

Online Courses for High School CS Teachers

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What's needed for successful on-line courses to achieve CS10K?

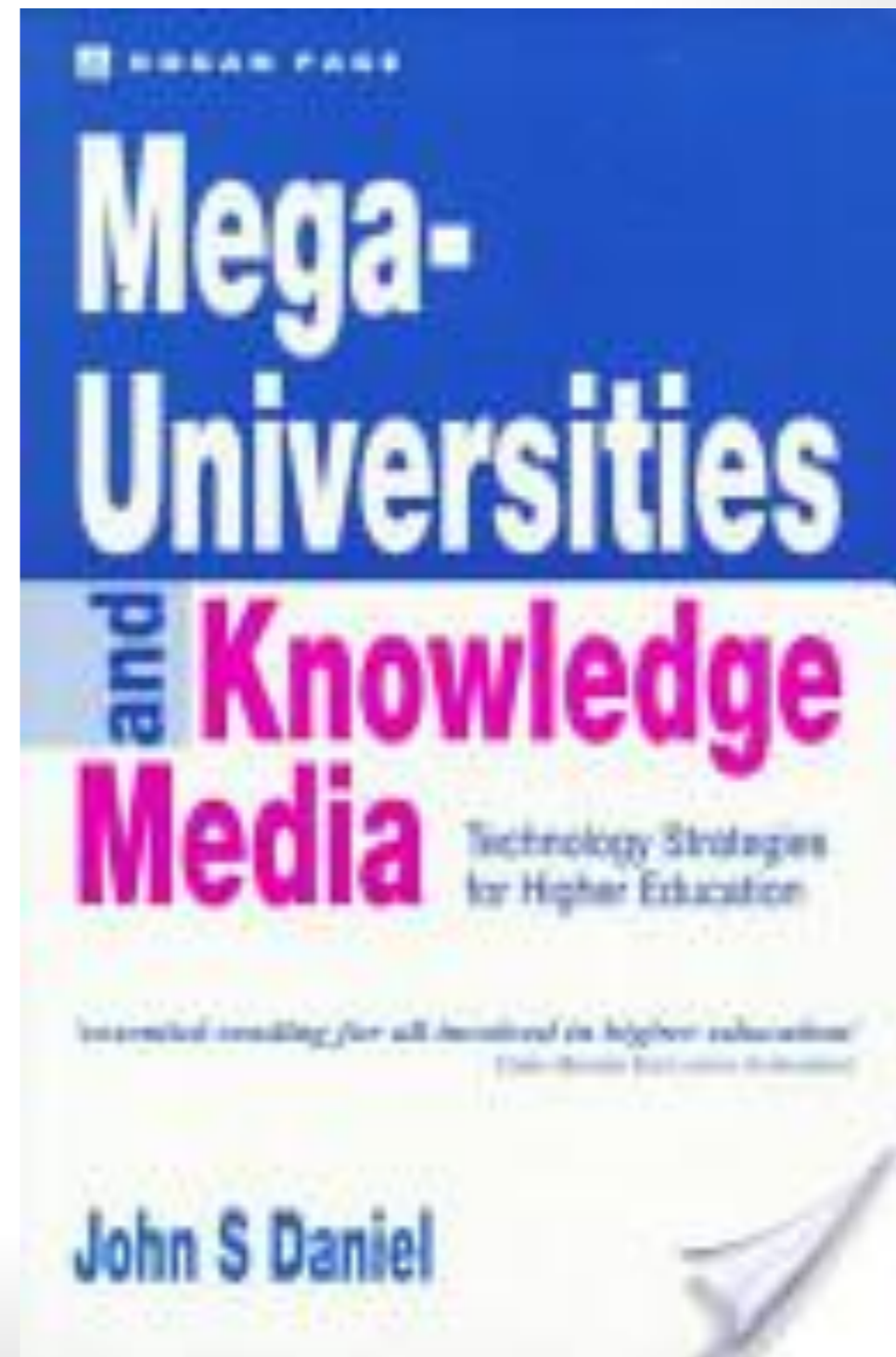
- How do we teach thousands of high school teachers, possibly with little mathematics or computer science background?
- What kind of pedagogy will fit into the lives of in-service high school teachers?
- How do we create sufficient, high-quality on-line materials to lead to successful CS learning at a distance?
- What will motivate high school teachers to be motivated to take classes, to be engaged with the content, and to sustain their interest?
- What do teachers need to develop into successful computer science teachers?

