TEACHING AND LEARNING COMMONS
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LEARNING STRATEGIES

FOR MATH CLASSES

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LEARNING MATHEMATICS

WHY
&
HOW

DISCLAIMER

ALL OF THE FOLLOWING IS BASED ON TEACHING EXPERIENCE WITH:

- CALCULUS (**MATH 10A, 10B**)
- UPPER DIVISION CLASSES (**MATH 102, 109**)

WHY LEARN MATH

GOOD WHYS:

FOSTERING INTEREST

WITH REAL LIFE APPLICATIONS

FOR MATH 10A & 10B, THESE INCLUDE:

- Understanding velocity of a vehicle
- Optimizing an investment portfolio
- Half-life of chemical elements
- Models for population growth
- Main foundation behind many disciplines (engineering, CS, etc), and useful in others (medicine, psychology), thus of crucial importance in many professions

Ideally tie the material to students' everyday experience if possible, or to other disciplines, such as chemistry, engineering, etc., through examples.

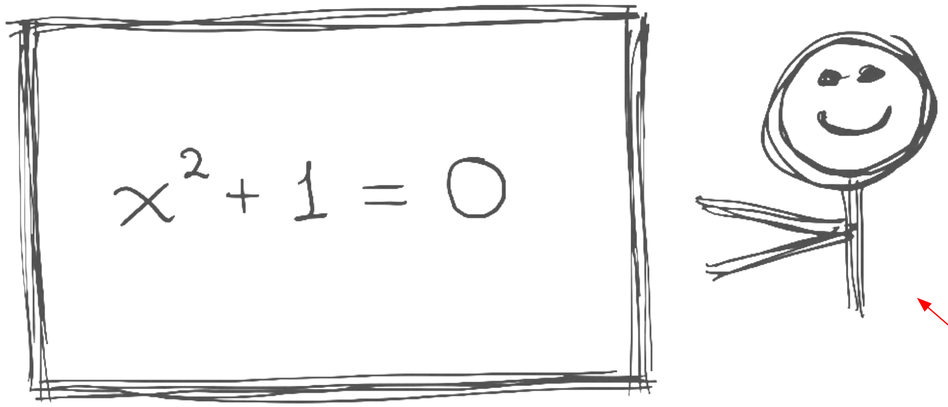
Revisit these multiples times through the course of the class to reiterate importance of the subject.

CREATING A REWARDING EXPERIENCE

GOALS: FEELINGS OF WORTHWHILE, PRODUCTIVE EFFORT, & ACHIEVEMENT

- Encourage and reward partial progress in a problem
- Create interactive, dialectic environment allowing students to actively contribute
- Ask open-ended questions, build upon answers, try to incorporate students' suggestions

THE **HUMAN** COMPONENT



THIS IS YOU (OBVIOUSLY), CONVEY-
ING PASSION & EXCITEMENT ABOUT
THE SUBJECT, AND HUMANIZING
THE MATERIAL.

HOW TO LEARN MATH

MANAGING PRIOR KNOWLEDGE & PRECONCEIVED NOTIONS

PROCESS OF STUDYING & LEARNING MATH

COMMON DIFFICULTIES

PRIOR KNOWLEDGE & OLD HABITS

FOR STUDENTS

UNIVERSITY VS HIGH SCHOOL APPROACH TO MATH:

- Higher focus on conceptual understanding & theory
- Less focus on memorization & mechanical application of methods

Example - no use of calculators in Math 10A, 10B, wealth of mnemonic rules in high school math.

PRIOR KNOWLEDGE USED OR FORMULATED IN DIFFERENT WAYS:

Example - Integration by substitution referred to as “u-sub” in high school.

PRIOR KNOWLEDGE & OLD HABITS

FOR TEACHERS

UNIVERSITY VS HIGH SCHOOL
APPROACH TO MATH:

- Be aware & try to accommodate students' transition by grounding material in examples without compromising conceptual understanding
- Use visualizations to illustrate concepts if possible

Example - Introduce the concept of a function by example of yearly population, visualize using blobs & graphs.

PRIOR KNOWLEDGE & OLD HABITS

FOR TEACHERS

PRIOR KNOWLEDGE USED OR FORMULATED IN DIFFERENT WAYS:

- Be aware of students' weak areas, try to briefly review while introducing new material that relies on such prior knowledge (eg. trigonometry for Math 10 students)
- Activate students' prior knowledge by "easing them in" (eg. using familiar notation)

Example - Integration by substitution referred to as "u-sub" in high school, whereas often it might be necessary to use different letters. In the beginning use letter u, then progressively use different letters to illustrate that the particular choice of letters does not matter mathematically.

