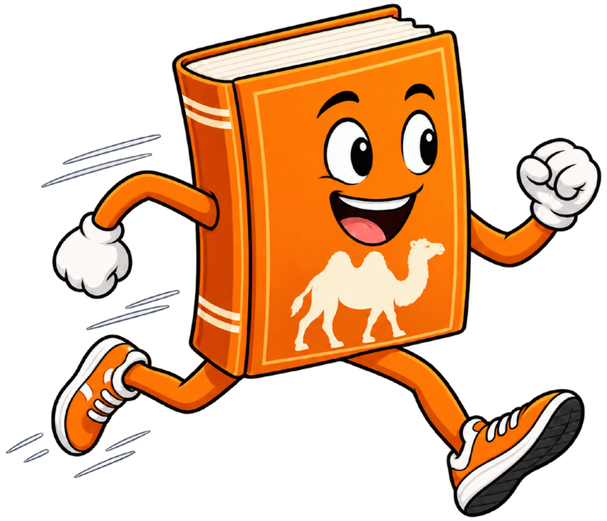
Textbooks that run

Interactive 0-install CS education in the browser



KC Sivaramakrishnan
26th September 2026
IndiaFOSS 6.0, Bengaluru

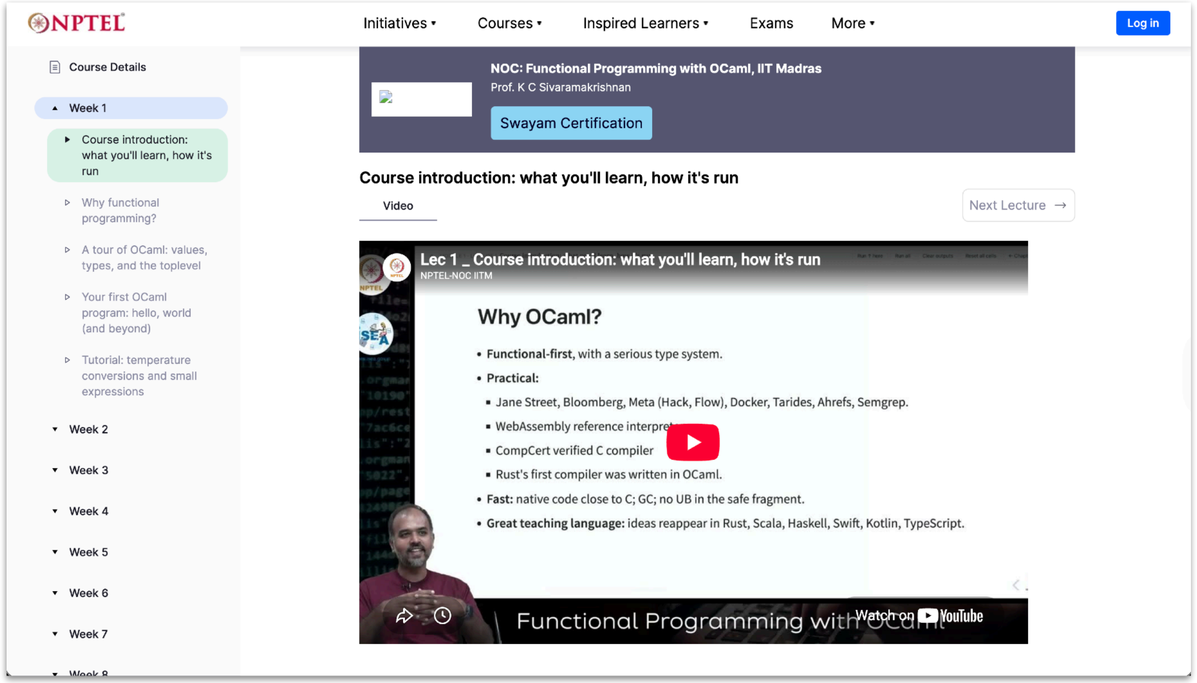
FP Launchpad

IIT MADRAS

Tarides

Story of the book

Functional Programming with OCaml



https://nptel.ac.in/courses/106106002

1227 Enrolled

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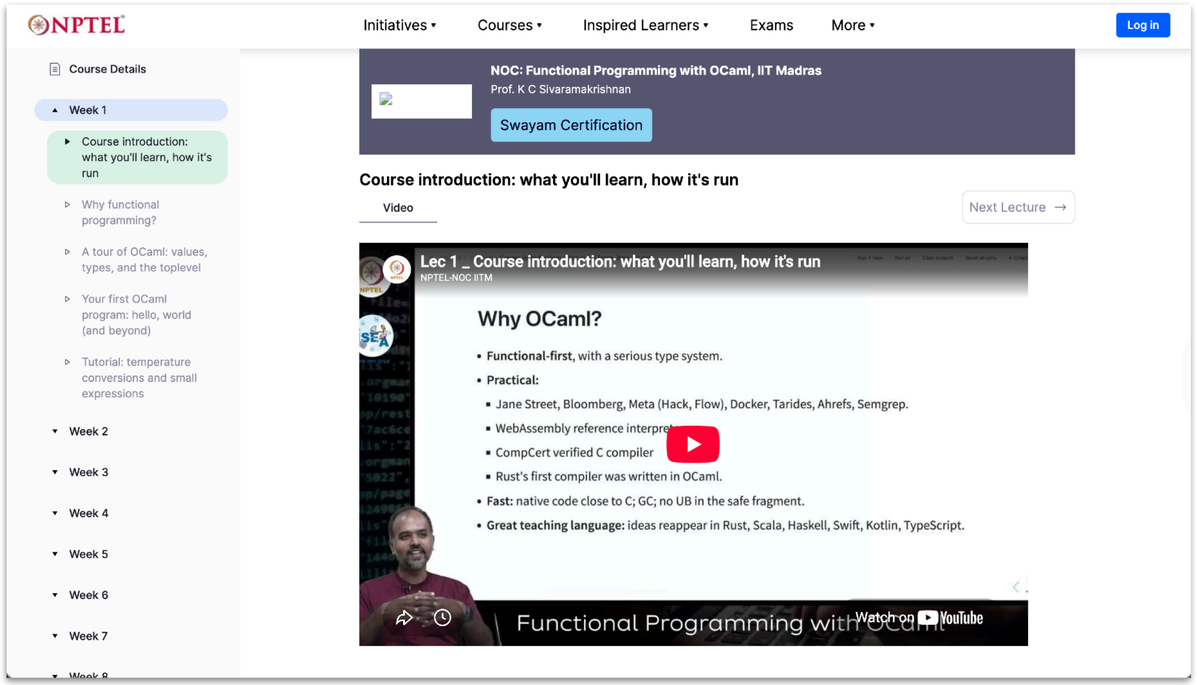