2 Concrete Examples

1. Open University UK
2. Studies of adult professionals studying computer science

1. UK Open University

- A university that accepts all students, with tens of thousands taking classes at any time.
- The quality on par with many brick-and-mortar institutions.
- OU completion rate 56.5% (1995).
 - Open University of the Netherlands: 30.8%
 - Recent Stanford on-line AI class: 18%

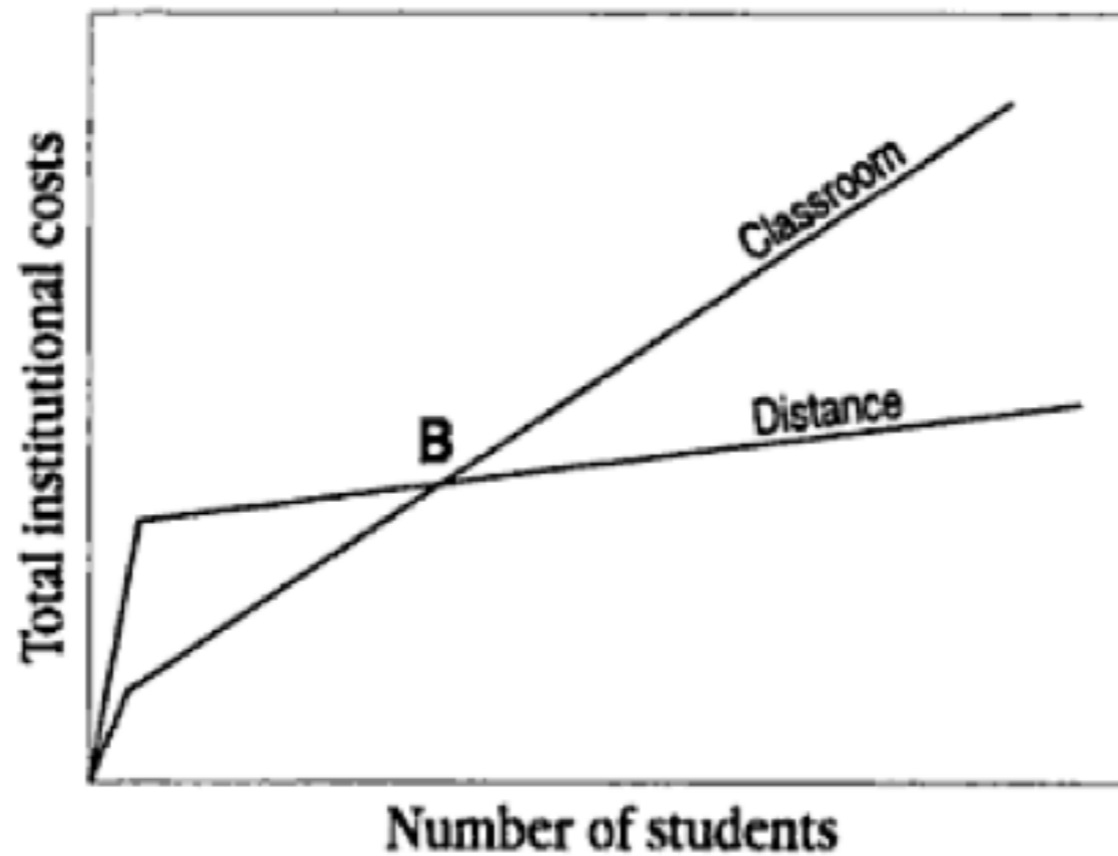


Remote-classroom vs. Correspondence Model

- The OU depends on a correspondence school model:
 - Create high-quality, engaging materials.
 - Design expecting students to study on their own.
- Alternative model: Remote classroom.
 - Record the classroom (e.g., lectures) as they happen, then make them available for replaying.

Differences: Costs and Engagement

- Ratio of fixed costs to variable costs in Open U is 2000:1, compared to 8:1 in traditional universities.
- Rely heavily on books, because the quality can be maintained without increasing costs.



