

# Assessment for e-Learning:

## Case Studies of an Emerging Field

### Technology & Assessment Group

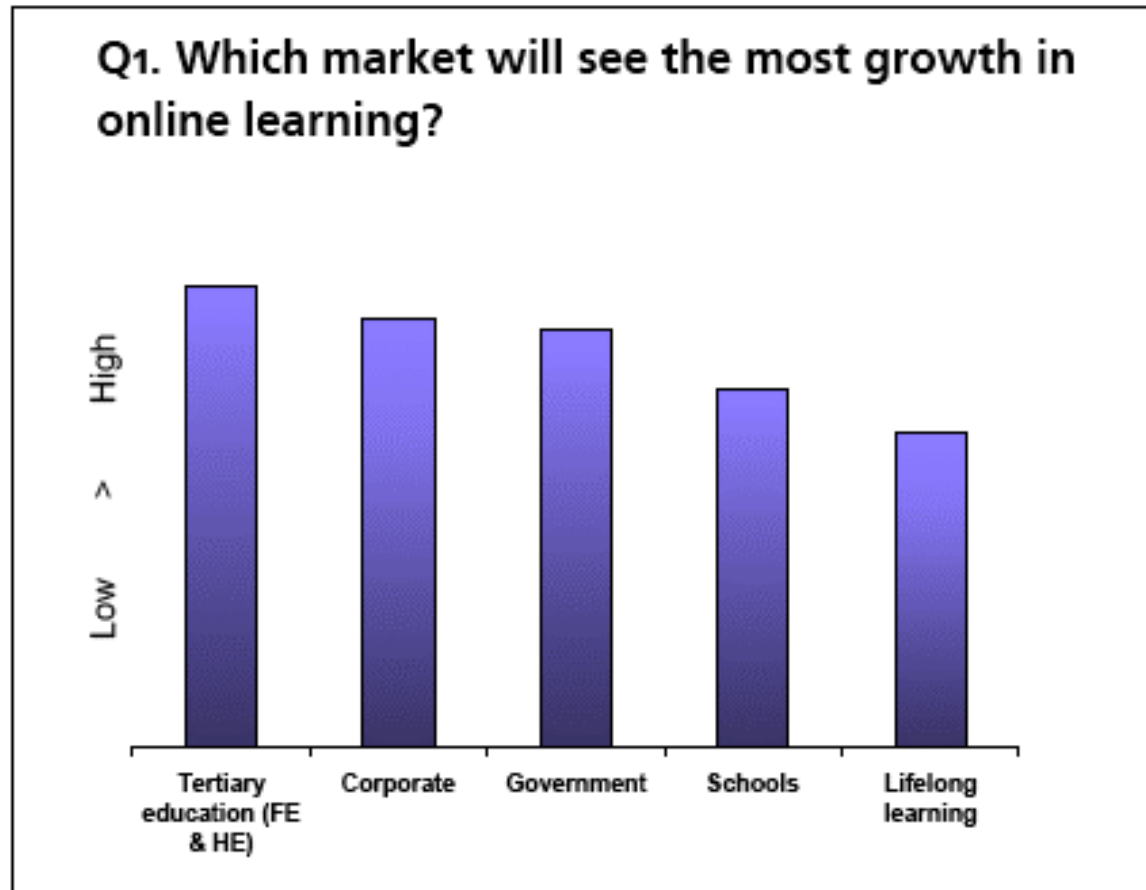
University of California, Berkeley & University of Oregon

Presenters: Kathleen Scalise, Diana J. Bernbaum, Mike Timms, S. Veeragoudar Harrell, Kristen Burmester | Discussant: Cathleen Kennedy

- “... distance learning grows into a \$5 billion a year market — up 38 percent in 2004 alone ...” —salon.com
- Assessment for personalized learning through e-learning products is a "quiet revolution" taking place in education. —General Teaching Council Conference, London