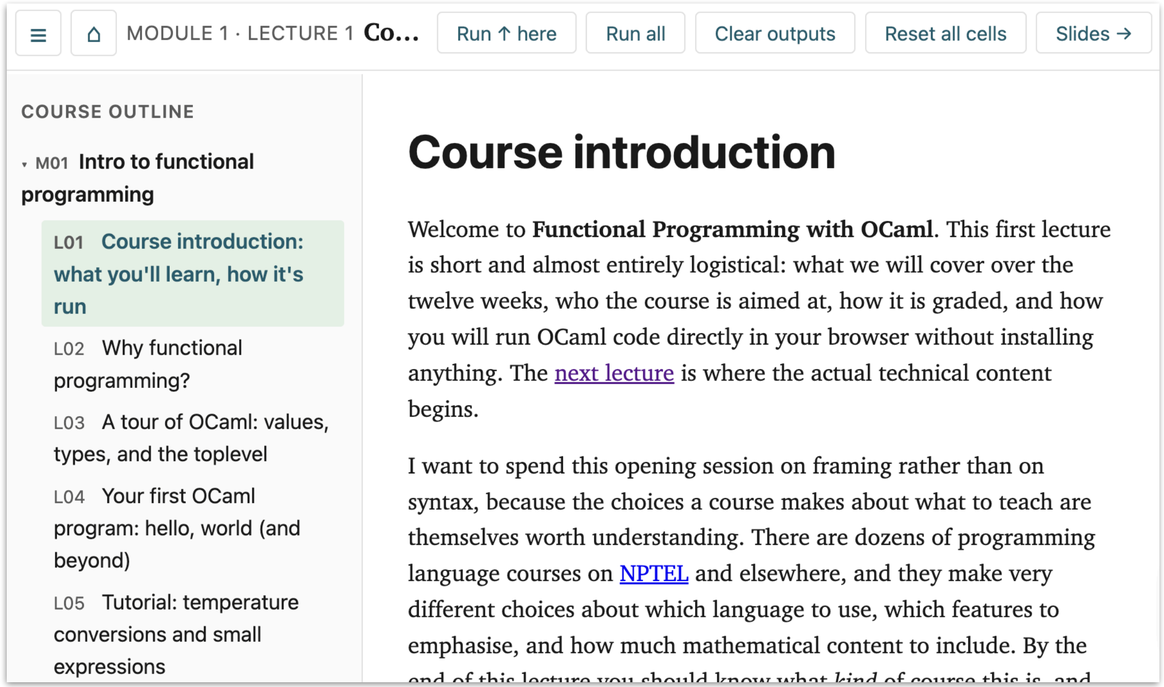

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https://fplaunchpad.org/ocaml_nptel

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NPTEL

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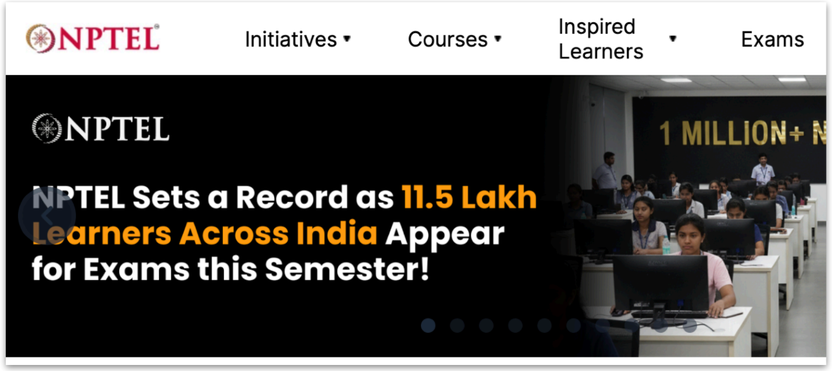

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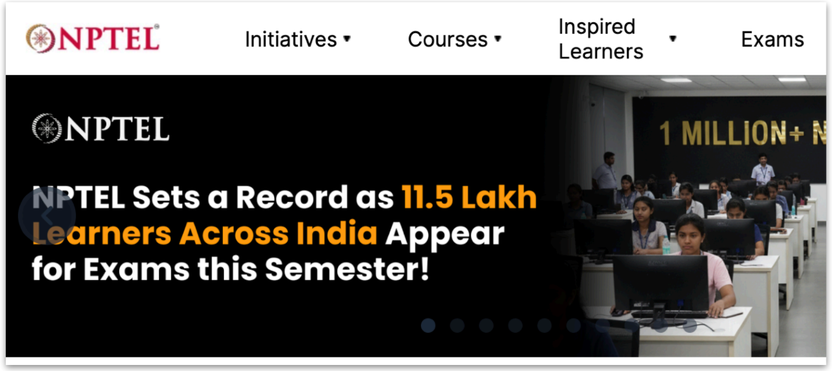

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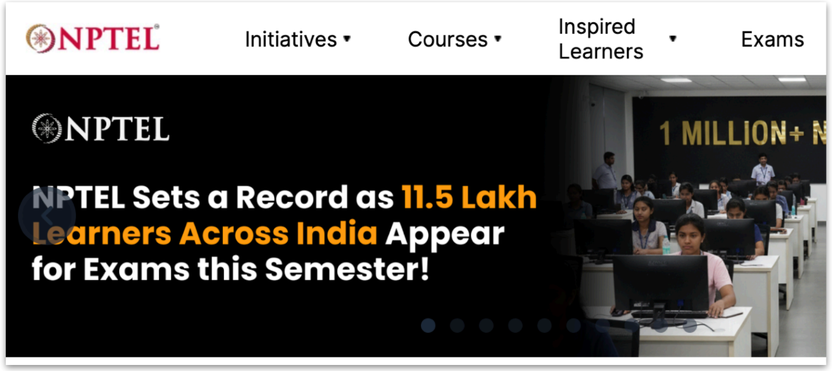