Even today

The screenshot shows the Open University website for the course TU100 - My digital life. The browser address bar displays the URL: <http://www3.open.ac.uk/study/undergraduate/course/tu100.htm#course-materials>. The page includes a search bar, navigation links for Accessibility, Sign in, Contact, and Search the OU, and a main navigation menu with options like Study at the OU, Undergraduate, Postgraduate, Research degrees, Professional skills, and Study explained. A prominent text box overlay contains the following text:

Through six themed teaching blocks you'll cover the key aspects of modern computer technology. Each block includes a blend of printed and online text, pictures, animations and practical activities. Specially recorded audio and video materials accompany the teaching material. These include interviews with leading researchers, experts, companies and users from a wide range of countries, including the USA, Nepal, Iceland and Switzerland.

The page also features a sidebar with a 'My digital life' section, a 'Teaching' section, and a table of course details. The table includes the following information:

This course:	
Code	TU100
	60
	1
SCQF level	7
FHEQ level	4

Additional text on the page includes: 'Are you already an OU student?', 'StudentHome for your personal information.', 'and funding for study from October 2012.', 'graduate course in Computing and ICT.', and 'This course is expected to start for the last time in February 2017.'

2. Challenge of CS pedagogy

- How do adult professionals learn CS?
- What is it like for adult professionals in on-line CS classes?

Who are graphics designers who program?

- Mostly arts/media trained.
- Don't consider themselves programmers.
- But do some significant automation of their process.

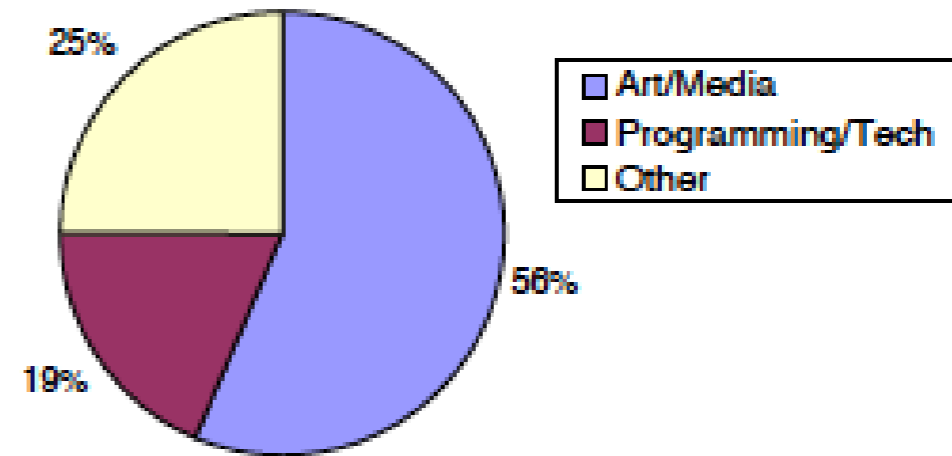


Figure 1: Area of Occupation (n=16)

Table 1: Coursework and Self-Affiliation (n=18)

Statement	Yes	No
Have you had formal training in programming (e.g., classes, degrees, certificates)?	38.9%	61.1%
Do you consider yourself a programmer?	16.7%	83.3%

Table 3: Uses for Automation (n=20)

Use	% Reporting Use
Iterative application of an action within one project	85.0%
Batch processing multiple files	75.0%
Conditional application of an action	60.0%
Duplicate object creation in one project	45.0%
Control of multiple programs	40.0%
Dynamic media generation	25.0%
Other	10.0%

Dorn & Guzdial, ICER
2006

Where are they getting their CS knowledge?

- Mostly on-line:
 - FAQs and other documentation
 - Books (when applicable)
 - Lots of examples and networking.
- Not so much classes

