



Computer Science (CSCI) 698 Practicum in Teaching Computer Science

*(some slides from Laurent Itti
Gaurav S. Sukhatme, Saty R)*

Andrew Goodney
goodney@usc.edu

USC

School of Engineering

University of Southern California



PeCK

- Last time discussed/defined teaching
- Now... what to teach? Especially intro?
- Pedagogical content knowledge
- <https://core.ac.uk/download/60542139.pdf>



PeCK

- “...the ways of representing and formulating the subject that make it comprehensible to others”
- “...the most regularly taught topics in one’s subject area, the most useful forms of representation of those ideas, the most powerful analogies, illustrations, examples, Explanations and demonstrations..”



PeCK and CS

- What parts of CS do we teach?
 - Do we jump straight to indirect addressing for assembly or P vs. NP?
 - Start with basics... help students build mental models for computation
 - Connection to Bloom's Taxonomy?



Intro courses

- CSCI 103L at USC
 - variables, arrays, control flow, functions and decomposition, strings, images, pointers, dynamic allocations, objects, linked lists, etc...
- CS 106A at Stanford
 - Control flow, decomposition and variables, images, functions, lists, etc...
- CSCI 170 at USC vs. Stanford CS103
 - Discreet math courses, very similar topic lists!



ABET

- Engineering Degree Accreditation
 - Most USC Engineering degrees are ABET accredited
- Part of ABET specifies topics from basics to advanced that must be covered somewhere in an accredited CS degree
 - Content knowledge



CS PeCK

- How to explain?
 - a variable
 - assignment
 - array
 - pointer
 - linked list
 - stack
 - queue
 - function call
 - bubble sort
 - inverted index



Nifty Assignments

- PeCK for assignments
 - Usually CS0/CS1/CS2
- SIGCSE “nifty”
 - Publication track at SIGCSE (CV builder!)
 - <http://nifty.stanford.edu/>
- CCSC Nifty (regional)
 - <https://www.google.com/search?q=CCSC+nifty>



POGIL

- POGIL: Process Oriented Guided Learning
- <https://pogil.org/>
- <https://vimeo.com/93407527>
- [Implementation guide](#)



POGIL

- Researched based teaching method
 - Constructivist
 - Guided inquiry exercises
- Students work in groups of 4
 - Roles for an activity are fixed!
 - Facilitator, Spokesperson, Quality Control, Process Analyst
- College chemistry departments



Could it work for CS?

- Can POGIL work/scale for CS at large universities?
- <https://bmyerz.github.io/pogil-for-computer-organization/>
 - Surveys of computer science and engineering instructors have indicated that two of the common reasons they do not adopt research-based instruction strategies are preparation time and lack of materials.
- <https://www.cspogil.org/Home>
 - CSCI 103L labs?



Instructional Design

- How the brain learns, teaching philosophies, teaching techniques, content knowledge...
- Finally putting it all together requires designing instructional materials
 - Slides, notes, assignments, exams, books...
- “instructional design is the creation of instructional materials. Though, this field goes beyond simply creating teaching materials, it carefully considers how students learn and what materials and methods will most effectively help individuals achieve their academic goals.”
 - <https://online.purdue.edu/blog/education/what-is-instructional-design>

Components of Instructional Design

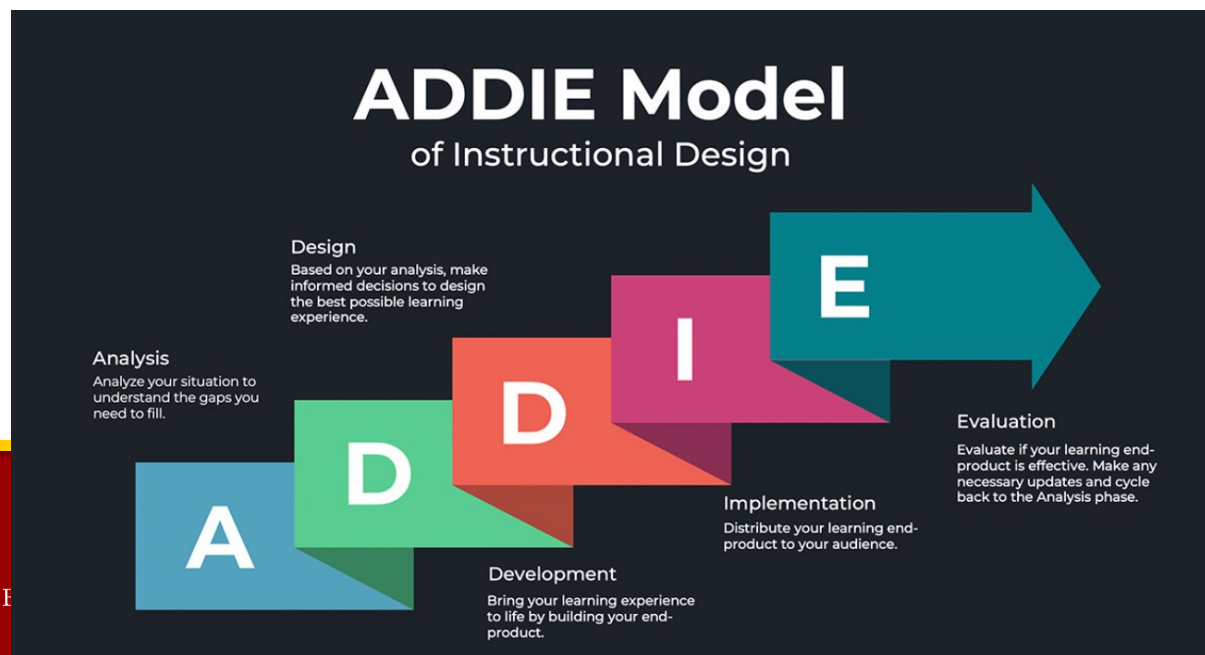


- Good instructional design should take students through a well designed process:
 - Learning OBJECTIVES (define the goals)
 - Instructional ACTIVITIES (content)
 - Effective ASSESSMENTS (did we achieve the goals)
- Goals -> teaching/learning -> measure success



Design Methods

- Steps to guide the instructional design
 - Seem squishy to me, but structure can help guide thinking/research/design/implementation
- <https://www.personio.com/hr-lexicon/addie-model-effective-training-in-5-phases/>
- Also: <https://whatfix.com/blog/simplify-instructional-design-process/>
 - Research, creation, delivery, feedback, updates





USC CET

- Center for Excellence in Teaching
- Lots of resources for teaching and instructional design
- <https://cet.usc.edu/teaching-resources/course-design/>