

# Breathing Life into the Liberal Arts Math Course: Ten Teaching Tips

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Teaching the liberal arts math course for general education students presents unique challenges, but the course also offers exciting life applications and opportunities for integrating faith with a variety of creative topics. I try to make the course interesting by actively involving students and relating mathematical topics to their lives. In this paper I will discuss some things I have tried in the liberal arts math course I teach at Taylor University: using students' names, use of undergraduate teaching assistants (TAs), group guessing games, handout booklets, hangman, group projects, memory verses, reflection papers, and life lessons.

I feel like I have been successful when I get some student comments like the following: "I used to hate math, I actually started to enjoy it because of this class (which is crazy to me)" and "I liked it, it was fun and I got to know a lot of cool people and learn about God's creation through math."

## Course Overview

The three-hour liberal arts math course I teach at Taylor University is called Investigations in Mathematics (MAT 120). We carefully chose this title because we really want the students to "investigate" mathematics. In most class session students are involved in some kind of group exploration. The course description is:

A course designed to engage students in relevant college-level mathematics from a problem-solving perspective. Students will experience interesting problems and real-life applications of mathematics from a variety of contexts. Emphasis will be on thinking, reasoning, and exploring patterns as well as communicating mathematical ideas. The underlying ideas include some of the pinnacles of human thought: numbers, infinity, the fourth dimension, probability, statistics, randomness and chance, chaos and fractals.

My colleague at Taylor, Matt DeLong, has also been very instrumental in developing our course. He found Burger and Starbird's excellent textbook, which creatively presents many of the most interesting topics in mathematics, many of which naturally lend themselves to applications of faith:

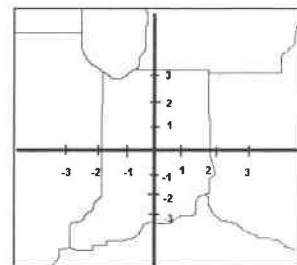
Burger and Starbird. (2005). The Heart of Mathematics: An Invitation to Effective Thinking, 2<sup>nd</sup> edition: Key College Publishing.

The key objectives for our MAT 120 students are to 1) foster positive attitudes and appreciate the nature of mathematics, 2) develop reasoning and problem-solving skills, and 3) integrate mathematics with issues of faith and apply to various areas of life.

## Ten Teaching Tips

### 1. First Day of Class Activities

On the first day of the semester I ask students to introduce themselves by sharing a few things like their major and something unique they did over the summer or Christmas break. I also draw a coordinate system on the board over a rough map of our region, and I ask them to estimate the coordinates of their home town, and we as a class try to guess the name of the town. Since this takes a while, I also give them a sheet of number puzzles to work on, which demonstrates how every number is interesting (a topic in the textbook). I work hard to learn their names through the introductions.



### 2. Using Student Names

One of my daughter's high school teachers is known for shaking every student's hand every class day. I decided to try saying every student's name at least once some time during every class session. This is still more of a goal than a reality, but I do try to mention many students' names. I sometimes call on a group of students by mentioning 2-3 names, and then I may ask 2-3 others what they think about the original response. I think students feel much more connected when they hear their names in class. Students also enjoy seeing their names in problems on handouts, quizzes, and tests.

### 3. Using Teaching Assistants (TAs)

Several of our math majors serve as TAs in various freshman and sophomore-level courses. They sit in on the class sessions, help with group activities, answer homework questions, hold study sessions, and do most of the grading. We have found that students in the class are more likely to attend study sessions when they get to know the TA during class sessions.

### 4. Group Guessing Games

I will sometimes begin a lecture by asking a question and having each group of students write down a guess. Then we will develop the mathematics necessary to find the answer, and the group closest to the right answer wins the game. Here are a few examples.

