

Assessment Methodologies: Technology and Student Learning

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The Alice in Wonderland approach to assessment

"Would you tell me, please, which way I ought to go from here?" said Alice.

"That depends a good deal on where you want to get to," said the Cat.

"I don't much care where—" said Alice.

"Then it doesn't matter which way you go," said the Cat.

"—so long as I get *somewhere*," Alice added

"Oh, you're sure to do that," said the Cat, "if you only walk around long enough."

--Lewis Carroll

The K.I.S.S. principle of assessment design

A simple, doable design is better than a complex, impossible design.



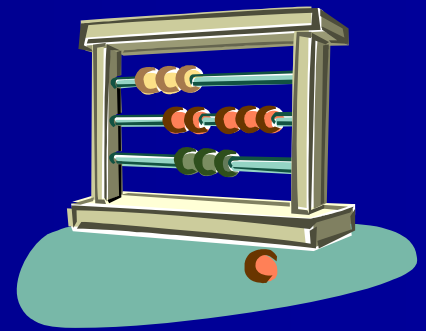
Hitting the target...

- You must clearly define your questions.
- And, if your data doesn't answer your questions... what's the point?!



What level of significance do I need?

- Don't let the statistics run your design!
- Statistically significant may not be practically significant.
- I can't obtain a random sample!
- Quantitative and qualitative approaches must complement each other



Issues to ponder with data

- Uncollected data cannot be analyzed!
- Data is not always “clean” and can require work
- Look for data you already have



Data do not equal information...

- Data, by itself, answers no questions and is nothing more than a bunch of numbers and/or letters
- How you interpret the data for others can determine how well they understand.
- Visuals are good!
- Ongoing assessment is best.



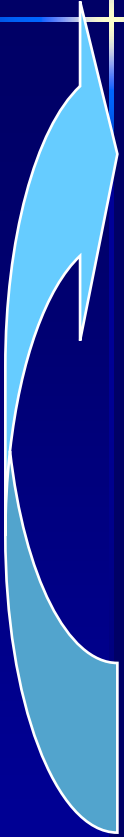
Make an impact with your assessment...

- The final step in assessment (or evaluation) should be determining how your results can impact decisions for the future.

"The value of knowledge lies not in its accumulation, but in its utilization"

Anonymous

Assessment Cycle

- 
1. Define your question(s).
 2. Determine methods that can answer question(s).
 3. Implement methods, gather, and analyze data.
 4. Interpret results – did you answer your question?
 5. Make decisions based on results.

Assessment/evaluation tools used by attendees

- Surveys (19%)
- Focus groups (13%)
- Course-based performance (11%)
- Observations (11%)
- Tests/exams (10%)
- Pre-collected data (10%)
- E-portfolios (8%)
- Rubrics (7%)

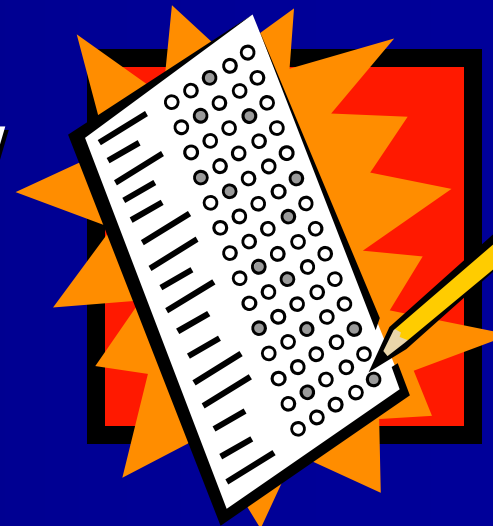
Surveys (pros)

- Quick and easy to administer to a large number of people
- Can administer electronically
- Researcher controls questions and can minimize unrelated questions
- Researcher bias minimized since standardized
- Open ended questions can enable participants to give you details



Surveys (cons)

- Data relies on participant perception
- Response rate for electronic surveys is lower than F2F administration
- Some responses can generate more researcher questions
- Item interpretation can vary



Focus groups (pros)

