

Teaching Toward Expertise

2006 Fritz B. Burns Distinguished Teaching Award Lecture

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Outline

- What this talk **will be** about
- Teaching basics we already know (a review)
- Learning, understanding, expertise
- Teaching *toward* student expertise
- Assessment
- What this talk **was** about

PART 1

Introductory Remarks

What this talk is about

- One aspect of good teaching, namely, getting students on the right path to **expertise** in some endeavor (aim high)
- What might be meant by expertise, and some examples
- Pedagogical methods that address expertise acquisition
- Assessment (a little bit anyway)

What this talk is not about

- How to use the Socratic Method (right?)
- How to get tenure
- The benefits and rewards of good teaching
- Jean Piaget



Why care about expertise?

- Happiness 😊 and fulfilment usually comes from doing one's best, and if one's best is expert level, then all the better
- Teaching one's best means students perform *their* best (cool, eh?)
- Mediocrity is no virtue (though modesty is!)



Questions

- Are students your customers?
- What do you want the students to be able to **do** (or **achieve** or **create**) after they finish a course, or after they graduate?

This is what *they* want



Resources

- CTE
- WWW (it's not that bad) (usually)
- Journals, books, trade mags, infomercials
- SoTL HOWTOs, projects (one at LMU now)
- Your colleagues
- Your students (hmnnpfhpt) (No, really) (They can give feedback) (Hopefully constructive)

PART 2
Background

Teaching 101

- Teaching, like any discipline, has its theory and practice
 - Fundamentals/Classics/Theory of the discipline of education (Examples: Bloom's Taxonomy, Piaget's stages of cognitive development, MI, ...)
 - Practical side: What kinds of things can you *do* to improve teaching? (Example: Berkeley Compendium of Suggestions for Teaching with Excellence)

Berkeley Compendium

- Old (1983) but still usable (need to replace e.g., "Walkman" with "iPod")
- Much of the content moved into Barbara Gross Davis's 1993 text *Tools for Teaching*
- Contains over 200 techniques, organized into 25 sections
- Each suggestion of the form "If you want to" then "You may wish to consider" with some concrete examples and notes on usage

BC Top-level Sections

(1) Discussing Points of View Other Than Your Own (2) Discussing Recent Developments (3) Giving References (4) Emphasizing Conceptual Understanding (5) Explaining Clearly (6) Being Well Prepared (7) Giving Lectures That Are Easy to Outline (8) Summarizing Major Points (9) Identifying What You Consider Important (10) Encouraging Class Discussion (11) Inviting Students to Share their Knowledge and Experiences (12) Inviting Criticism of Your Own Ideas (13) Knowing If the Class Is Understanding You (14) Having Students Apply Concepts (15) Giving Personal Help to Students (16) Relating to Students (17) Being Accessible Outside of Class (18) Having an Interesting Presentation Style (19) Varying Speed and Tone of Voice (20) Motivating Students' Best Work (21) Giving Interesting Assignments (22) Giving Exams Demonstrating Student Understanding (23) Keeping Students Informed of Their Progress (24) Making the Most Effective Use of Teaching Assistants (25) Developing an Impressive Introductory Large Lecture Course

Random BC Suggestions (1 of 2)

- (47) Begin and end lectures with a summary statement
- (66) Use an assignment as a basis for discussion
- (23) Rephrase explanations of major points several times
- (26) Emphathize with students' difficulties in learning
- (46) Pay attention to your boardwork
- (54) Divide your lecture into blocks of time
- (53) Use dramatic pauses and repetition
- (57) Redirect student questions

Random BC Suggestions (2 of 2)

- (87) Begin your lecture with a series of questions
- (114) Probe for adequate answers from students
- (142) Relate the course material as a story
- (175) Replicate assignments covering basic concepts
- (199) Hold review sessions before the exam
- (186) Do assignments for real-world clients
- (208) Make extensive constructive comments on student work
- (197) Include an extra credit problem to write a question

PART 3

Learning, Understanding, Expertise

Useful Terms

- Learning: acquisition of knowledge and understanding
- Understanding: ability to use insights and perspectives to generate or validate novel propositions
- Expertise: facility, competence, proficiency...
- Mastery: uh, no one "masters" anything unless the thing is (by nature) limited: in interesting endeavors we just always improve

What's an Expert?