How much money would Ken need to invest now in one lump sum to have one million dollars in 40 years, if he invested the money at 10% compounded annually? (Answer: \$22,094.93)

If Ron deposited \$1 per day every day for 45 years in an account paying 8% compounded daily, how much money would he have after 45 years? (Answer: \$162,351.09)

Suppose Jeremy spins a penny many times on the floor until it falls over. About what proportion of the time do you think it will land heads up? (Answer: significantly more than half of the time it will land tails up because of the coin's shape, which helps it fall out of the penny mold)

### 5. Handout Booklet & Hangman

I use daily handout sheets that have the main ideas of the lesson, directions for the group activities, problem statements, fill-in-the-blank definitions, and the daily assignments. These are

compiled before the semester begins, and the students purchase the handout booklet at the campus bookstore. We often play Hangman to fill in the key ideas for definitions and conclusions. For example, when we come to the definition for an annuity, the main idea in the definition is left blank, and students take turns guessing letters. I think this highlights the important part of the definition and students enjoy the game.

Definition: an annuity is an account in which money is deposited at the end of \_\_\_\_\_  
\_\_\_\_\_. (Answer: EACH PERIOD)

If  $r$  objects are selected from a set of  $n$  distinct objects, any \_\_\_\_\_  
\_\_\_\_\_ of these is called a combination. (Answer: UNORDERED  
ARRANGEMENT)

### 6. Daily Group Activities

We spend a large portion of the class sessions involved in group activities. We roll dice, flip coins, etc. to collect data for probability; we measure and take the ratio of height and navel to floor to explore the golden ratio; we build Platonic Solids and discover Euler's Formula; we draw fractals and make tessellation pictures. One of the students wrote, "It is a fun class because there is so much interaction within the class."

### 7. Group Projects

We have tried various kinds of projects in the course, all of which are open-ended and allow students to demonstrate their creativity while interacting with the mathematics.

- 1) Group Teaching Project—students prepare a lesson and teach the class one of the topics in the course: infinity, golden rectangle, symmetry, Platonic solids, 4<sup>th</sup> dimension, fractals, chaos, etc.
- 2) Creative Project—students apply the mathematics to an area of their interest or expertise and write a song or poem, create a scrap book or children's story, make a game or picture, etc.
- 3) Data Collection Project—students collect data on a research question of their interest and summarize using appropriate statistics, or students research buying a house and car and summarize the financial decisions (such as the savings from a 15-year over a 30-year mortgage).

### 8. Memory Verses

Each Monday I start class with a short devotional on a Bible verse that relates in some way to the mathematics we are studying. After three weeks I choose one of the three at random for students to write out on their quiz for a possible bonus point. This encourages students to practice memorizing Scripture and it gives us the opportunity to discuss biblical principles that relate to some of the topics we are studying in the course. Here are some sample verses:

Ephesians 3:18 (3 or 4 dimensions), Luke 13:19 (exponential growth), Proverbs 11:18 (lottery), Proverbs 13:11 (saving money), Psalm 147:5 (limits and infinity), Romans 11:33 (paradoxes of infinity), Ecclesiastes 3:11 (infinity or beauty), and Philippians 4:8 (math is lovely).

## 9. Reflection Papers

I assign eight one-page reflection papers to encourage students to think more deeply about the ideas in the course and to give them the opportunity to integrate mathematics with their faith and other areas of their life. Sometimes part of the reflection is to find something on the Internet (a picture of beauty, a way to save money, an interesting fact about Fibonacci numbers). Reflection topics include: the lottery, saving money and opportunity costs, debt and credit, math in nature, infinity and the nature of God, beauty and mathematics, and the fourth dimension. Here is a sample reflection assignment.

Look back at pages 232, 243, 249-250, 269 of the textbook and notice the references to beauty. Write a short reflection, about one page in length, that answers the following questions:

1. What do you think makes something beautiful? Include at least one picture (paste a real image) that helps illustrate your idea of the beautiful or lovely. You may want to consider Philippians 4:8.
2. How can beauty be seen in mathematics? Include at least one quote from the textbook or another source that talks about beauty in mathematics.

## 10. Life Lessons

At the end of most class sessions, we try to apply what we have learned to a life lesson. The textbook lists life lessons throughout the book. Sometimes we will list these on a class poster.

Break a problem down into smaller parts and live one day at a time.

Math can help us make good choices by considering probabilities.

Small changes now can make big differences later.

Be open to new ideas.

Look carefully at the details and explore patterns.

Teaching the liberal arts math course is actually a lot of fun, particularly when students see applications to their lives. One of my students commented about the course that he liked "how mathematics is related to the real world and God's creation and not just a presentation of formulas that I'll forget." For me, that is what it means to breathe life into the liberal arts math course.