



Research Methods in Science in Engineering

Teaching

Slide 1

1

Lecture Outline

- Steps for course development
- General advice

Slide 2

2

I'm going to teach a class! What do I do now??

Sometimes we will have our supervisor/advisor telling us that we need to teach a class for a semester. Probably most of you haven't taught a course or a class and don't know where to start.

What has helped me when I started as a professor (or teaching a new course) is to work on the general things first and then work on the specific things later.

General things:	Course Outline (Topics to Cover)
	Syllabus (Course Policies)
	Course Material (Power Points, Videos, etc.)
Specific things:	Assignments
	Tests
	Lecture Examples

3

Top Thing to be an Effective Teacher When You are Just Starting

Do the things that you would have liked your professors to do when you were a student

Which professors did you enjoy taking classes with?

Which professors did you not enjoy taking classes with?

What things did the professor do that made you enjoy/not enjoy their class?

From these questions, you can start avoiding doing the things that your professor did and you didn't like that were not conducive to learning.

4

Top Two Things to be an Effective Teacher Later in Your Career:

#1 – Care

Care about the students and the job you are doing to teach them.

#2 – Work Hard

Work hard to develop an effective course plan, create effective assignments, have effective discussions with students, and give effective feedback on their work.

Everything Else

Teaching style, teaching methods, etc., are all secondary compared to the above, yet when discussing education, we seem to ignore them entirely.

Steps for Course Development

Step #1 – Identify a Subject and Course Information

It is likely you are assigned a subject and will not get to choose.

If you can, choose the earliest (easiest) subject for your first course and develop other courses in sequence.

Look up the course information, like number of students, class location, class modality (online or in-person), etc.

Step #2 – Identify Your Teaching Style

The teaching style depends a lot on your experience, your personality, and class composition (size, student classification, available resources, facilities, etc.)

I think the natural talent and experience of the teacher is equally important to consider.

* Teachers should not use this as an excuse to stay stuck in their ways.

- Teacher-centered -> Lecture Style
- Student-centered -> Flipped Classroom
- Content-centered -> Course Gamification
- Interactive/participative -> Project-Based
- Mixture of different teaching styles

Step #3 – Plan the Course

Layout and organize all the **major** topics you want to cover on a calendar or Gantt chart.

Layout and organize all the assignments and exams the course will entail on the same calendar or Gantt chart.

Coordinate and synchronize the above two things over the entire duration of the course.

Build in some margin and some bonus topics to account for delays or being ahead of schedule.

Step #4 – Develop Course Material

Write a syllabus. ALWAYS start with the syllabus

The syllabus is the most important document for you and the students, as it lays down all the course policies, rules, and content.

Rules should be crystal clear about submissions, grading, and other policies.

The syllabus is a binding document that will help you fall on your back when you are dealing with unexpected circumstances (“I told you so, it’s in the syllabus!”).

The syllabus may also hurt you if the syllabus if it is not clear or is missing policies or information.

Step #4 – Develop Course Material

Write your course notes and create course content.

If you do not remember anything about the course or feel unprepared, you can start doing handwritten notes to help you remember and become proficient. Use the textbook assigned for the course to make the notes.

You can then organize your notes in a Power Point presentation that will be changed and corrected when you find mistakes or find better information.

Finally, you can record videos that can help students revisit the concepts after the class ends.

Step #4 – Develop Course Material

Write your assignments and exams.

This includes homework, quizzes, exams, in-class assignments or class activities.

Write instructions clearly and be specific on what students need to show.

The most common type of mistake students make in assignments/exams is not following instructions, so make sure there are no ambiguities and be as concise and clear as possible.

Make sure the assignments and exams are relevant to the course topic and they are something that you cover in class (avoid surprises).

Step #4 – Develop Course Material

Coordinate all of the above.

You will likely find yourself going back to add topics, reorganize order, change wording and notation, etc.

You will notice that you are either behind or ahead topics, so organize accordingly.

The semester is super constrained in time and resources. If possible, when you need to choose among covering more topics or focus on an important one, choose the latter.

With time you will find your own rhythm and cadence in covering topics that will help you better organize courses in the future,

Step #5 – Teach the Course

Treat your lectures like presentations.

Practice and strive to be clear and concise.

Make students comfortable to ask questions and participate.

Be kind and approachable.

Grade assignments promptly and provide meaningful feedback.

Get ready to adapt, improvise, and overcome!

Make the topics interesting.

Incorporate your research, experience, recent breakthroughs, etc.

General Advice

15

Assignments

- Make assignments as consistent with notation, wording and formatting to the course notes and lectures as possible.
- Make the assignments fun and meaningful.
- Do your best to gauge difficulty and time to complete assignments. Be reasonable.
- Create solutions along with the assignments to help catch mistakes and identify missing information.

16

Be Humble and Be Real

You do not have to know everything.

Do not fake it. Be honest if you are guessing.
You will lose the students if you act like a fraud.

Just be willing to dig to find the answers.

Be Fair and Consistent With Grading

If possible, grade all assignments in one sitting. At a minimum, grade the same problem for all students in one sitting.

It is very easy to penalize different students differently for the exact same mistake. This is amplified when grading at different times.

Ignore the name of the student when grading.

Consider a simplified grading scheme that makes it easier to be fair and consistent.

Grading and Feedback

Do NOT just check a box if an assignment is done or not.
This does not encourage students to do well.

Grade every assignment and provide feedback.
If a student knows you are looking and caring, they will try harder and learn more effectively.

When Overwhelmed, Simplify Grading

Students will try harder in a class if they think the professor is paying close attention.

Feedback on homework is critical to conveying that you are paying attention to them and care about them.

We occasionally find ourselves overwhelmed and cannot devote that level of attention.

Use a simplified strategy that makes grading fast but gives the illusion of paying close attention.

Expert Advice (Cheat Codes)

21

Expert Advice

The easiest way to become a good professor is to have CLEAR STUDENT EXPECTATIONS

How many times have you had a professor that you do not know what to do on the course to get a good grade and you try to figure them out throughout the semester instead of focusing on actual learning?

Write clear instructions, outline all the things that students need to show/do during the semester, connect the material to their career, provide clear feedback and rubrics on what they need to do to get a good grade, establish clear policies. You will make your life and your students' lives a lot easier.

22