- One who performs at levels far, far above a novice (or even an average practitioner) in some field
- One whose performance features **insight** and **intuition**
- One who *seems* to do things "second-nature" (subconsciously) where things just feel right and look right (but this comes from having built highly organized cognitive models)

World-class

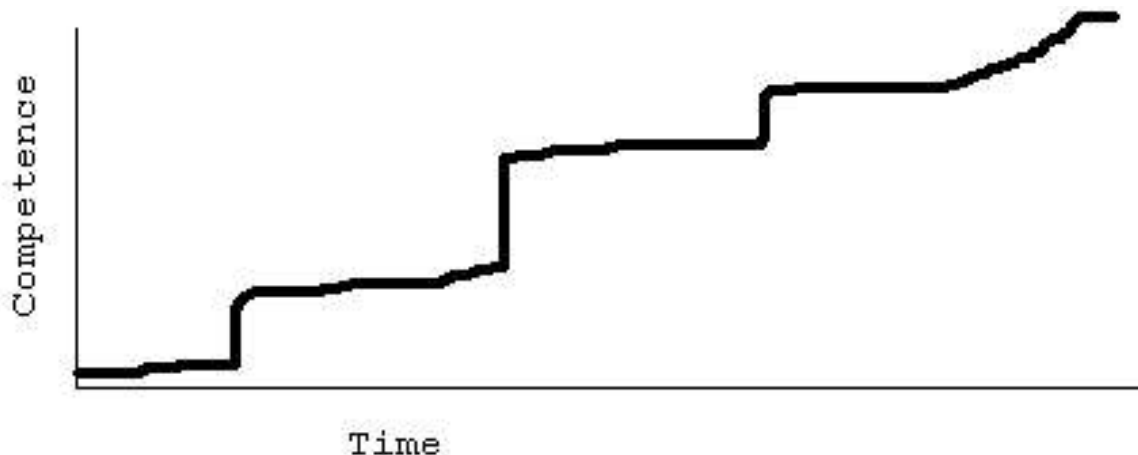


Tiger Woods is Apple's new Mac OS X spokesperson



How do you get to be an expert?

- Massive investment in time -- actually "effortful study", usually from an early age
- Persistence (that comes from motivation)
- Learning from mistakes
- Pushing to improve to the "next level"



Ten Years

Researchers [Hayes, Bloom] have shown it takes about ten years to develop expertise in any of a wide variety of areas, including chess playing, music composition, painting, piano playing, swimming, tennis, and research in neuropsychology and topology. There appear to be no real shortcuts: even Mozart, who was a musical prodigy at age 4, took 13 more years before he began to produce world-class music. In another genre, the Beatles seemed to burst onto the scene with a string of #1 hits and an appearance on the Ed Sullivan show in 1964. But they had been playing small clubs in Liverpool and Hamburg since 1957, and while they had mass appeal early on, their first great critical success, Sgt. Peppers, was released in 1967. -- Peter Norvig

The Expert Mind

- Great article in *Scientific American*, August 2006, by Phillip Ross
- Describes studies of how chess grandmasters, and experts in many other fields, may think
- Preponderance of evidence shows
 - "experts are made, not born" (e.g. Polgár sisters)
 - experts made from **years** of effortful study, **pushing the limits** of their skills to advance, and are **motivated** by competition and **success**

Do all fields have experts?

- Ross's article suggests not, with colorful language comparing "experts" and non-experts in stock picking, wine tasting and psychiatric therapy
- Ross singled out two fields where "expertise undoubtedly exists": teaching and business management. Go figure.
- We can add chess, computer science, tennis, creative writing, music, comedy, ...

