Lessons from Year 3
(in progress)

In particular for IIT Madras: Programming Challenges, Diversity

NOTE: in our MSc it is a pre-requisite that students have a BSc course in programming.

Programming Challenges in MUDE

Status quo: ~20% of students have difficulty with programming, despite a BSc course being pre-requisite for admission.

One of the primary functions of MUDE is to address these discrepancies and provide a "Landing Zone" for all students; however, the status quo is simply too severe for MUDE Team to solve alone.

Students that cannot participate in programming are at risk of missing out on learning opportunities throughout the MSc.

Survey Results (2024, Week 3)
(consistent with previous years)

N = 270 active students in MUDE so far this year

- Around 20 say they "have never programmed before" (22) or have never taken a BSc-level course in programming (18)

- 50 do not have experience with Python

Regarding online python material we send to students over summer:

- 175 recognized the course;

- 97 students reported not being notified about the course

Observations + Anectdotal Evidence
(i.e., no formal survey)

- Students confirm
  - The MUDE setup is very useful and appreciated
  - After graduation, students without MUDE take Python courses
  - BSc programming courses that do not include applied engineering/mathematical/numerical problems are useless
  - Collaboration is a very effective form of support

- Teachers observe:
  - Some students literally know nothing about programming
  - Computer literacy is also low
  - Students have told us that they feel unprepared for their program and wonder why they were admitted (not only programming)
  - ~70 students voluntarily joined the tutorials (new this year)

Summary of Programming Challenges

- Generally non-TUD students; mostly non-NL.

- Each year around 10% of our students have absolutely no programming experience, with probably an additional 10% being at such a low level that they need to start over anyway.
  → **should be 0%!**

- We have resources to help, but communication is challenging (bureaucracy, no lead person, students are moving to NL...)

We are looking for ways to get students up to speed with programming before Day 1.

Things that MUDE already does

- Made a [website to explicitly inform students about MUDE](#)

- [Preparation/Refresher "course"](#) (online, self-paced)

- Weekly Programming Assignments coupled directly with theory activities for the week

- Weekly Programming Tutorials to support beginners

- Customize assignments on daily basis to explicitly account for programming level (topics, approach, student workload)

→Students very motivated to learn; approaches working well

→It is too much work to account for absolute beginners

Possible Solutions

1. Make the online course more motivating/interesting

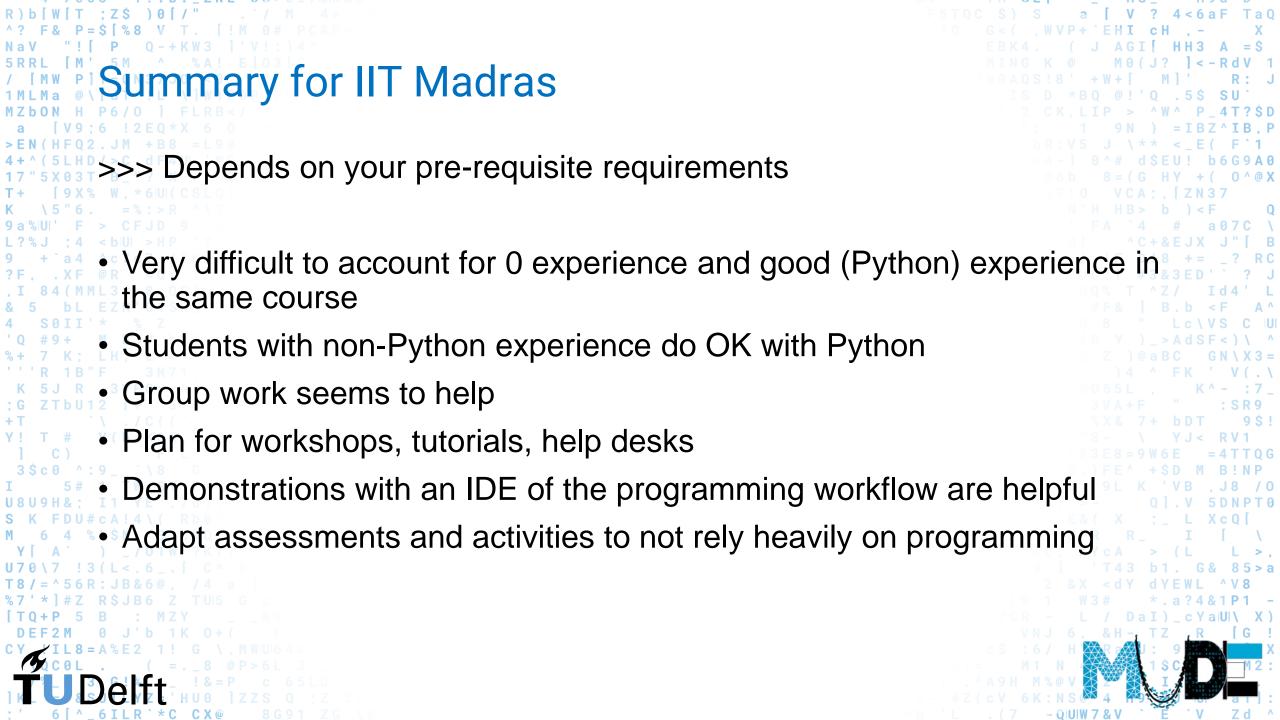2. Direct communication to incoming students about pre-requisite material and courses. Ideally this is targeted to specific groups of students who have now had issues consistently for 3 years.

3. Offering workshops and courses during the first week of class.

4. Self-assessment tests that are strongly encouraged or required; follow-up activities based on results (e.g., do the week 1 tutorial sessions)

5. Organizing faculty-wide help desk/tutorial sessions and/or office hours; recognize that programming skills should be worked on continuously. This would be relevant for staff as well.

6. Addressing international student intake process

Summary for IIT Madras

>>> Depends on your pre-requisite requirements

- Very difficult to account for 0 experience and good (Python) experience in the same course

- Students with non-Python experience do OK with Python

- Group work seems to help

- Plan for workshops, tutorials, help desks

- Demonstrations with an IDE of the programming workflow are helpful

- Adapt assessments and activities to not rely heavily on programming

What Students from India say about Programming in MUDE

- Preparation: BSc course not useful; focus on printing, no diff. eqns's, no applications, limited calculations and abstractions
- Applications to "real" problems are the most motivating; appreciated being given "a proper engineering problem"
- Weekly assignments appreciated: maintain progress, limit group dependence
- Particularly enjoyed the "interpretation" questions we ask, in part because the code is there to read and interpret
- Collaboration with other students highly appreciated (helps with previous!)

Our Tips for IIT Madras

- Identify/create/maintain reference materials for your students
- Allocate time for supporting students with little to no experience
- Incorporate regular programming assignments
- Consider small assessments / pre-knowledge checks (we don't do it…yet!)
- Use a TeachBook to focus on key concepts without installation issues
- Adopt MUDE approach for integrating theory and programming
- Include teachers that have relevant experience
  (e.g., notebooks, environments, software; Python "expert" not essential)

Resources

We are working on juypter books to use in many courses as common reference materials; they are a good start, but not all complete yet.

- Learn Python: repository and website
- Learn Programming: repository and website
- Learn Probability: repository and website

- MUDE website and this workshop for programming assignments