT)*
- *B. 6 thousand cars*
- *C. 9 thousand cars*
- *D. 36 thousand cars*
- *E. none of the above*



Lecture Question: Common Errors

23% of the cars owned by a rental agency have some defect. What is the probability that of 3 cars selected at random at least one has a defect? *(Hint: you might want to find first the probability that all three cars are good.)*

A. 23%	C. 45.64%
B. 1.21%	*D*. 54.34% **(CORRECT)**
	E. None of the above



Lecture Question: New Topics

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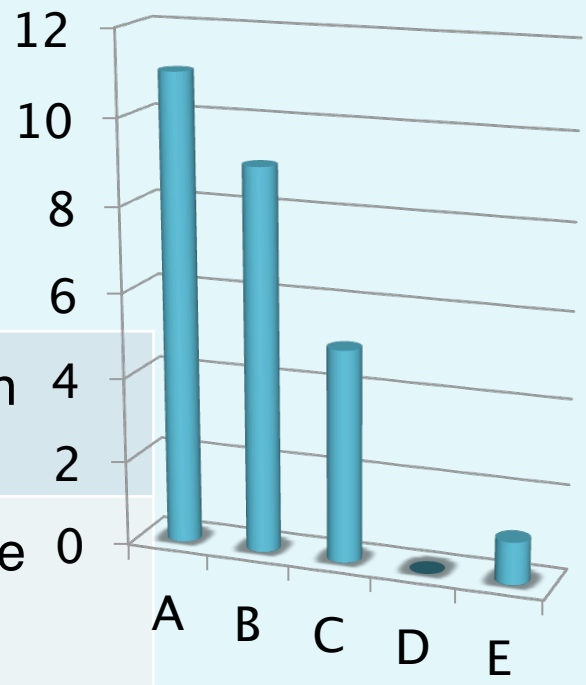
Consider the following system:

$$\begin{cases} x + 2y - 3z = -3 \\ 2x - y - z = 4 \\ x + y - 2z = -1 \end{cases}$$

This system has:

A. A unique solution, (1,-2,0)	C. No solution
B. Infinitely Many Solutions, *(z+1,z-2,z)* **(CORRECT)**	D. None of the above.



Exit Survey Comparison

- The survey data that follows is gathered in 3 distinct courses:
  - MTH 1310 – FYS, Fall 2013:
    - 15 students took the survey, most business majors.
    - Administered during week 10 of classes.
  - MTH 1310 – Standard course, Fall 2011
    - 26 students took the final survey, most business majors.
    - Administered last day of classes before final exam.
  - MTH 1110 – College Algebra, Fall 2012
    - 24 students took the survey, all STEM majors.
    - Administered last day of classes before final exam.

Extra Credit Question

Considering the three classes that answered this survey on the effectiveness of clickers in the classroom, whom do you think liked them better?