- Can obtain more details from participants
- Individuals can react to each other's comments
- Relatively cheap



Focus groups (cons)

- Only as good as the moderator
- Can get swamped with data to analyze
- Limited size of groups means they could take time to conduct



Direct Assessment of Student Learning

- **DIRECT** assessment methods involve judgment of students' display of knowledge and skills:
 - students' command of a specific subject or content area
 - performance of a certain task or skill
 - demonstrates a certain quality in his/her work (e.g. creativity, analysis, synthesis, or objectivity)*
- **INDIRECT** assessment methods involve opinions about students' knowledge or skills:
- **See "Sources of Information" handout**
- **See "Pros and Cons" handout**

*taken from "Student Learning Assessment: Options and Resources," Middle States Commission on Higher Education

Questions

- Question 1: How do **various** forms of technology/pedagogy affect student learning on the **same** outcome?
- Question 2: How does **a specific** form of technology/pedagogy affect student learning on **several** outcomes?

Resolve Level of Analysis

Level	Explanation
Student level	How well is any individual student performing?
Course Level	How well do students meet the outcomes/objectives for this course?
Program Level	How well do students integrate their knowledge and abilities from various courses into a fuller understanding of their profession?
College, Institutional Level	What do you know about the overall abilities of those who graduate from this institution?

Functional Taxonomy of Technology

- Bruce, B. C., & Levin, J. A. (1997). Educational technology: Media for inquiry, communication, construction, and expression. Journal of Educational Computing Research, 17(1), 79-102.
- Levin, J.A. & Bruce (2001) Technology as Media: The Learner Centered Perspective. Paper presented at the 2001 AERA Meeting, Seattle WA, Symposium 33.48.
- Tomei, L.A. (2005) Taxonomy for the technology domain. Hershey, PA : Information Science Pub.
- Hannafin, M. J., Land, S., & Oliver, K. M. (1999). Open learning environments: Foundations, methods, and models. In C. Reigeluth (Ed.), Instructional-design theories and models: Volume II (pp. 115-140). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.
- Hill, J. R., & Hannafin, M. J. (2001). Teaching and learning in digital environments: The resurgence of resource-based learning. Educational Technology Research and Development, 49(3), 37-52.

Taxonomy of Tools & Technologies: NC State University

(Adapted From Bruce & Levin, 1997; Hannafin, Land, & Oliver, 1999)

Taxonomy	Tool/Technology Examples:
Planning class activities (instructor) or tasks/projects (students), or setting goals	MS Project, Timeliner, Electronic Calendar
Seeking or accessing information/representations	search engines, library databases, digital libraries, data tables
Collecting data or capturing information/representations	scientific instruments, capturing video/audio/photographs, bookmarks, saved searches, digital drop boxes for students to collect accumulated files, collecting survey data, podcaster tool to capture RSS feeds
Organizing and synthesizing information/representations	concept mapping software, building a database with keywords to sort on
Analyzing or manipulating information/representations, or changing parameters in models or simulations	statistical analysis, qualitative coding, spreadsheets, creating tables/graphs, visualization software, GIS systems, Maple
Integrating one's own ideas with external or existing information/representations	wikis, Web annotation, mark-up or reviewing tools in Microsoft Word, peer critique
Creating, generating, or expressing new ideas or information/representations	creating models from data, writing with word processors/blogs, desktop publishing, creating PowerPoint presentations, editing Web pages, editing video/audio presentations, creating a podcast for delivery, creating multimedia, creating new programming code
Constructing physical items	robotics, architectural models, paintings, weaving
Assessment, monitoring progress on student learning	WebAssign, Vista quizzes, drill and practice software, peer critique, classroom student response systems or "clickers" (where the student receives feedback on their learning)
One-way communicating of information/representations	instructor announcements in WebCT Vista, posted online lecture created with Viewlet Builder or Camtasia, posted PowerPoint slides, posted student presentations or shared exemplars, one-way e-mail
Two-way communicating about information/representations	discussion boards, chats, listservs, two-way e-mail
Collaborating on tasks/projects	shared document preparation, wikis, social spreadsheets, electronic whiteboards, screen sharing software