Learning from mistakes

- Often the best, in the sense of being the *most memorable*, learning experiences happen when confronting mistakes and fixing them
- This is especially true for the "oh I had no idea that..." mistakes
- So... shoot down common mistakes in lectures ("You might think... but..."), give good feedback, make subsequent assignments build on previous ones, etc.

A diversion: misconceptions

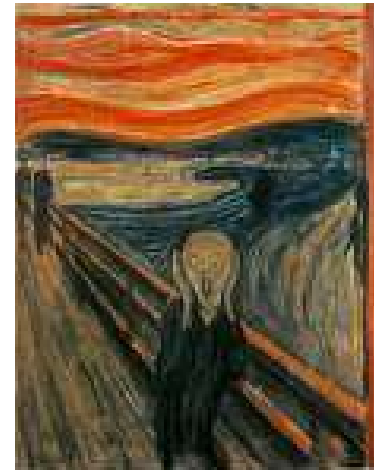
- Important because they are **indicators of lack of understanding** or a **disconnect between textbooks facts and applications**
- See handout for sampling of Gardner's examples from physics, biology, math, economics, humanities, arts, history and literature
- Usually cured by sensory (tactile, visual, auditory, etc.) demonstration of reality

Another diversion: malapropisms

- Richard Lederer's examples (small sampling from those in December 2005 Harper's):
 - Most books say the sun is a star. But it still knows how to change back into the sun in the daytime.
 - CO₂ is lighter than air because leaves absorb it, and they are on top of trees.
 - The pistol of a flower is its only protection against insects.
 - Involuntary muscles are not as willing as voluntary ones.
 - The wind is like the air, only pushier.
 - Darwin's book stated that all animals evolved from primeval man.
 - If conditions are not favorable, bacteria go into a period of adolescence.

Be careful you teacher you!

- Gardner writes (*The Unschooled Mind*, p. 179):
 - "Indeed the more fully a teacher has assimilated sophisticated understandings, the less she may be able to see into the mind of the child and recognize its tendencies toward misconceptions and stereotypical thinking"
- ACK! The second time I teach a course it might be WORSE!?!



PART 4

Teaching future experts

So where are we so far?

- The bad news
 - Expertise takes about 10 years to develop
 - Early starts often matter
- The good news
 - It's teachable
 - It's teachable to almost anyone: effort and motivation matter; gender, race *do not* -- even in the sciences. Really. :-)
 - Even prodigies are teachable: have fun with them



So what do we do?

- If the student has had six years of effortful study, it's easy! Just guide them through the final four! Woot! Mission accomplished!
- (Okay just kidding)
- Question is "how do we *lay the best foundation* for the ten year journey?" (awwww... sweet)
- Not so important to have results NOW. Ensure students achieve a *high comfort level* with the main ideas, or basic skill set, of a course

So how do we do it?

- Mentor-Apprentice
- Coach
- Personal Trainer
- Guide
- Guru
- What else?

Mentoring

- Gardner: most effective methodologies are **apprenticeships** and **children's museums**
- Start with assignments that involve building on your own work
- Choose ongoing projects and give intermediate feedback
- Make one-on-one time with students but make sure they're comfortable; labs might be better than offices; be proactive - drop in

Coaching

- Not 100% applicable, but some good aspects:
 - Praise student success (show them you are thrilled, really thrilled -- increases motivation)
 - Team environment shows some students that "yes, other students are getting it so I can too"
 - Coaches understand player weaknesses: "To improve you need to ..."
 - Emphasis on students' *hard work*
 - Coach only succeeds if players succeed