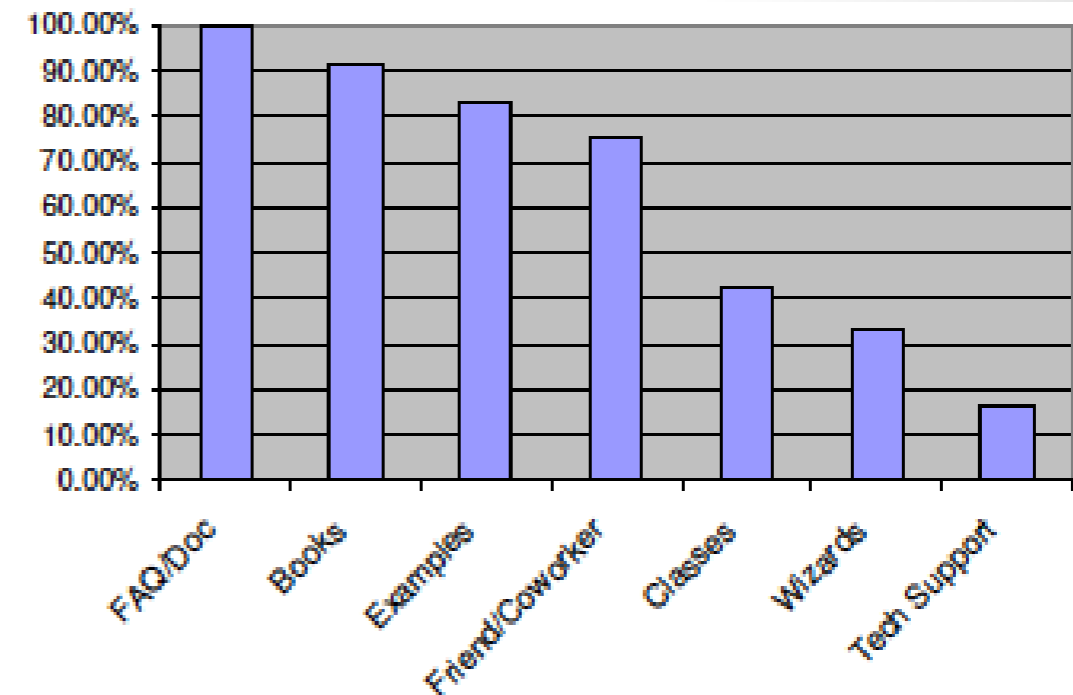


Figure 3. Percent of Participants Rating Resource as Likely or Very Likely to Use

Dorn & Guzdial, CHI 2010

Table 5. Resources for Learning

Online	Offline
<ul style="list-style-type: none">• code samples or example demos• walkthroughs and tutorials (e.g., www.w3schools.com, www.smashingmagazine.com)• language or library references (e.g., www.ruby-doc.org)• subscription-based online training sites (e.g., www.lynda.com)• forums or user groups• blogs, both as authors and as readers• podcasts	<ul style="list-style-type: none">• books• code samples• tutorials or other help files provided with software• manuals• colleagues, friends, or instructors• strangers with similar job descriptions (e.g., other webmasters)• classes

What do software engineers do?

Answer: The Boring Stuff.

Dorn & Guzdial, ICER
2010

- P2: I was able to take different samples from different places and instead of just being let's say an MIS major, or computer science major, you know it's—
you're not going to be front-end anything with computer science. You're going to be back-end everything.
- P4: I think as a **front-end developer**, you focus more on the design and the usability, and you're focusing more on the audience. And then on the **back-end** I think you're focused on more, these are like the software developers. **And they're programming something, and they don't really see what it's gonna look like; they're just making it work.**

Who is in CS?

- *Like Yardi and Bruckman (ICER 2007), participants held negative stereotypes of those in CS:*
- P2: I went to a meeting for some kind of programmers, something or other. **And they were OLD, and they were nerdy, and they were boring!** And I'm like, this is not my personality. Like I can't work with people like that. And they worked at like IBM, or places like that. They've been doing, they were working with Pascal. And I didn't...**I couldn't see myself in that lifestyle for that long.**
- P5: I don't know a whole ton of programmers, but the ones I know, **they enjoy seeing them type up all these numbers and stuff and what it makes things do.** Um, whereas I just do it, to get it done and to get paid. To be honest. The design aspect is what really interests me a lot more.

Why don't they take CS classes?

- **P7: I started out in computer science, but didn't like it at all.** The fact that I wasn't learning anything new. I took an intro to programming course, and then I talked to some other people in the program and it was all repetition and I guess there wasn't any really new. **So you weren't really learning any concepts.** You were learning the languages, and I didn't like that at all. **So that's why I left...**
- Do we just teach *languages*?
Why don't they see the *concepts*?

They want to know more

- P1: So I mean technology changes. So what I am ideally looking to focus on are like the foundation. The things that change less, you know what I'm saying? **Like computer science um, theory**, you know I'm saying I mean? That kind of like, it's applicable to what I do, and it's not so constantly shifting.
- P10: I was the kind of programmer that could make stuff work. But I didn't really have solid understandings. At one point I picked up **a book on design patterns** and I looked at it, and I was like that's really, that's really interesting... So I was like well **I wanna keep doing that because it made me a better programmer. And it was more fun to program, and it was more thought provoking.**

How do we teach working high school teachers?