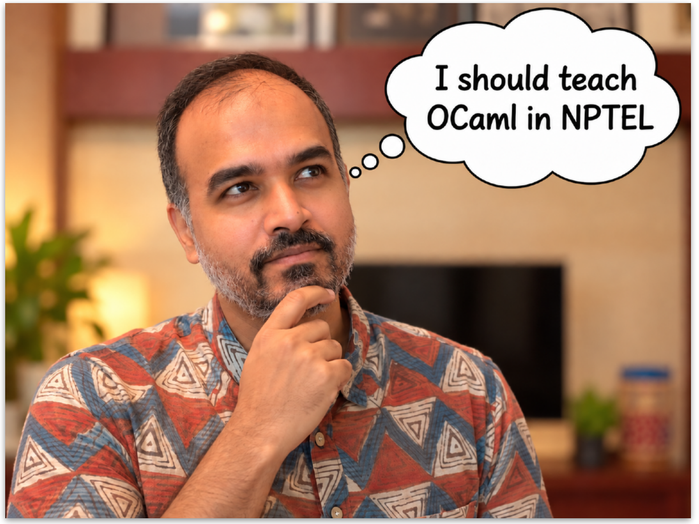

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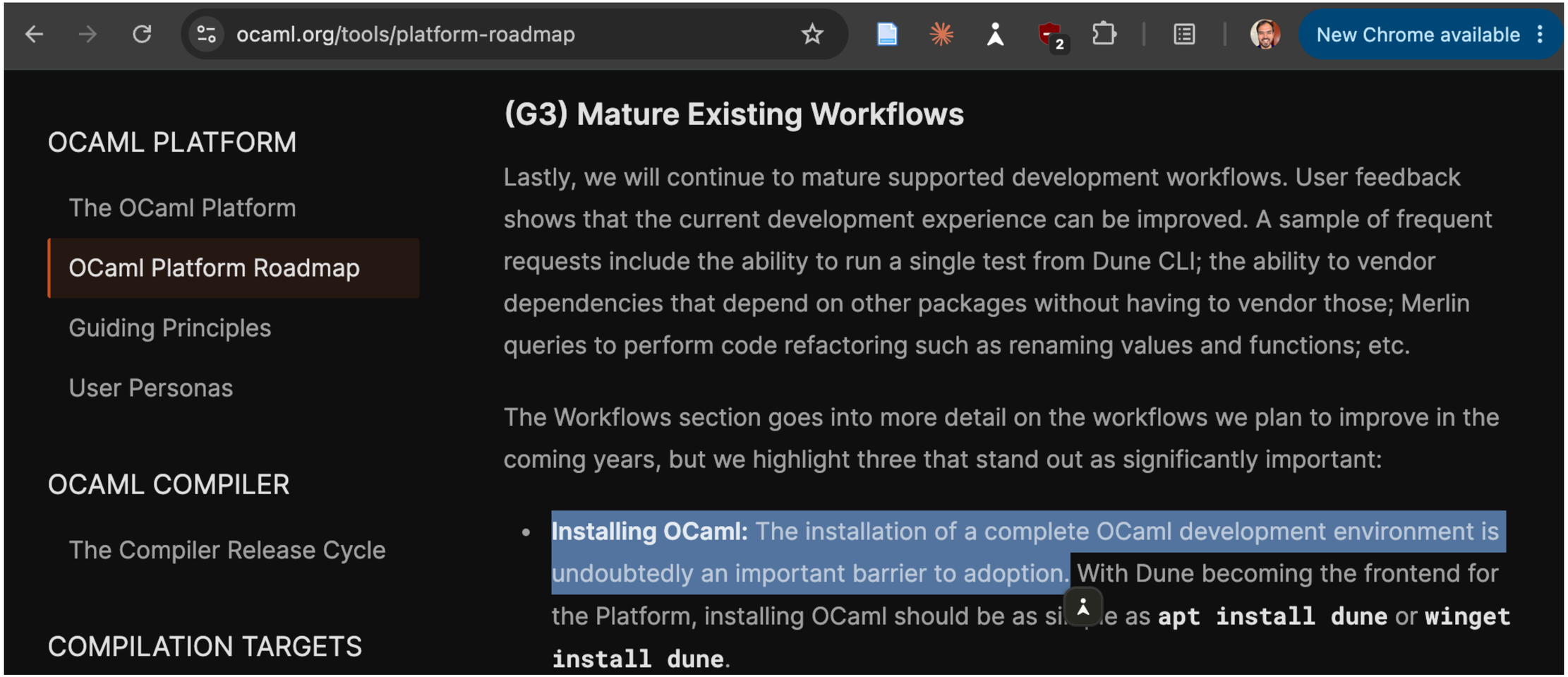
- Videos recorded in a studio
  - 2 TAs to run the course
  - Personalised attention is impossible

Installation challenge

- A big challenge for ***learning*** and ***adoption***



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- Personal experience
  - IITM — many students unfamiliar with terminal
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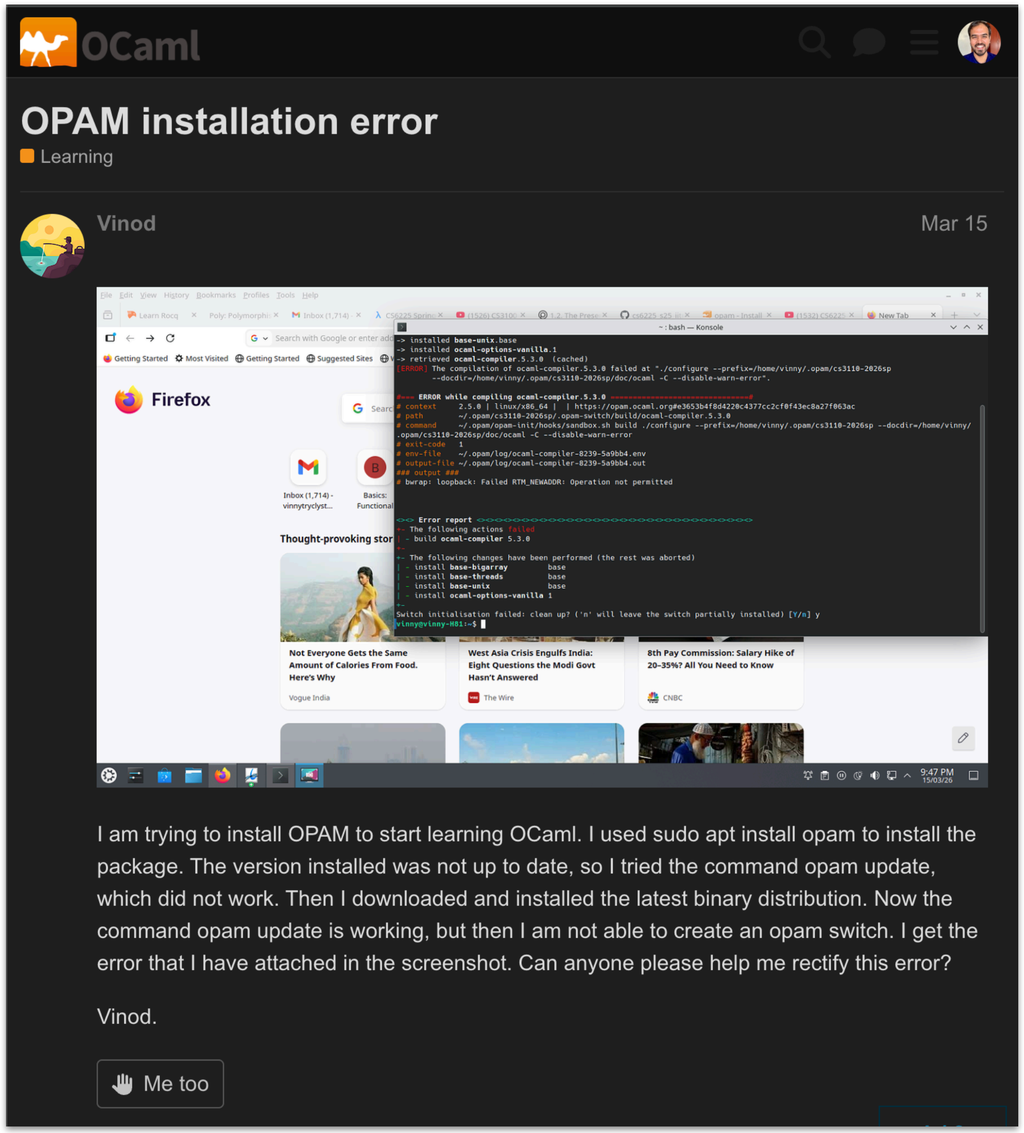
- Users and students ***disengage*** when installation is a challenge
  - Especially challenging when students have little support



Who do we not hear from?