Example - Draw trigonometric circle, briefly recall what sine & cosine are when material is related to trigonometry.

STUDYING & LEARNING MATH

USING THE TEXTBOOK

BUILDING A MENTAL MAP

LEARNING AS A CONTINUOUS PROCESS

TALKING TO OTHERS

READING THE TEXTBOOK

• READING A MATH TEXTBOOK IS A SKILL THAT TAKES TIME TO DEVELOP

• UNREASONABLE TO EXPECT MATH 10 STUDENTS TO GAIN MUCH FROM INDIVIDUAL READING

Informal feedback surveys: Math 10 students find lecture notes far more useful than textbook, not the same for upper division.

• ISSUES: TEXTBOOK SECTIONS OFTEN LONG & VERBOSE, HARD TO NAVIGATE AND IDENTIFY CORE IDEAS TO FOCUS ON

Rigorous mathematical language is abstract & formal.

Time and practice (and good textbooks) make perfect over time.

BUILDING A MENTAL MAP

AS A STUDENT:

• IDENTIFY THE FEW CORE CONCEPTS & IDEAS IN EACH LECTURE

• ORGANIZE THEM (EG. USING FLASH CARDS) AND UNDERSTAND THEIR RELATIONS TO EACH OTHER

• BUILD UP FROM THEM, PRACTICE IN EXTRAPOLATING (STANDARD PRACTICE IN MATH & SCIENCE)

AS A TEACHER:

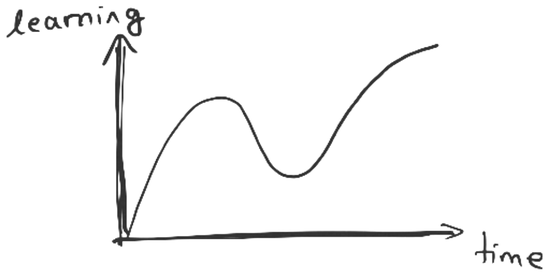
• AS A TEACHER, PRESENT ESSENTIAL IDEAS AND INTERCONNECT THEM AS MUCH AS POSSIBLE

LEARNING AS A CONTINUOUS PROCESS

- COMMON MISCONCEPTION: LEARNING IS DONE IN CLASS

- LECTURE, INDIVIDUAL READING, DOING HOMEWORK, ARE ALL DIFFERENT STAGES OF LEARNING

- PLATEAU EFFECT: LEARNING TAKES TIME, REPETITION & PRACTICE ARE KEY



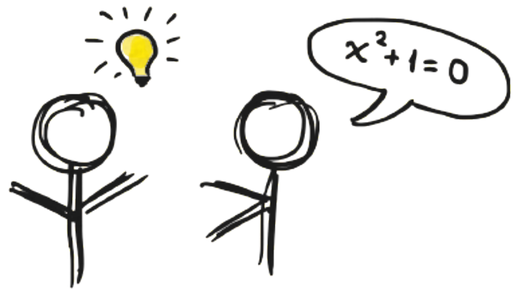
TALKING TO OTHERS

- SCIENCE & MATH IN PARTICULAR HAS HISTORICALLY BEEN A COLLABORATIVE ENDEAVOR

- VERBALIZING MATH IS IMPORTANT IN DEVELOPING UNDERSTANDING & INTUITION

- TALKING TO OTHERS, SUCH AS PEERS, TAS, PROFESSORS, ETC., HELPS ONE'S UNDERSTANDING AND OFTEN LEADS TO DEEPER AND MORE SPHERICAL CONCEPTUALIZATION

- ATTENDING OFFICE HOURS, FORMING STUDY GROUPS, TALKING TO CLASSMATES, ARE ERY VALUABLE AND EFFECTIVE WAYS OF LEARNING



COMMON DIFFICULTIES

- Getting past the barrier of math language & notation (eg. FTC 2 in Math 10B)

- Focusing on less important aspects of the material (eg. simplifying answer when evaluating an integral)

- Difficulty identifying holes and weaknesses in background (eg. trigonometry)

- Getting past “high school mentality”

- Not taking advantage of available resources, such as ofice hours

- Placing emphasis on exams as opposed to learning (this is a systemic issues, rather than the students’ fault)

T H A N K Y O U !