A. The freshmen students (FYS course)

B. The standard business students

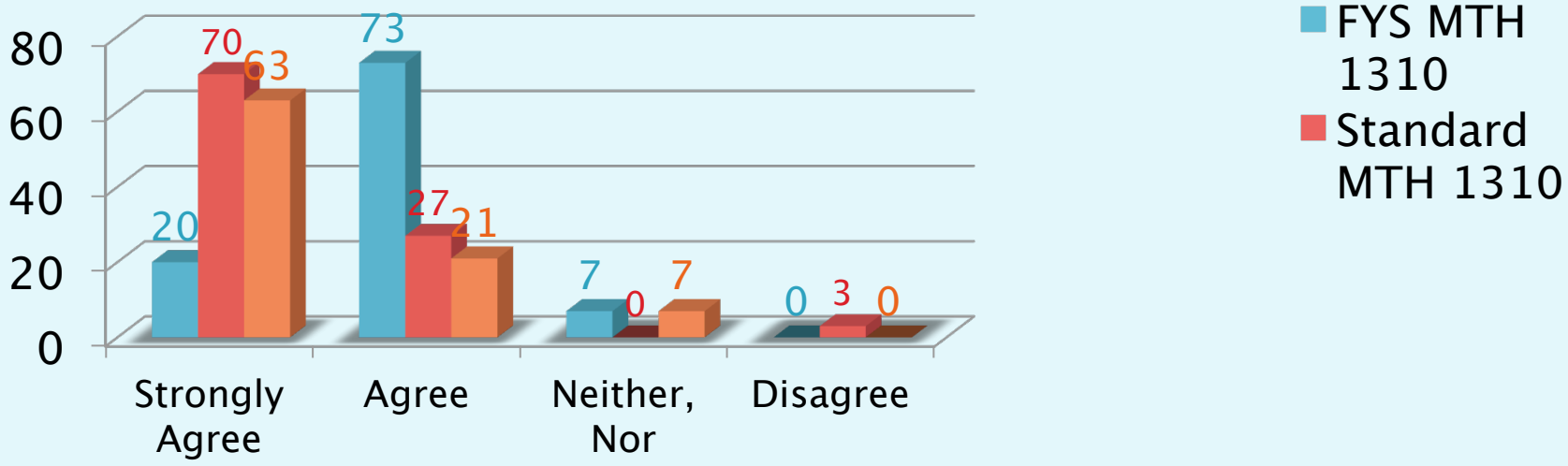
C. The college algebra students

D. I am not sure/not enough information

E. None of the above

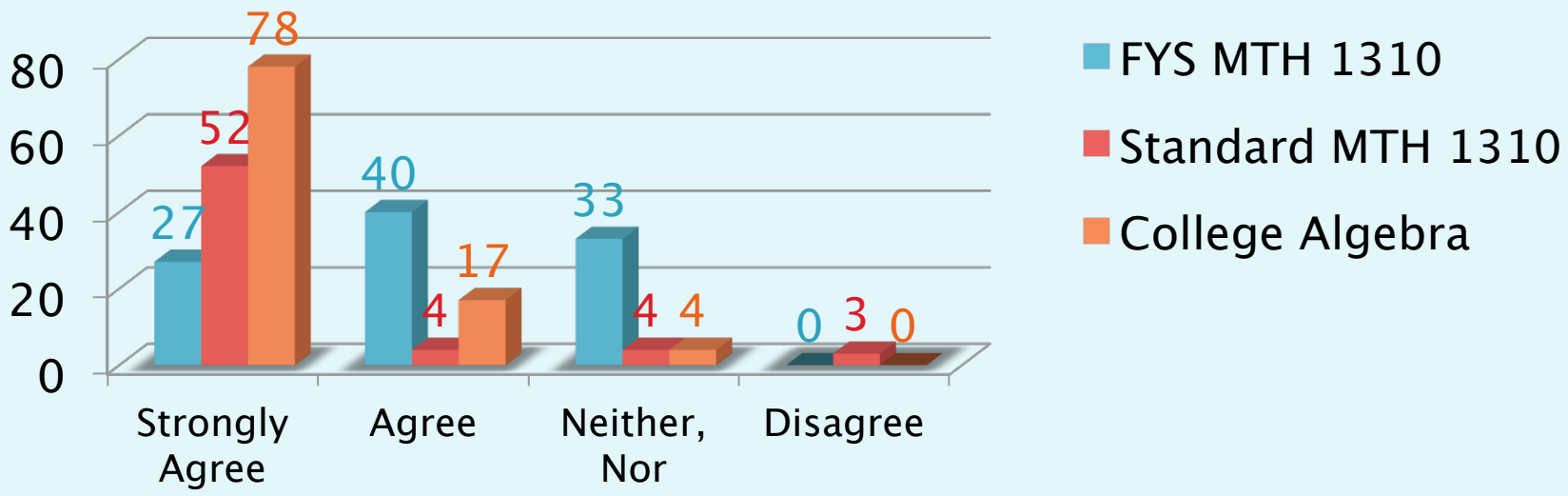
Exit Survey Results - Motivation

Q1: Using clickers helped me to pay attention in the class. *(all labels on the graphs below represent class percentages)*