Earlier workflow

- CS3100 Paradigms of Programming
  - OCaml + Prolog
- Jupyter Notebooks + Docker
  - RISE for converting them to reveal.js slides
  - nbgrader for assignment evaluation
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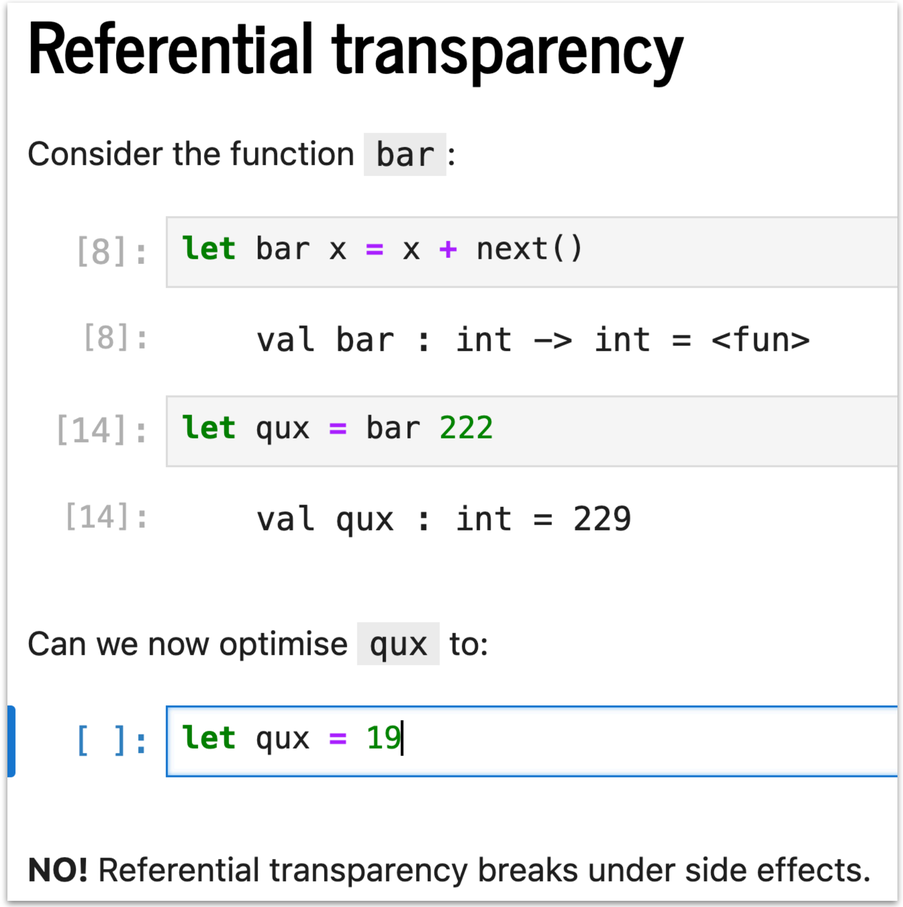

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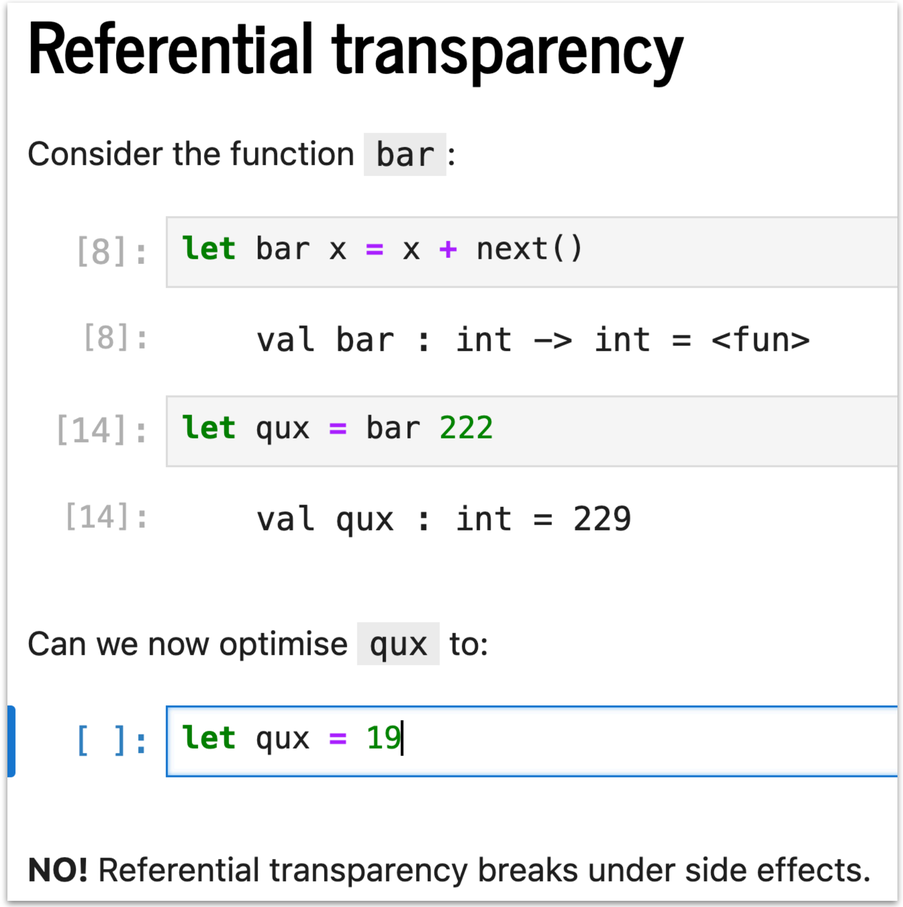
- Downsides
  - Needs Docker — Image is ***2.86GB***
  - Editor is not language-aware — no types, live error, code completion
  - Not a book — cannot be read in isolation; meant to go along with lecture videos



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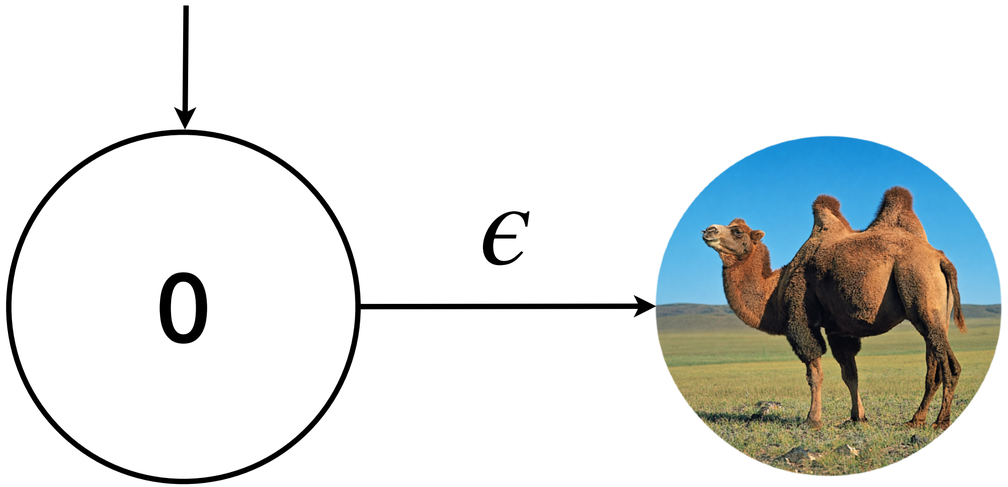

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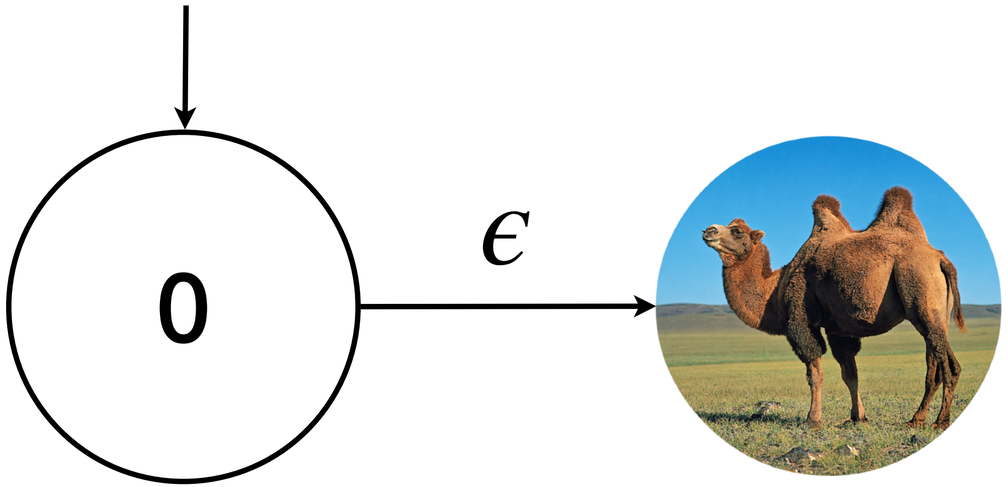