Question 1

- Question 1: How do **various** forms of technology/pedagogy affect student learning on the **same** outcome?
- Assessment Method: Rubrics

Direct Method: Rubrics

- **Rubric:** a printed set of scoring guidelines (criteria) for evaluating work (performance or product); a clear guide to what is expected of the learner
- Step 1: Define & operationalize the “outcome”
 - Use Bloom’s Taxonomy: [link to verb list](#)
 - <http://www.nwlink.com/~donclark/hrd/bloom.html>
 - <http://faculty.washington.edu/krumme/guides/bloom1.html>
- Step 2: Develop a Rubric by further refining outcome into dimensions
 - Use of “Rubric Makers”

Example:

Outcome = Critical Thinking

- Step 1: Define & operationalize the “outcome”:
- **Critical Thinking – Students should be able to:**
 - analyze facts, generate and organize ideas,
 - discern alternative patterns of inference and reaching factual or judgmental conclusions based on statements of knowledge and belief,
 - recognize and avoid common mistakes in reasoning,
 - gather and evaluate evidence,
 - distinguish different kinds of reasoning,
 - think not just about the actual state of affairs, but about possibilities,
 - transfer thinking processes from one subject to another and from the classroom to the “real world.”

Step Two: Develop Rubric

Rubric Tool:

http://teachers.teach-nology.com/web_tools/rubrics

You fill in cells and it creates the rubric:

	1	2	3	4	
Analyze facts, generate and organize ideas	Unable to analyze facts or organize ideas	Analyzes is superficial; unorganized	Analyzes some but not all key information, questions, and problems fairly competently	Analyzes key information, questions, and problems clearly and precisely	—
Distinguish different kinds of reasoning	can not identify different kinds of reasoning	can identify some of the different kinds of reasoning, but not all	Competently distinguished different kinds of reasoning in theory but not in practice	Demonstrates differences in deductive and inductive reasoning and problem-solving skills	—
Transfer thinking processes from one subject to another	Unable to transfer thinking processes from one subject to another or draws wrong conclusions	Superficially evaluates; draws some wrong conclusions and some good conclusions	Shows a wide variety of thinking skills and accurate conclusions	Can explain assumptions and reasons when applies thinking processes to other subjects	—
				Total---->	—

Tools to help with developing Rubrics

- Rubric makers:
 - http://ipeer.apsc.ubc.ca/ipeer_site
 - <http://www.rubricbuilder.com/>
 - http://teachers.teach-nology.com/web_tools/rubrics
 - <http://rubistar.4teachers.org/index.shtml>
- “rubric” in any search engine!
 - Lots of examples of rubrics, but make sure they fit your needs

How to use Rubric

- Develop team of faculty
 - Each faculty member assign similar assignment (end of course paper) about critical thinking
 - Each uses a **variety** of the technology/pedagogy (e.g. discussion boards, simulations, in-class active learning, out-of class activities, etc)
- All use **same** rubric on the papers:
 - are there differences on any dimension of the rubric with different technologies?

Example:

Course A with Technology X: Score each student's paper

Students:	1	2	3	4	5	6	7	8	9	10	11	12	13	14
analyze facts, generate and organize ideas	4	2	4	4	4	2	3	1	4	4	4	4	3	2
distinguish different kinds of reasoning	3	1	3	2	3	3	3	1	4	4	4	4	4	3
transfer thinking processes from one subject to another	2	1	3	3	3	2	2	1	4	4	4	4	4	3