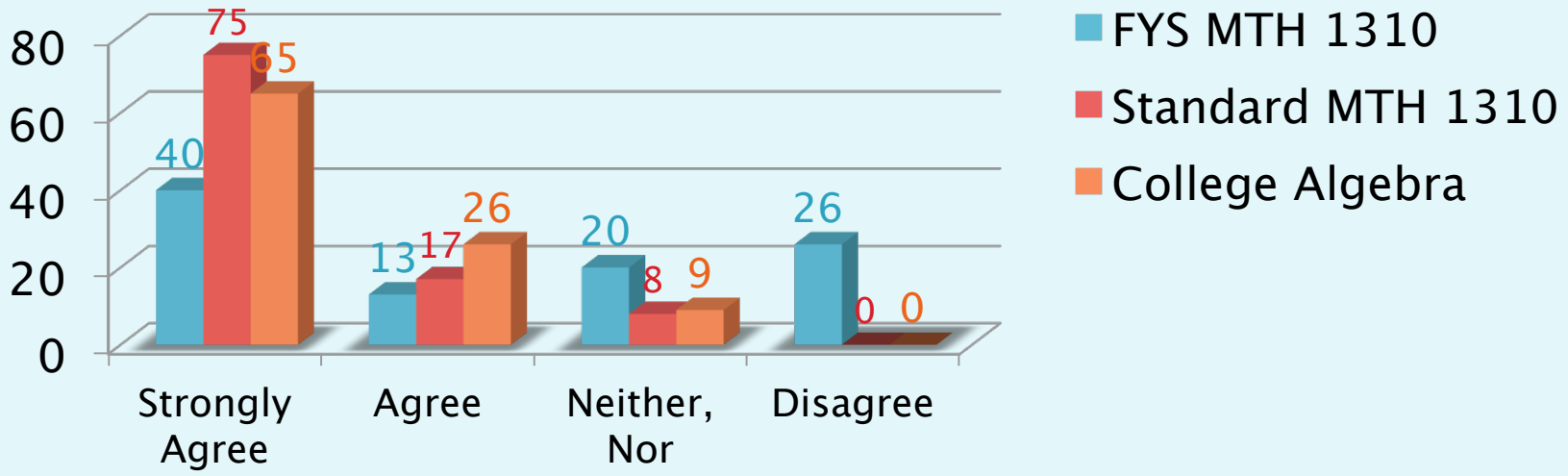
Exit Survey Results - Motivation

Q2: I felt more involved in the class because I used a clicker. *(all labels on the graphs below represent class percentages)*



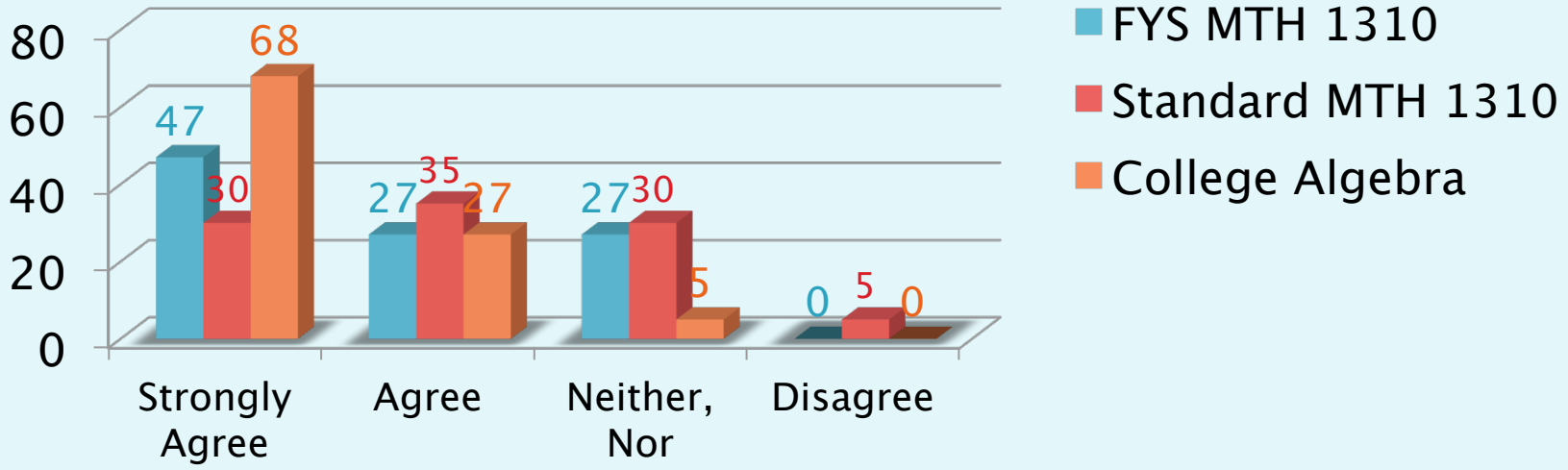
Exit Survey Results – Class Participation