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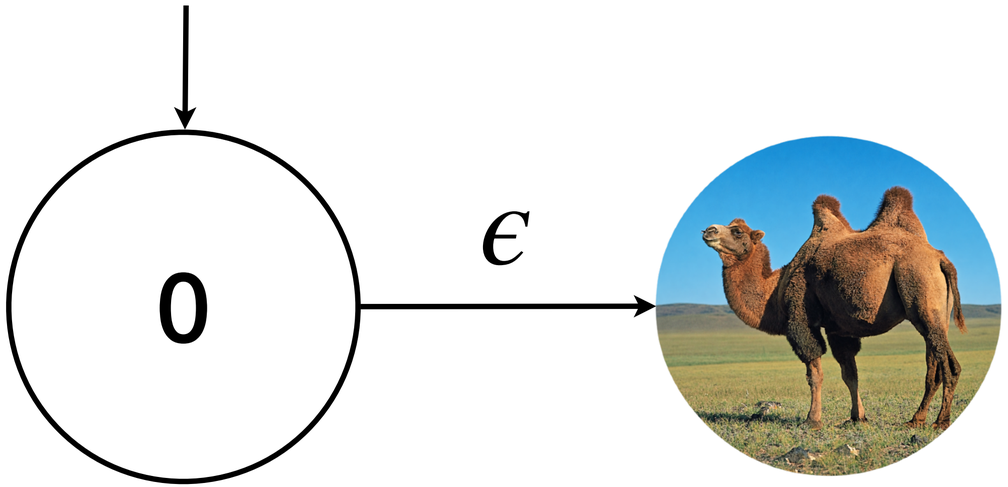
  - One source for textbook and executable slides
  - Readable Git diffs and merges
  - Automatically type-check and test the code



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Tech — OCaml Platform

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<x-ocaml>let x = 42</x-ocaml>
```

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15  let x = 42                                          Run ▶
    val x : int = 42
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Liberally licensed
Open Source software

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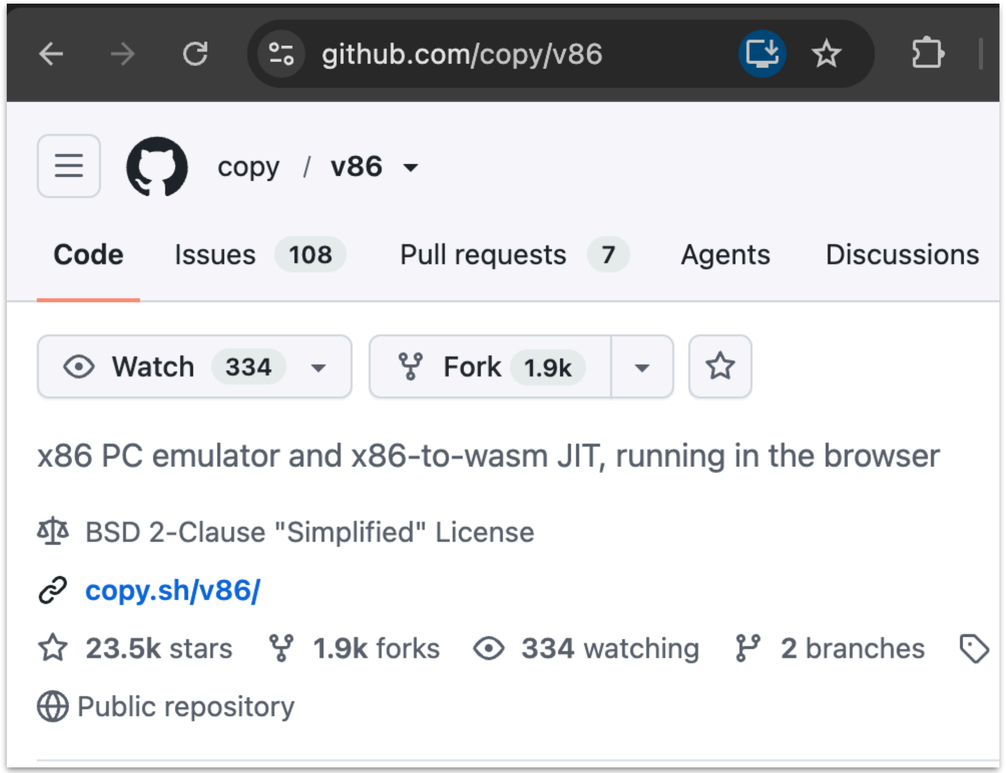

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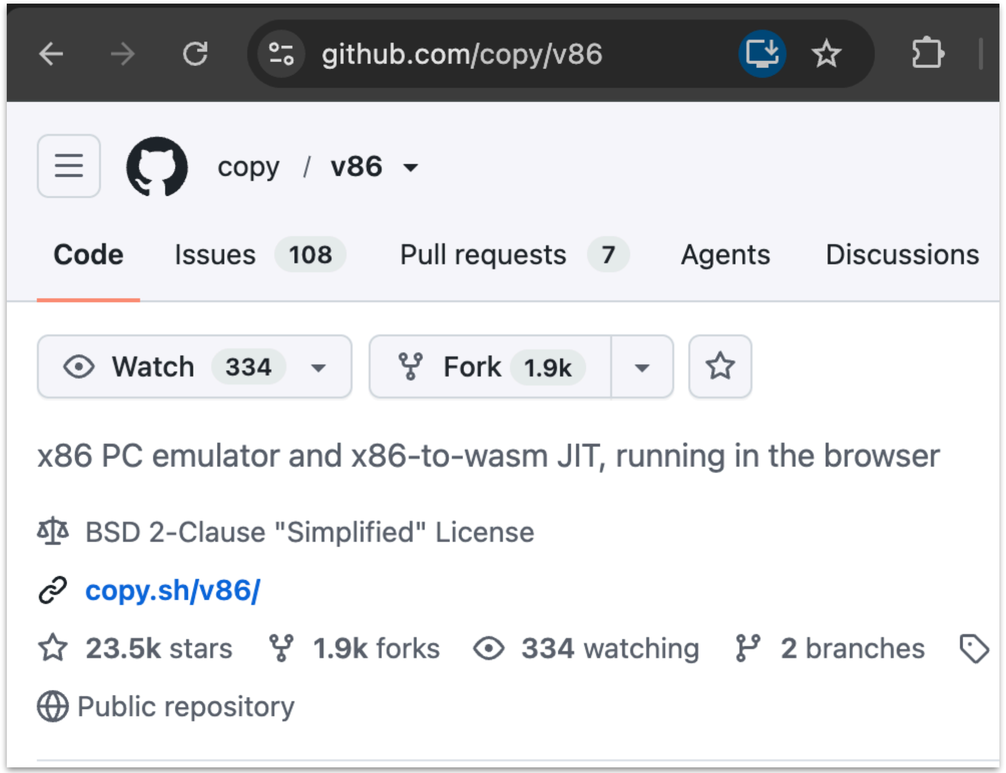

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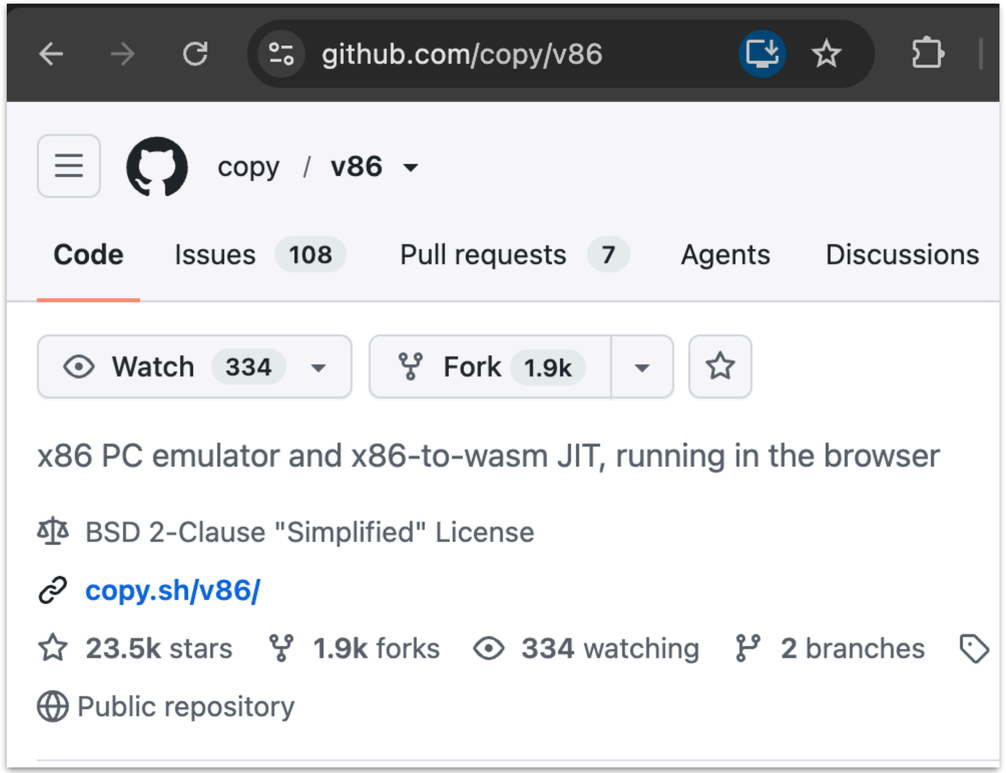

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  - Both MCQs and programming puzzles
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  - Analytics available publicly
- Feedback in both directions
  - Reader about their understanding
  - Author about their explanation
    - *Aim to revise the book based on analytics!*

Profiling Programming Language Learning

WILL CRICHTON and SHRIRAM KRISHNAMURTHI, Brown University, USA

This paper documents a year-long experiment to "profile" the process of learning a programming language: gathering data to understand what makes a language hard to learn, and using that data to improve the learning process. We added interactive quizzes to *The Rust Programming Language*, the official textbook for learning Rust. Over 13 months, 62,526 readers answered questions 1,140,202 times. First, we analyze the trajectories of readers. We find that many readers drop-out of the book early when faced with difficult language concepts like Rust's ownership types. Second, we use classical test theory and item response theory to analyze the characteristics of quiz questions. We find that better questions are more conceptual in nature, such as asking why a program does not compile vs. whether a program compiles. Third, we performed 12 interventions into the book to help readers with difficult questions. We find that on average, interventions improved quiz scores on the targeted questions by +20%. Fourth, we show that our technique can likely generalize to languages with smaller user bases by simulating our statistical inferences on small N. These results demonstrate that quizzes are a simple and useful technique for understanding language learning at all scales.

Authoring the modules

- Book is written in Markdown with Pandoc-style fenced divs

