Paper, Pencil, Program

- Intro
  - I have had three mentors at Duke who have changed the way I now approach learning math.
    - I've never thought of myself as a math person, **confidence, unfamiliar territory**
    - Because of them, I have learned to **recognize, appreciate 3 modes** of learning that I am now always trying to put into **practice.**
  - Three words: Paper, Pencil, Program.
    - I call the first mode **paper**, because
      - Engaging source of info, formal, rigid | textbooks, linear presentation
      - Reading how someone else thinks, but that's not always how YOU think.
    - The **Pencil** mode represents
      - The act of interpreting, visualizing, integrating new ideas with old ones
      - Draw what you need to see things in a different way.
      - **It's about being playful.**
    - **Program** mode represents an *imperative* I now feel to code
      - Take loose, squishy ideas and insert them into a scaffolding
      - Exercise in teaching things to yourself, to others, and to a machine!
      - When abstraction meets the machine, **things get concrete real fast**

- **Paul Bendich** - was my professor during fall of my Junior year **topology,** weird form of **geometry**
  - Interactive teaching tools to visualize the diagrams he drew on the blackboard
  - **Programming** can lead to positive feelings. **I made this.**
  - **I taught a computer, I taught myself.**
  - I spent an hour in class, then 10 hours on my own struggling to make a **program**.
  - *Where did the real learning take place?* **POINT** AT PROGRAMMING

- **Justin Curry** - I encountered his gift for teaching last semester - **Linear Optimization**
  - Sounds boring. It's not. It's about optimizing things!
  - He taught me to look for the philosophy and "big ideas" that could be gleaned
  - The first time I'd ever done math for an hours straight at the chalkboard - **pencil mode**
  - Giving us inspirational papers to read: **Curry taught me to seek out better resources.**

- **Chris Tralie** I'm in his course right now. It's called Digital 3D Geometry.
  - We get a **whirlwind** tour of the subject's landscape
  - **dive deep :** simulating echoes in 3D environments, aligning 3D shapes (Nasher sculptures)
  - In the middle of putting 30 hours into an assignment, fear not figuring things out
  - Walk out of lecture understanding. When I try to code it up, that's where the magic happens
  - **Programming is an emotional journey,** Learning should be an emotional journey
  - Trigger a sense of **wonder and discovery** by pushing me from **Paper** to **Pencil** to **Program**
- Conclusion
  - This semester, I've **had lunch with these guys** and told them as much as I've told you.
  - I hope you reach out to whomever has been a great influence on how you learn.
  - In Chris's case, he's **more experienced** than I, but **we talk all the time about learning**, because we're **both trying to figure out how to learn math**, and in his case, **how to teach it.**
  - For him, teaching us is a **programming** exercise in itself!