- Study of adult/professional students in CS classes.
 - They don't have the time to spend hours in front of the IDE.
 - Lacking background, e.g., in mathematics.
 - They get stymied by small errors.

When Life and Learning Do Not Fit: Challenges of Workload and Communication in Introductory Computer Science Online

KLARA BENDA, Georgia Institute of Technology

AMY BRUCKMAN, Georgia Institute of Technology

MARK GUZDIAL, Georgia Institute of Technology

“I had my few afternoon hours that I could work on the stuff, but it all just boiled down to me not having time for my family when I was taking the courses. I think the bottom line was with my family structure, I shouldn’t have taken more than one course at once.” [...] “sometimes I felt like I wasn’t putting enough into one class because I was putting so much into the other class.” [...] “Then I had to put more time into the family, because I didn’t put in as much as I should have, but I still had to put time in for them.”

Andrew - “I said one time that I couldn’t get this mathematical problem to work. His response was, “I’m not going to teach you algebra.” So if you get one little piece or spacing wrong, it doesn’t work.”

John – “There were times that it would take me hours to find one comma out of place, or find that one something that was wrong, so I didn’t mind sticking with it but it just got to the point where I just didn’t get it.”

What teachers want and what they find

- Quote from Computinged.Wordpress.com:

One word: Summer. I have taken several courses in order to be ready to teach CS 1, which I am teaching this year. First, I went through a textbook. Then I took a six-week online course. Then, I basically took my own course. The six-week online course was a disaster for me. The content was good, but I had no time to complete all the assignments. Those were all first-level courses and now that I'm ready for CS 2 essentially, it's harder to find things. Everything I see is geared toward the complete novice.

I've looked at online courses through the community colleges, but they often don't offer what I want in the summer, which is when I have time. And places that do offer good courses in the summer are ridiculously expensive. I'm not going to pay \$3k to take a course, even if it would be "good for me".

One thing I've done that's been successful is the weekend workshop. I've done a couple of these to pick up, for example, Arduino programming or Scratch. But these are usually focused around a particular technology, and geared toward beginners. If you have time to continue playing around with what you've learned, then it's great. I took both of the workshops in the summer. See? Summer!

What are your issues and solutions for on-line CS classes for teachers?



What are your issues and solutions for on-line CS classes for teachers?

Discussion:

- Midge - CT, help bio/math teachers to teach CS.
- Teachers want discussion w/teacher, CS teachers don't do this typically.
 - How do we do on-line for teachers?
 - Using teachers to answer teachers.

Ben - Scalability requires market incentives.

- Learning computing larger market.
- Teach world computing.

How can assessment be done effectively?

We need better tools, errors must be better.

Joe - Evaluate tools for what works.

- Pedagogy on-line is different.

Distance makes it harder for communications.

- Setting expectations key.

- Seeing real teacher help

Hybrid courses may be most successful, bring teachers to campus

Outside Blackboard, Moodle - what's there?

- CMU OLI

How create CoP, like Greenroom?
community of practice

- Piazza for communication + Analytics.

Andy: Supporting blind students, most commonly mainstreamed.

- Oninet school; bureau cracy

NACOL - Best Practices for online teaching/learning.

Ursula - Dept. of Ed metastudy.

Uri - WISE as a framework

Online courses for AP CS.

- FVHS - Bill Jordan

2 CS sequence
Chris - Correspondence School is a model. How make the tutoring work?

- How support on-line tutoring?

Boise State - all on-line. Senior, trained teachers help.

- Earlier cohorts help later.
- Using App Inventor.
- Difficult to sustain online across time zones. Asynchronous key for working professionals.

DCCCE - Lijun Ni, Brian Morrison

On-line tutoring in the programming environment

- Java-wide - concurrent editing, no context shifting.

Jan Jenkins - Valdosta State

Flexible job is to be an EU/UK tutor. Answer Q's, Face-to-Face

- Very attractive.

Service & internships for undergrad. use them as tutors.

- Faculty award from NCWIT for REU advisors.

Role of competition: More for students than teachers.

- Stack Exchange for Q&A for CS Pedagogy.