```
:::slide

## What's next

Lecture 5: **local functions and mutual recursion**.

- The `go`-inside-a-function pattern, made explicit.
- Functions that refer to each other.

:::
```

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````
:::quiz code id=M03-L04-q2
Write a tail-recursive `sum_of_squares : int -> int` that returns
`1*1 + 2*2 + ... + n*n` for non-negative `n`. `sum_of_squares 0 = 0`.

```ocaml
let sum_of_squares n =
  failwith "not implemented"
```

```ocaml skip
let check b m = if not b then failwith m
let () =
  check (sum_of_squares 0 = 0)    "zero";
  check (sum_of_squares 1 = 1)    "one";
  check (sum_of_squares 3 = 14)   "small: 1 + 4 + 9";
  check (sum_of_squares 5 = 55)   "five: 1 + 4 + 9 + 16 + 25";
  print_endline "all tests passed"
```
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````

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↺ Run ▶

Check ▾ Hide tests

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Run ▶

▶ Show reference solution

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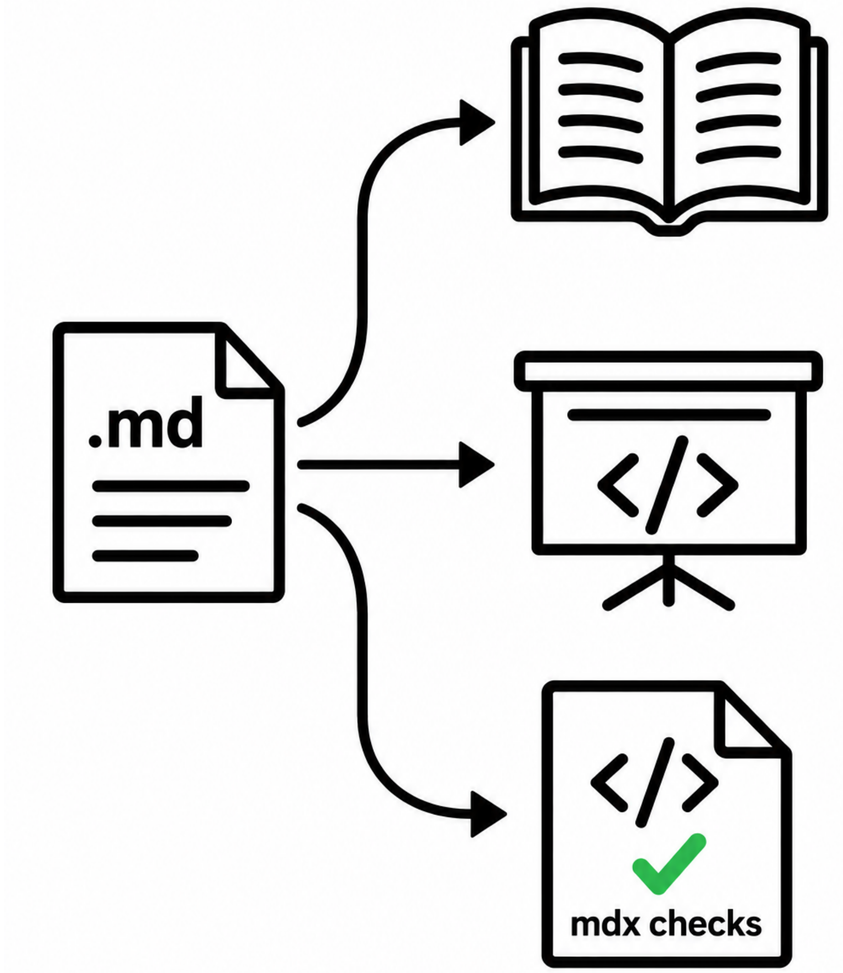

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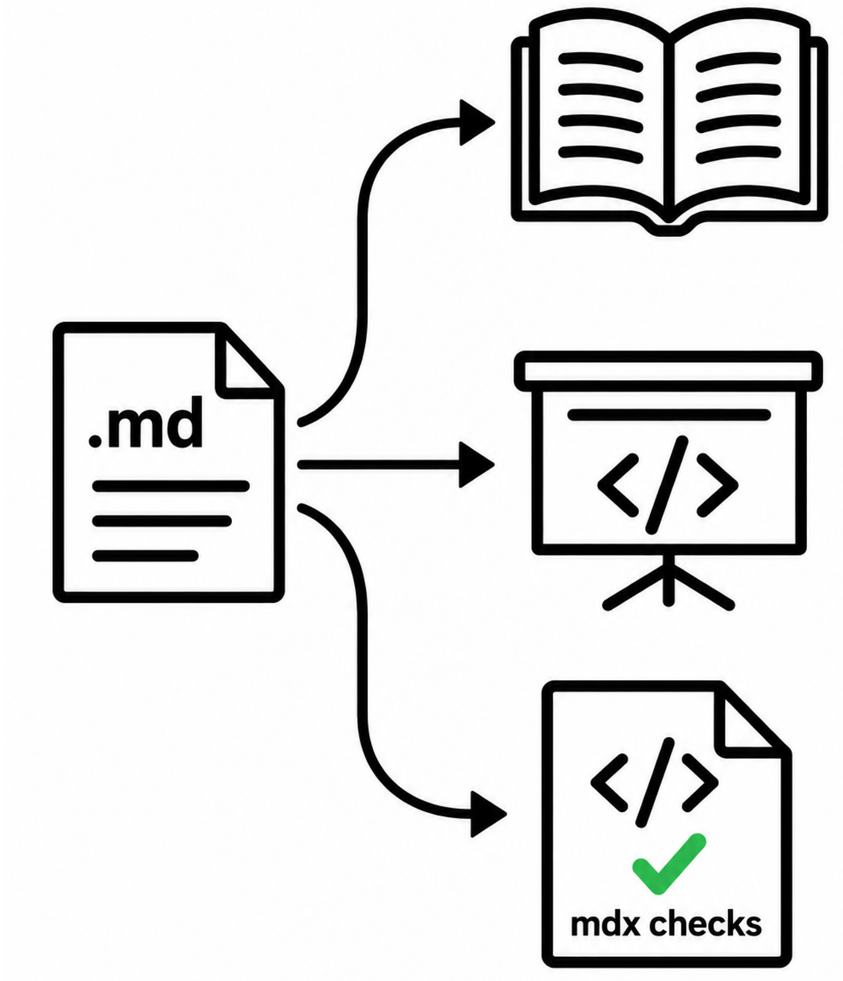