Q3: The clicker questions got me to participate more in classroom discussions. *(all labels on the graphs below represent class percentages)*



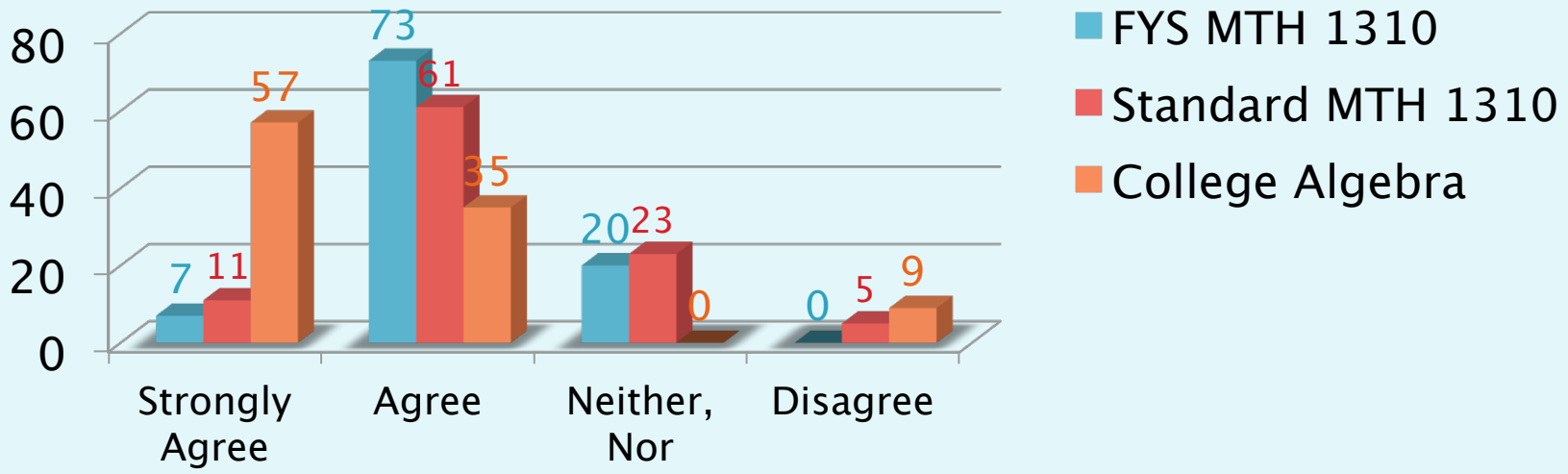
Exit Survey Results – Learning Goals

Q4: Using clickers helped me understand how well I was learning the material. *(all labels on the graphs below represent class percentages)*