Report of Course A with Technology X

– Number of students for each cell

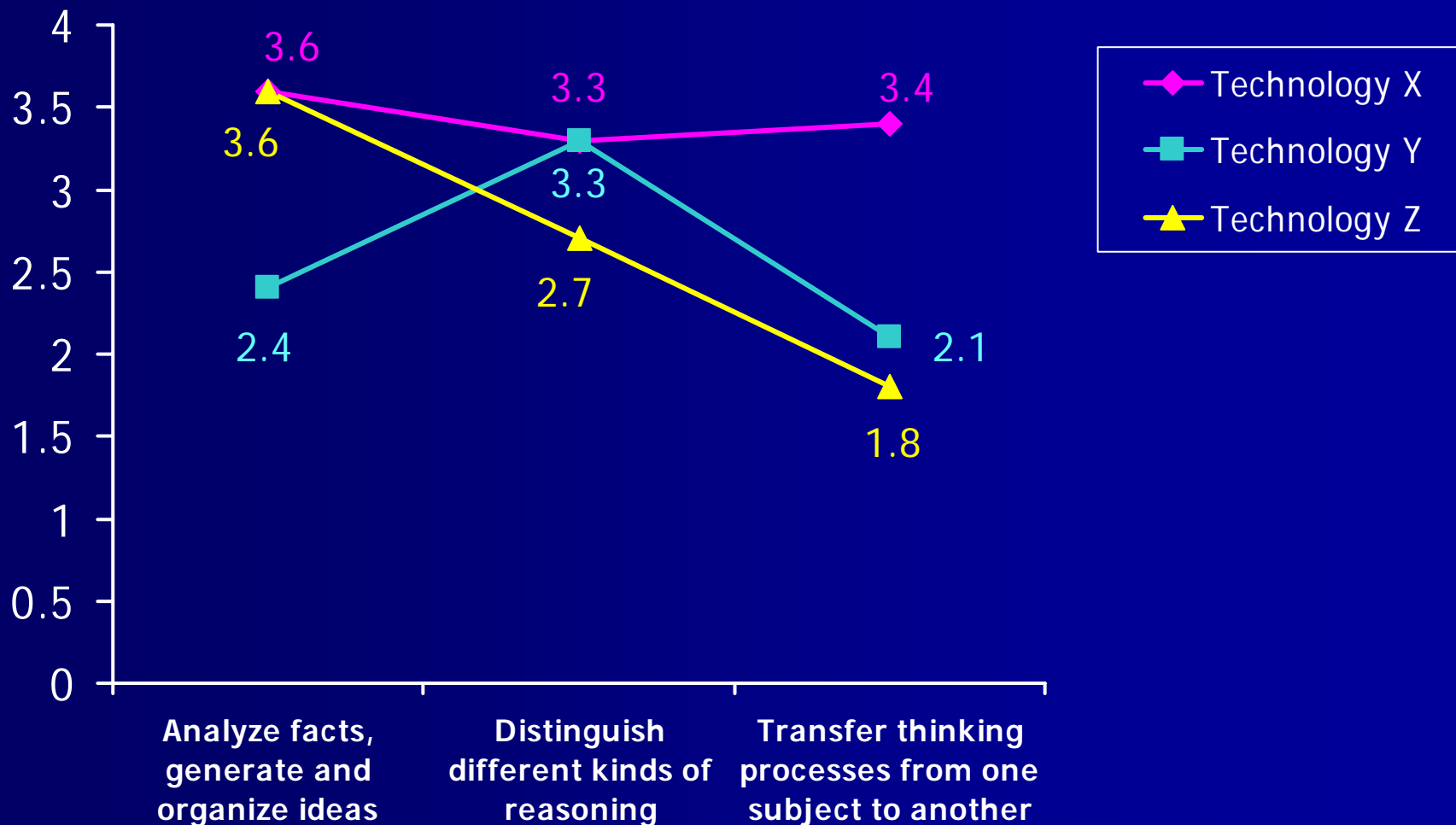
	Accomplished 4	Developing 3	Novice 2	Unacceptable 1	Average
Analyze facts, generate and organize ideas	25	5	3	1	3.6
Distinguish different kinds of reasoning	15	15	3	1	3.3
Transfer thinking processes from one subject to another	19	9	5	1	3.4
Total					10.3

Report of Course B with Technology Y

– Number of students for each cell

	Accomplished 4	Developing 3	Novice 2	Unacceptable 1	Average
Analyze facts, generate and organize ideas	1	15	15	3	2.4
Distinguish different kinds of reasoning	1	19	9	5	3.3
Transfer thinking processes from one subject to another	0	6	24	4	2.1
Total					9.0

