

Networking Education and the hands-on experience

10 observations, insights, and advice that I wish someone had told me



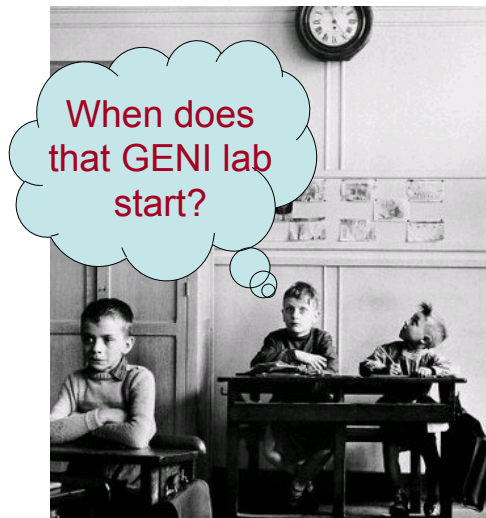
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A minute of reflection



Question: what is one lesson that you've learned about hands-on networking education (since becoming a professor) that would be valuable for someone else (who might not have learned or considered it yet) to know?

1. (Many) students learn best by doing



for some students
.... being in a
classroom isn't
always fun

1. (Many) students learn best by doing



- ❖ Students learn by “seeing” networks in action
 - configuration
 - measurement
 - what’s happening and why?
- ❖ Kurose & Ross
Computer Networking
Wireshark Labs: 20K hits/month/lab

"Tell me and I forget. Show me and I remember. Involve me and I understand."

2. Some students want to touch something physical



4-router, 4-hub, 4-host rack
Mastering Networks, Lieberherr & El Zarki

- ❖ Some students *really* want to touch something physical and real:
 - makes the experience somehow more “real”
 - *a key challenge for virtualized labs*
 - integrate local (physical) and remote (virtualized) resources?

3. Some students learn best in teams



- ❖ Humans: social creatures
 - students *enjoy* helping each other
 - learn from each other, by doing together
 - learn by teaching each other
- ❖ team-based lab assignments
 - interoperability?
 - simultaneous experiments?

4. Leave a legacy via your educational material



❖ Make your educational activity valuable to others, for the long term, beyond your (own) students

- research papers last forever
- good books have long shelf life
- leave tangible education material that others can pick up years later

5. Know your audience



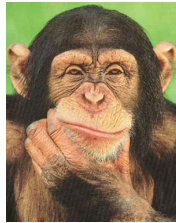
❖ Write to who will be using your materials

- undergrads
- grads
- researchers
- users

❖ ... and for what purpose

- what learning outcomes?

6. It's going to take a lot of time and thought



- ❖ good writing takes time
 - how to motivate (not just “do this”)
 - anticipating problems and misunderstandings
 - value of good diagrams (people are visual)
- ❖ the value of revision
 - will learn from having students pass through
 - improve over time (commit for the long term)

7. Write for the professor's pain



assuming you want professors to adopt/use your material

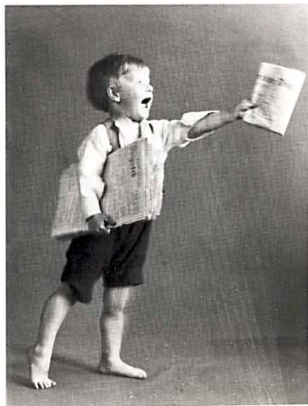
- professors have no time
- what a professor wants:
- Meets their educational goals
 - easy-to-use, out-of-the-box
 - easy to maintain
 - clear for students – few question
 - easy to grade – we hate to grade
 - easy to reuse (year after year)

8. Get a (reliable) co-author, who writes like you



- ❖ motivate (and guilt) each other forward
- ❖ 2nd pair of eyes, opinions
- ❖ half the work

9. Get a publisher (with a sales force), editor



- ❖ printed, published book leads to legacy
- ❖ editorial process pushed you forward (deadlines)
- ❖ expand your reach/impact:
 - research-intensive universities less than 25% of 4-year education market
- ❖ *room for debate*: will open source educational material work?

10. *A time for creativity:* what will a book
(experiential lab book) look like N years
from now



- ❖ interactivity?
- ❖ multimedia?
- ❖ results visualization?
- ❖ personalization?
- ❖ explanation?
- ❖ extensibility?

11. Bonus (very personal)
observation



Enjoying what you do!

Writing and developing
education material: a

creative
great fun
deeply rewarding
experience

What did I miss?

- ❖ induce creative solutions (not too cookbook)
- ❖ measurement important
- ❖ what is the right team size (match to situation)
- ❖ debugging – process of learning by figuring out why something isn't working
- ❖ a great TA is great (essential?)
- ❖ inter-student discussion board