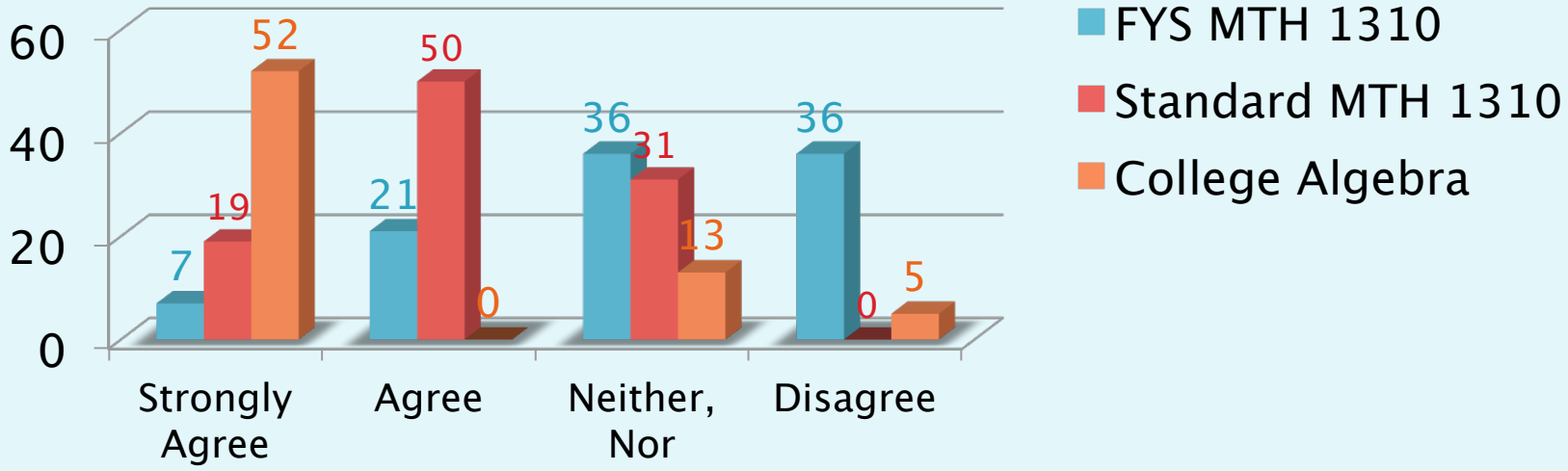
Exit Survey Results – Learning Goals

Q5: Answering the clicker questions helped me understand the concepts behind the problems. *(all labels on the graphs below represent class percentages)*