Guru

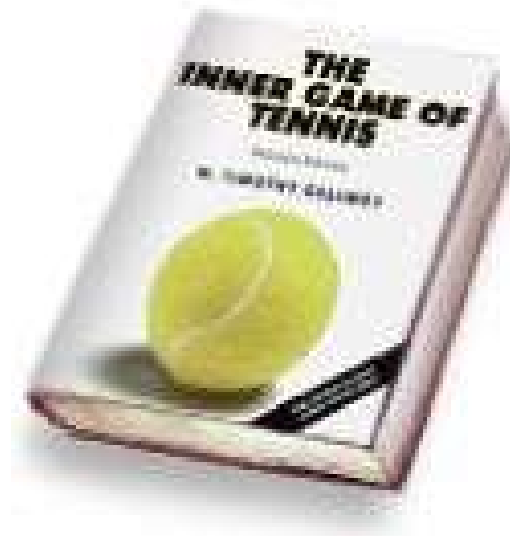
- Word *guru* means teacher in Sanskrit
- Signifies a kind of "spiritual guide" that helps to "awaken ... knowledge" (I got that from Wikipedia of all places)
- None of us are, nor can be, an heir of Guru Nanak Dev, but we can contemplate the meaning of the terms "guide" and "awaken knowledge" as they relate to teaching

Teacher-student relationship

- We all have different limits, but FYI here are what "works for me"
 - Social settings: on-campus lunches, basketball, football, gym workouts ok, off-campus not ok, unless a university function (don't let them drive)
 - Classes and labs: mutual respect, but not friends
 - Email: answered twice a day
 - IM: window constantly open, but questions about my weekend or personal life go unanswered

A pretty amazing example

- A classic
- If we have time, let's see some video.




(Hey how much time *is* left for this presentation, anyway?)

What did you think?

- besides just "BOUNCE HIT!" ?
- and besides the fact that the narrator can't pronounce mu`u mu`u despite winning the Draper Prize (equivalent of the Nobel Prize in engineering)?
- Backhand at 7 minutes was pretty cool, no?
- How does this apply to teaching in your discipline?

What we're doing in CMSI

- Creating a novel curriculum of the future (mostly on NSF's dime) based on the open source culture 
- One component is a teaching arc correlated to expertise acquisition

The study, testing, and fixing of existing code

Addition of new functionality to existing code

Creation of term length projects, designed and implemented from scratch

Production capstone projects integrating ideas from all classes

PART 5
Assessment

Assessing expertise

- Define beforehand what it is you are assessing (varies by discipline, of course)
- Best tool (IMHO) is a *knowledge-expertise grid*
 - Recognizes that expertise is developed in stages
 - Recognizes that there are several dimensions of knowledge

Knowledge-Expertise Grid

- Example from LMU's own Drs. Dewar and Bennett (Content elided -- see their site)

		Acclimation	Competence	Proficiency
Affective	Interest			
	Confidence			
Cognitive	Factual			
	Procedural			
	Schematic			
	Strategic			
	Epistemic			
	Social			

PART 6
Wrap Up

Summary

- We reviewed some teaching methods
- We turned the focus to expertise, and how experts think and act
- We saw motivation, hard work, effort, study, practice, persistence are more important than raw talent
- We talked about the ways that expertise may be teachable
- We mentioned assessment

Some great stuff...

- Six recommendations:
 - Berkeley Compendium
 - Richard E. Korf's Effective Classroom Teaching Slides
 - "The Expert Mind" article in *SciAm*, August 2006
 - Alan Kay video *Doing with Images makes Symbols*
 - Rick Garlikov's Essays (Socratic method one is good)
 - Any book or paper by Howard Gardner

...and where to find it

- In case you prefer not to use an Internet search engine yourself:
 - <http://teaching.berkeley.edu/compendium/>
 - <http://www.cs.ucla.edu/~korf/cra.ps>
 - <http://www.sciam.com/article.cfm?chanID=sa006&colID=1&articleID=00010347-101C-14C1-8F9E83414B7F4945>
 - <http://www.archive.org/details/AlanKeyD1987>
 - <http://www.garlikov.com/>
 - <http://www.howardgardner.com/>

Parting Shots

(Sounds better than "Sage Advice")

- Success requires effortful study, but students won't study unless motivated
- Motivation comes from successes and noticeable leaps of improvement, and the recognition and **praise** of these successes from mentors
- So design classes and programs to *make the advances apparent*
- But praise the approach or the effort, not the intelligence of the student (Carol Dweck)

Ciao

- Thanks for coming
- Questions, comments, complaints?
- Reception follows, I hear

Chow time...