Comparison of Technologies on Rubric Dimensions



Institutional Examples:

Example of how rubrics used across different courses

- Washington State University, which has also expanded to other institutions:
 - <http://wsuctproject.wsu.edu/ctm.htm>
- Columbia College with Townson University:
 - http://www.colum.edu/info/assessment/FIPSE/Writing_Index.htm

Strengths/Limitations

Strengths

- Can be used by others besides instructor, to assess quality
- Clearly defines what is to be measured
- Allows for assessment of higher cognitive abilities
- Use same rubric on variety of work products

Limitations

- Developing accurate rubric dimensions that reflect learning outcomes and levels of learning takes time and skill
- Initially, labor intensive for faculty
- Need consensus of group of faculty

Question 2

- Question 2: How does a **specific** form of technology/pedagogy affect student learning on **several** outcomes?
- Assessment Method: Course-based assessment; embedded assessment

Embedded/Course-based Assessment

- Step 1: Define & operationalize the “outcomes”
- Step 2: Define specific course-based methods
- Step 3: Develop matrix of courses by common outcomes



Step 1: Define Outcomes

- Question 2: How does a **specific** form of technology/pedagogy affect student learning on **several** outcomes?
- Example: Students will be able to:
 - Analyze data
 - Show engagement with their learning
 - Visualize the material

Step 2: Define specific course-based methods

- **What is Course-Based Assessment?**
- Method of collecting information that demonstrates that students are acquiring the skills and knowledge defined by program (or course) outcomes.
- Collection of information generated in the classroom for assessment of the program.
- Uses “work” already generated by students.
 - Or, faculty can create new assignments that will be used for purposes of assessment.

What Is It? Continued

- Cost-efficient
- Student motivation is less a factor than with some other methods
- Over time – may be able to determine “value added”- as the instructors follow cohorts of students throughout the curriculum

Course Based Assessment Links Common (Program) Outcomes to Course Outcomes

- For studying technology impact:
 - **Step 3:** Develop matrix of courses by common outcomes
 - Faculty may have to redo their course syllabi to develop course outcomes that map to common outcomes

Matrix of courses with common technology/pedagogy compared to outcomes

- **Within each cell write specific course outcomes**

	Analyze data	Engaged learning	Visualization
Course ABC	specific course outcome	specific course outcome	specific course outcome
Course XYZ	specific course outcome	specific course outcome	specific course outcome
Course EFG	specific course outcome	specific course outcome	specific course outcome

Matrix of courses to outcomes with common technology/pedagogy

- **Now add in assessment methods for each cell**

	Analyze data	Engaged learning	Visualization
Course ABC			
Course XYZ			
Course EFG			

Assessment Methods

Examples

- Final test in course X has 5 questions related to one outcome.
- Lab reports are examined by a group of faculty to determine how well students can write lab reports (using a rubric).
- Outside experts are invited into a classroom and given a grading scheme as they listen to student presentations. Experts can judge content, oral skills, presentation style.
- Students rate each other using a team work survey – can be used to see where most student have difficulty.

Comparison of Same Technology – in Multiple Courses for Different Outcomes: **Example of Results**

Outcomes	Number of Courses That Had Student Work Related to That Outcomes	How Well Students Performed– Averaged Across Courses
Analyze data	10	80
Engaged learning	8	70
Visualization	6	75

Summary: Course-based Assessment

1. Course by Outcomes Matrix
2. Faculty for the chosen courses define and map their course outcomes to “study” outcomes
3. Develop course-based assessment methods (define who, when, what)
4. Each faculty who is doing this gathers summary data on their course
5. Feed data into other data for decision making