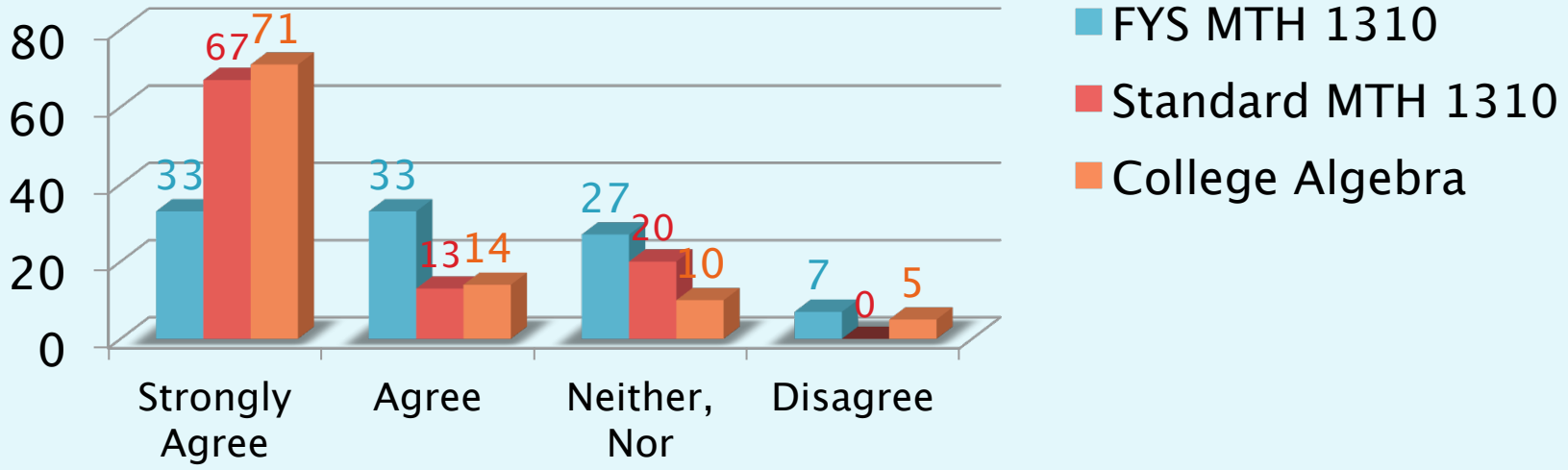
Exit Survey Results – Course Success

Q6: Answering the clicker questions helped me be more prepared for the exams. *(all labels on the graphs below represent class percentages)*



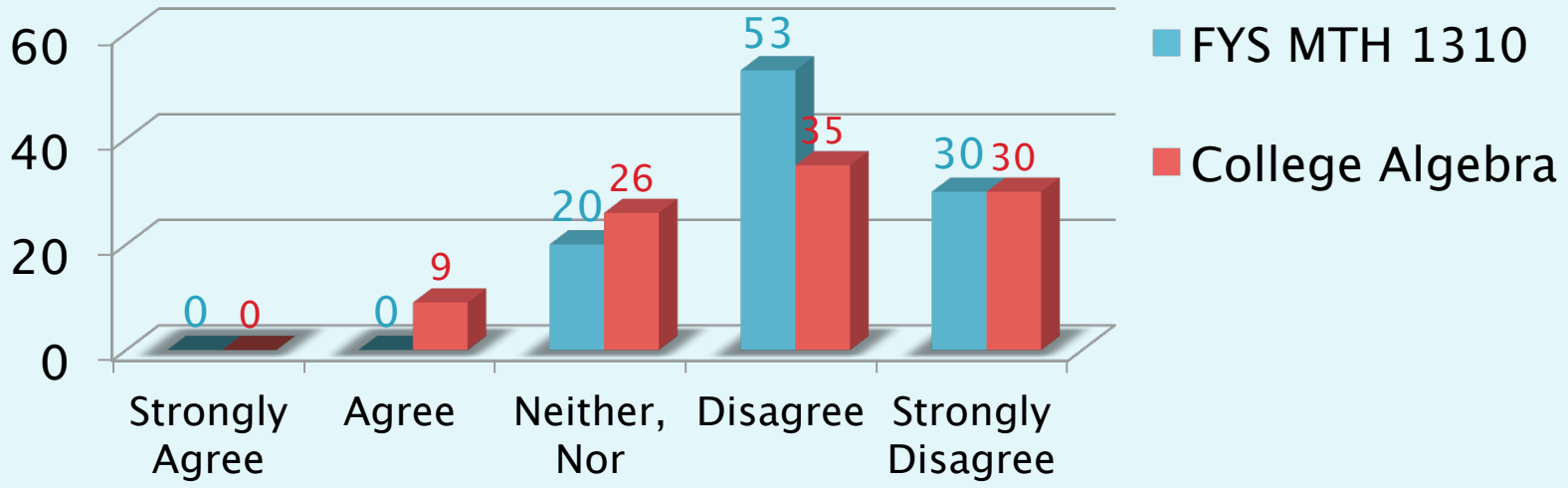
Exit Survey Results – Course Success

Q7: Using clickers helped me get a better grade in this class. *(all labels on the graphs below represent class percentages)*