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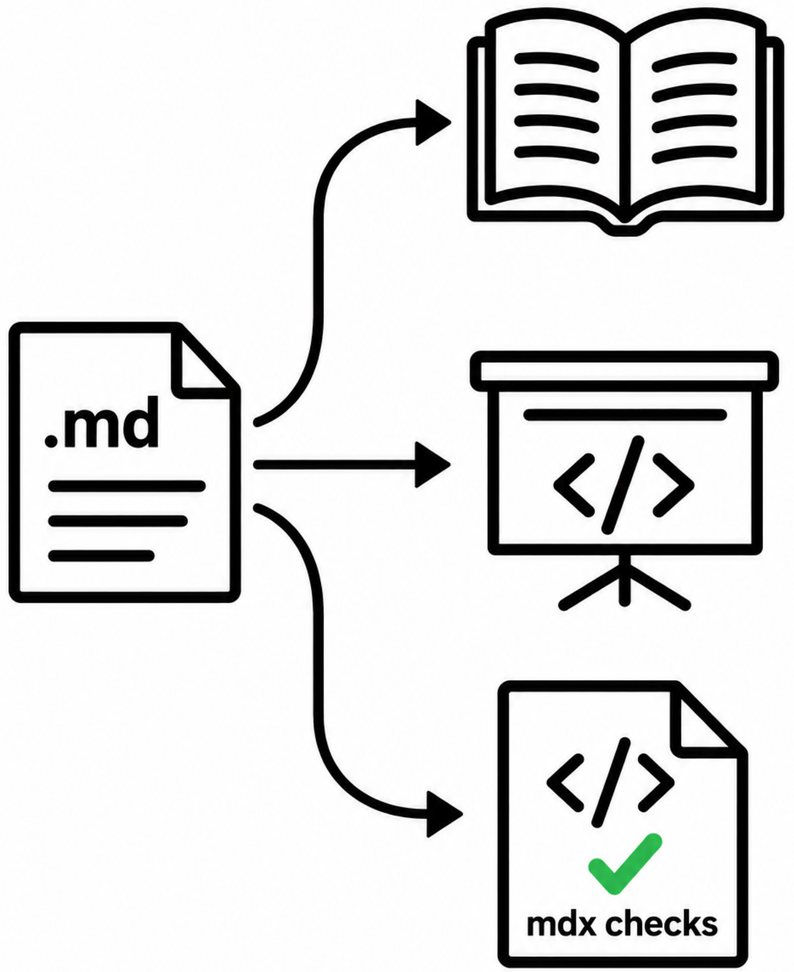
- ***Automated checks support review***
  - **ocaml-mdx** compiles and runs the code examples
  - Additional checks for slide overflow and broken cross-refs



Agentic Programming

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  - Claude Opus 4.7+; 207M non-cached tokens
- Platform side almost entirely vibe coded.
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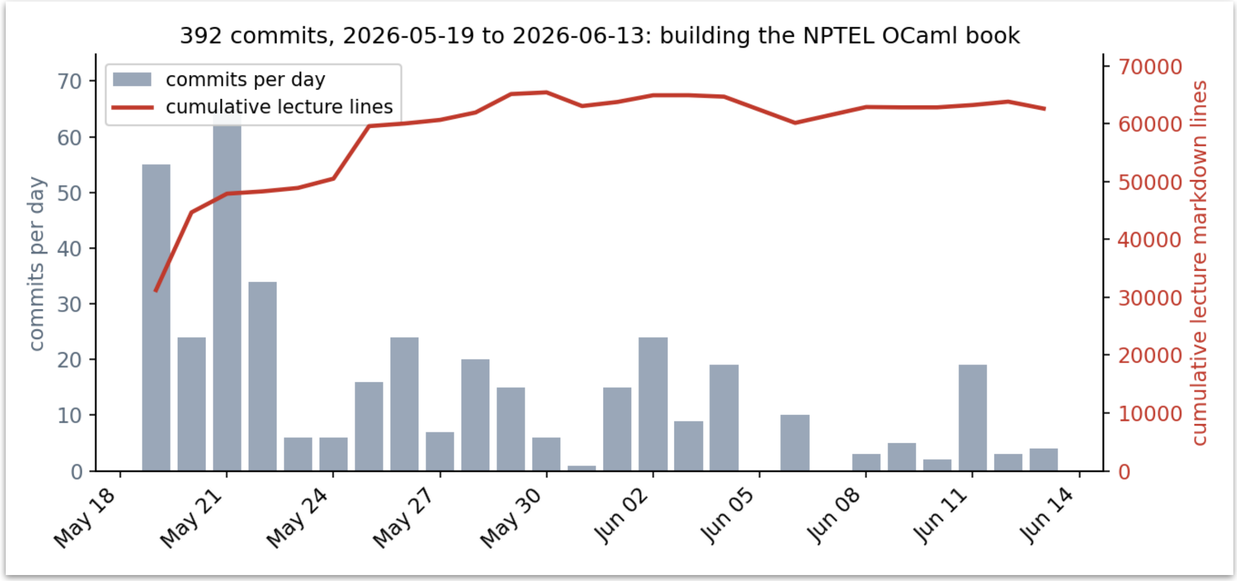

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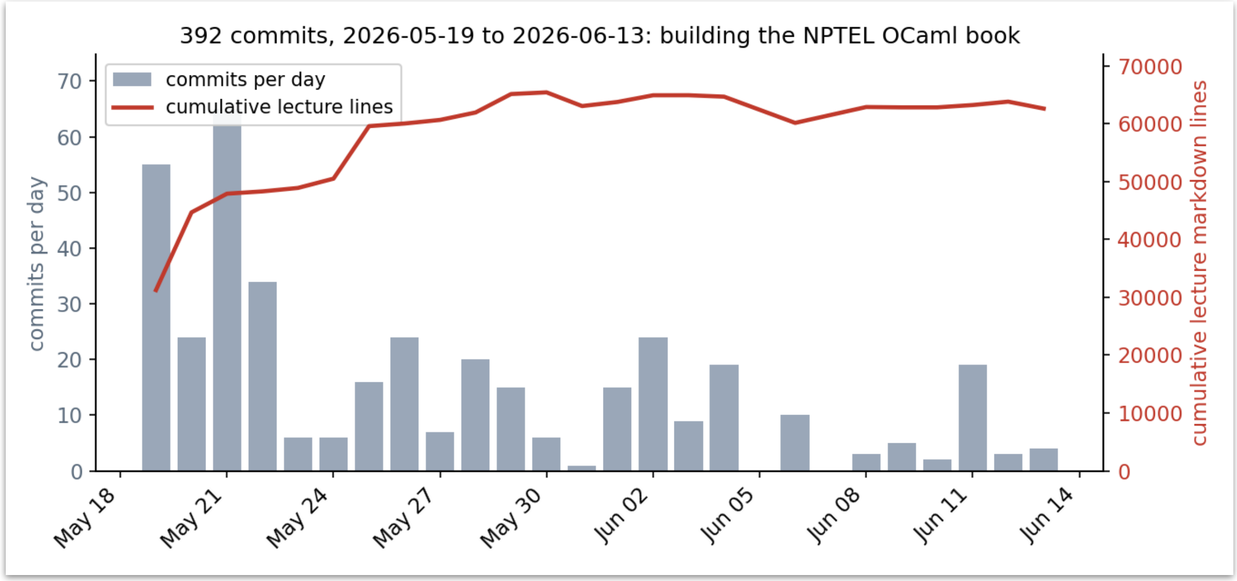
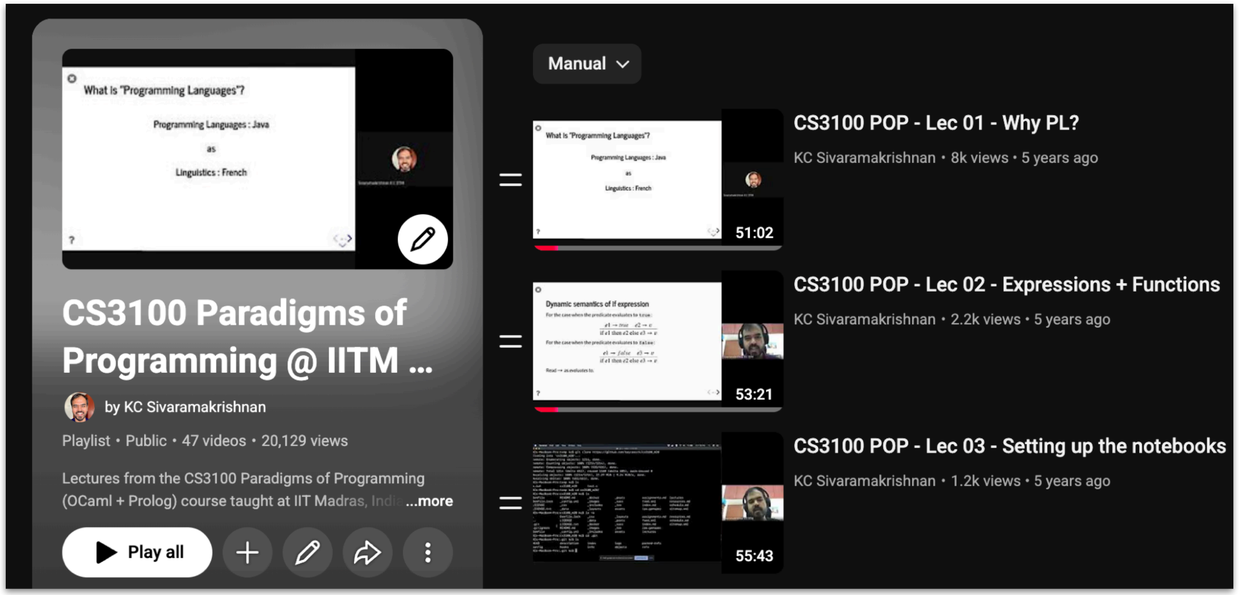
- Content is derived from IITM CS3100
  - ***60k lines of markdown***
- Agent “learnt” the material
  - ffmpeg to scene (slide) detect
  - Local Whisper model for transcribing audio
  - A small script aligns slide & transcript





Reflections on Agentic Development

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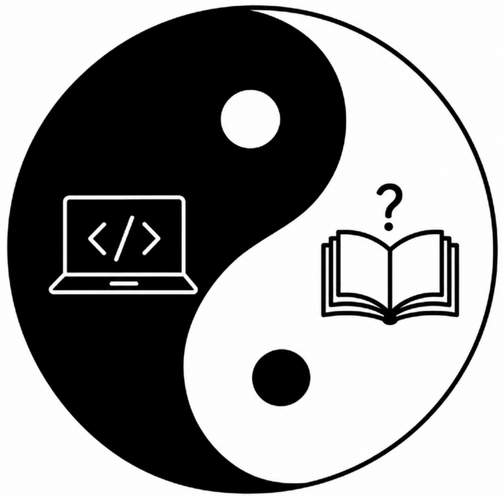

Reflections on Agentic Development

- Platform development was ***mostly good***
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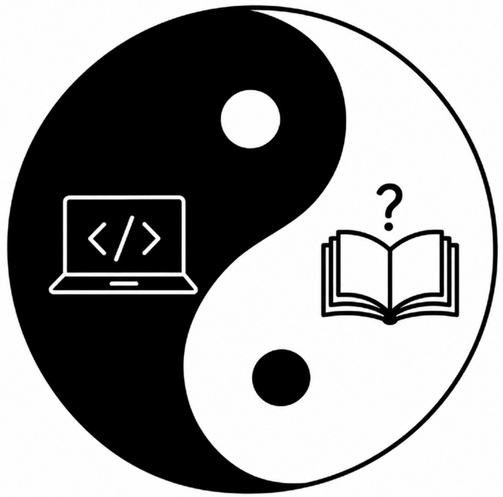
  - OxCaml JS bundle size reduction from 285MB to 4MB
- Content writing was ***mostly bad***
  - Assumed too much about what the learner already knew
    - Used concepts before introduction; presented ideas without motivation
  - Great oracle but bad teacher
    - **Curse of Knowledge** — an expert assumes others have their specialised knowledge
    - **Pedagogical Content Knowledge** — knowing how to teach is separate from knowing



A Skill for writing chapters

- **No forward concepts**
  - Use only concepts that are currently in reader's toolbox
- **No jumps**
  - Motivate each idea, introduce using small examples
- **Slides carry the content**
  - Viewers don't read chapters first $\Longrightarrow$ slides alone must carry the narrative
- **Fresh activities**
  - Programming quizzes shouldn't repeat existing content
- **Reviews in fresh agent**
  - Prompt to assume basics and ask the agent to read preceding content

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  - Gaps need educators to innovate

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Functional Programming with OCaml
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FP Launchpad

Post-bacc fellowship — Cohort 2

Deadline: Dec 10th 2026