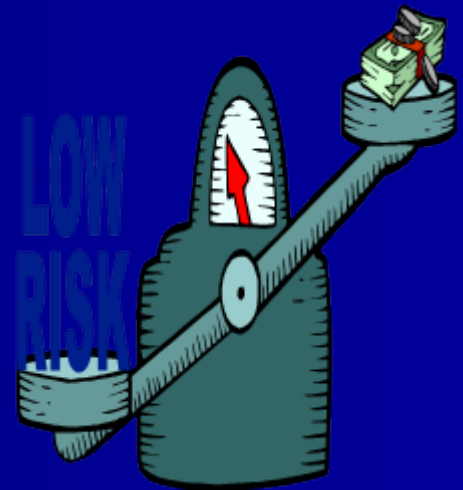
Strengths of This Method



- Clear connection of assessment to outcomes
- Clear connection of learning to curriculum
- Ease of understanding where to make improvements

Limitations

- Willingness of faculty to share results with others
- Time / cost
 - Initial design of instruments, test, assignments
 - Multiple faculty examining same work for interrater reliability
- Obtaining agreement across faculty about methodology



Comparison “With” Vs “Without” Technology?

- As outcomes are defined—consider WHAT the technology adds to the learning.
 - Visualization
 - Real world experience
 - Discussions with experts around the world
- Why are you using technology? What can students learn now that they could not learn before?
- Because some of the outcomes are “additions”, can’t always do comparisons.

Maple® Use in Calculus (NC State)

Maple®, a modern engineering tool for visualizing concepts in calculus used to solve real world problems. In laptop sections students "Let Maple® do the sketching". As a result, they have the advantage of seeing the surfaces immediately in front of them as the instructor discusses the process.

TEST Questions	Regular Section	Laptop Section
Two integrals - one used substitution and the other used integration by parts.	85%	87%
Convergence of a series	80%	76%
Students' graphic understanding of the relationships among the integral, right sums and left sums for increasing functions	79%	94%
Graph the region between two curves and find the area between them. Then revolve this region about a line to produce a solid of revolution -find the volume of this solid.	69%	79%

Caution – Don't Do Alone

- On any project, team should include:
 - Assessment professionals (someone knowledgeable about assessment)
 - IT professionals
 - Instructional Designer/Pedagogy Experts
 - Decision-makers
 - Faculty

Finding Someone Knowledgeable About Assessment

- Assessment or evaluation professional
 - Anyone with “assessment” in their title
- Faculty with assessment or evaluation background (e.g. psychology, education, sociology)
- Assessment committees – at dept, college, institutional levels
- Institutional research or planning office
- Registrar/admissions
- Centers for faculty development on teaching, technology
- “Google” your institution’s website: survey, assessment, planning, benchmark, performance indicators, goals, outcomes

Where Is Data?

- Other resources at your institution
 - See “Sources of Information” handout – think about where this type of data is located already! Typically institutional research office, planning office, Provost or Academic Officers, registrar, admissions, deans administrative office
 - Look for most recent institutional accreditation report
 - Most recent program accreditation reports

NCSU Websites: Other's Work and Practical Advice

- Assessing student learning in **technology-enriched spaces**: <http://www2.acs.ncsu.edu/UPA/assmt/litre/index.html>
 - online searchable bibliographic database contains citations since 2000
 - “Frequently Asked Questions” page
 - Resources page
 - Best Practices – coming soon
- Program assessment: Internet Resources for **Higher Education Outcomes Assessment**
<http://www2.acs.ncsu.edu/UPA/assmt/resource.htm>

FYI: NC State's "Learning in a Technology Rich Environment"

- Quality Enhancement Plan for Learning in a Technology-Rich Environment at NC State:
http://litre.ncsu.edu/pdf/litre_qep.pdf
- LITRE Goals and Assessment Plan:
http://litre.ncsu.edu/dfiles/goals_short.html
- 2003 LITRE Faculty Survey Report:
http://litre.ncsu.edu/fac_sur.pdf
- Assessment of LITRE:
<http://litre.ncsu.edu/dfiles/assess.html>

FYI: Assessment of Laptops in Classroom

- NC State University, College of Engineering:
www.engr.ncsu.edu/soc/assessment
- Clemson University: New Directions for Teaching and Learning #101, 2005

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