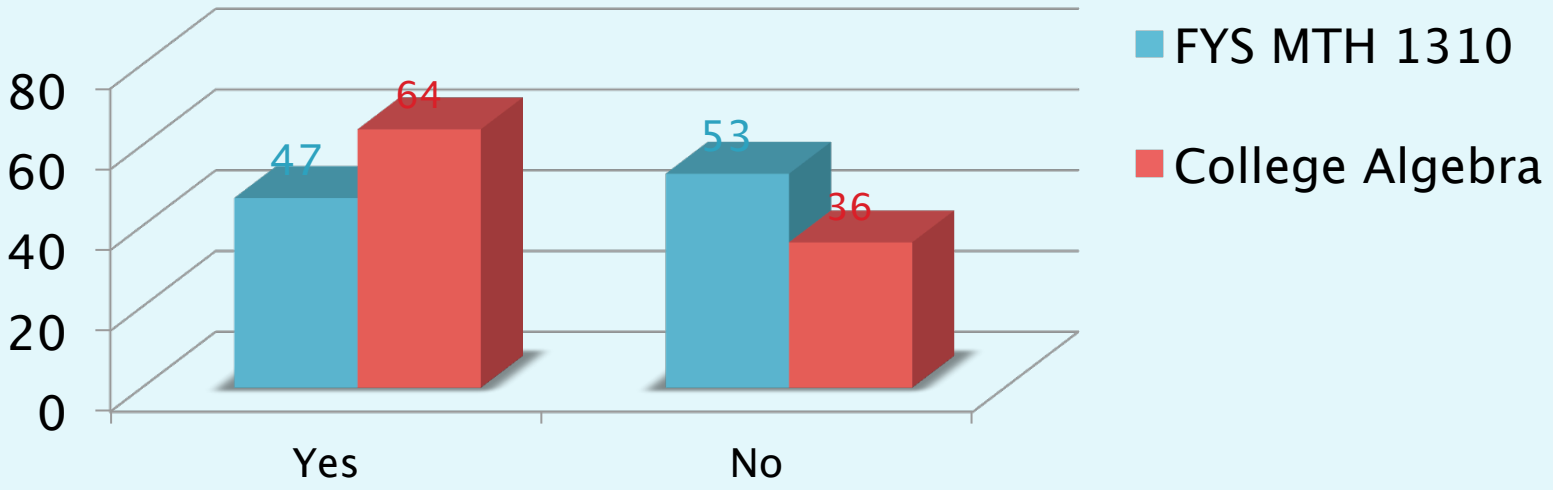
Exit Survey Results

Q8: The clicker questions took too much time from the lecture, I wish there were fewer questions. *(all labels on the graphs below represent class percentages)*



Exit Survey Results

Q9: Is this your first course using clickers? *(all labels on the graphs below represent class percentages)*



Course Evaluations Comments

We don't have student comments yet for this semester, but these are some of my student written evaluations for the Fall 2011 *Finite Mathematics* course.

The question is: **"Describe how actively you have participated in all aspects of learning process."**

- A lot! Using clickers (was) very helpful.
- I've never devoted so much time to any class in my lifetime.
- Doing HW, studying and going to class/using clickers.
- I actually attended class. I enjoyed learning and working through the homework. This class actually made me want to minor in Math.

Logistics – Daily Class Structure

- Allow 15-20 minutes per day (the courses I taught are 2-hour courses) for the clicker questions.
- Ideally start with a quick clicker question to check understanding on previous material/concepts
- I usually start the second hour with 1-3 questions related to the material JUST introduced that day.
- Depending on the topic, I may conclude the lecture with 1 more advanced (conceptual) question.
- On review lectures I build the full hour period around clicker questions (usually given to the students on a review worksheet).

Logistics – Class Points

- Sign-up the students into the I>Grader system the **first day** of classes.
  - For a small class (<50) it takes 10 minutes to do it in class.
  - For a larger class you can ask the students to enroll online, before the first day of classes.

- Include clickers in your course grade scheme:
  - Attendance points.
  - Quiz Grades.
  - **Extra Credit (for tests/final exam).**

Conclusions – Should You Try It?

YES!

- It will keep your students more **involved** in the classroom.
- You get **instant feedback** on the topics that are not clear to your students.
- **Better retention** – the material covered in clicker questions seems to stay longer with the students than standard lecture topics.
- **Better attendance**. Students want to come to class.

MAYBE?

- **Time constraints:**
  - Prep Time - it really takes longer to write good questions.
  - Lecture Time – you have to allow less time for standard lectures.
- There exists no perfect approach to teaching – no solution works for all of us.
- **Logistics** – they may be expensive to buy and your classroom may lack the technological infrastructure for them.

Thank You!

If you have any questions or for further details on this topic here is my contact information:

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