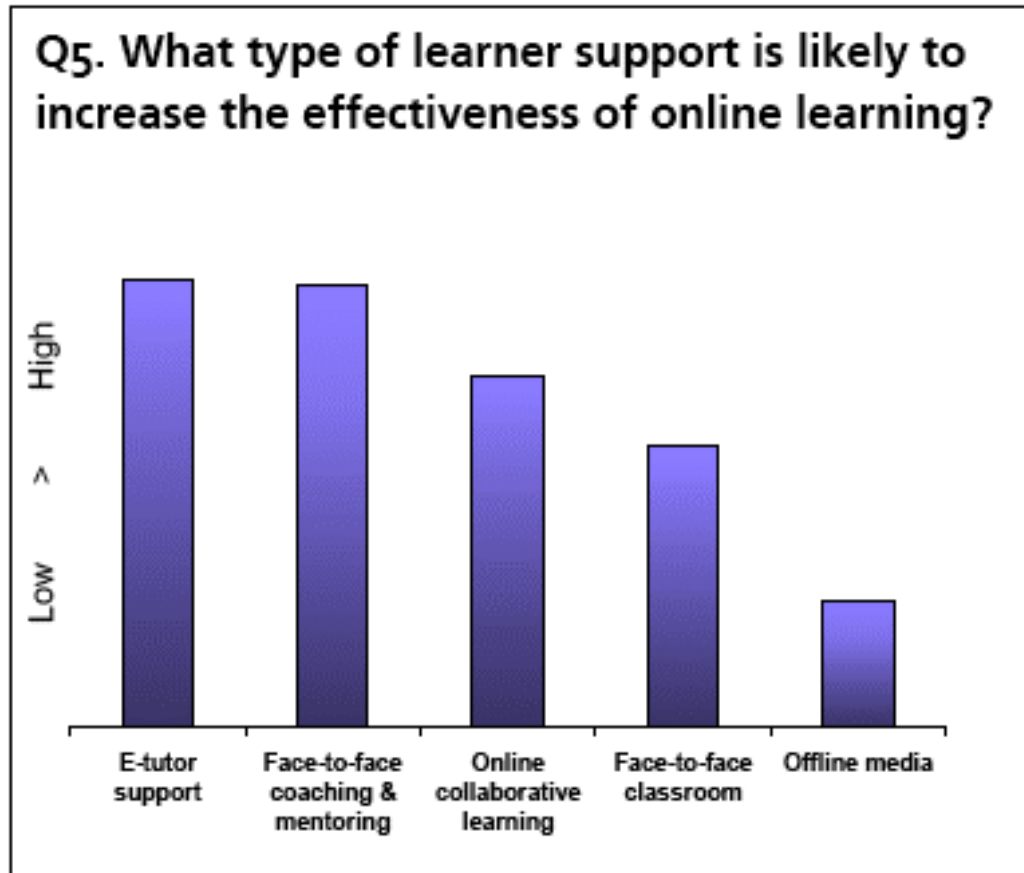


# Some e-Learning Trends:



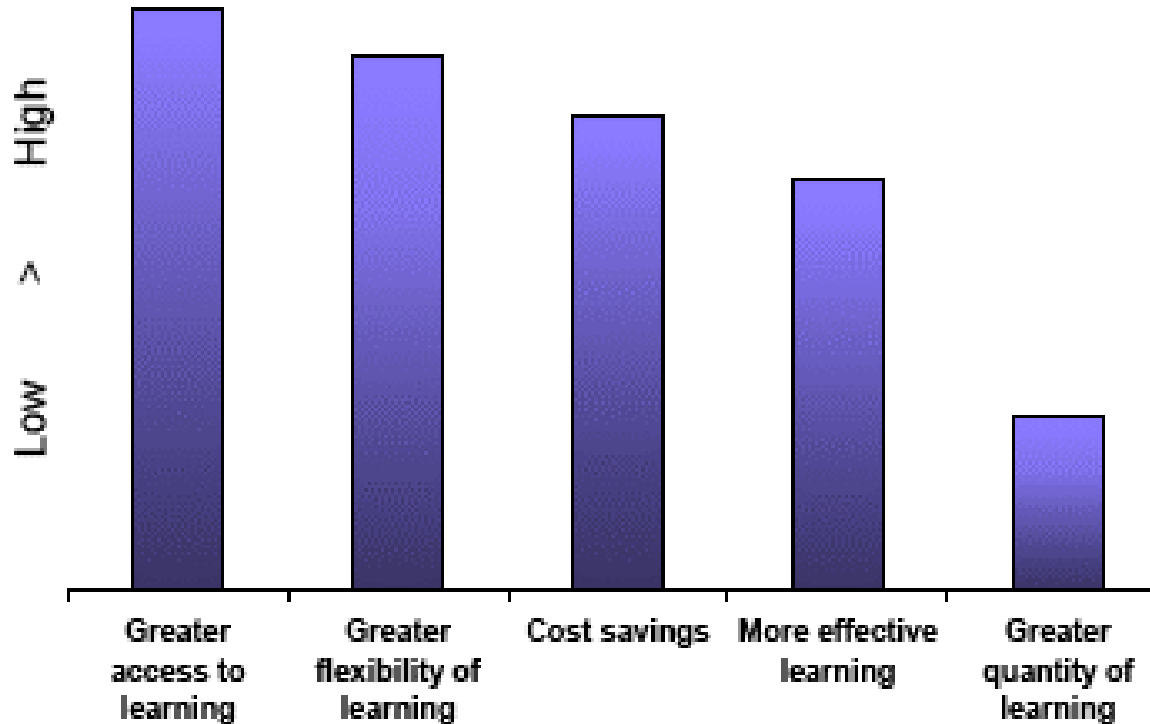
\*EPIC Survey 2003: The Future of e-Learning

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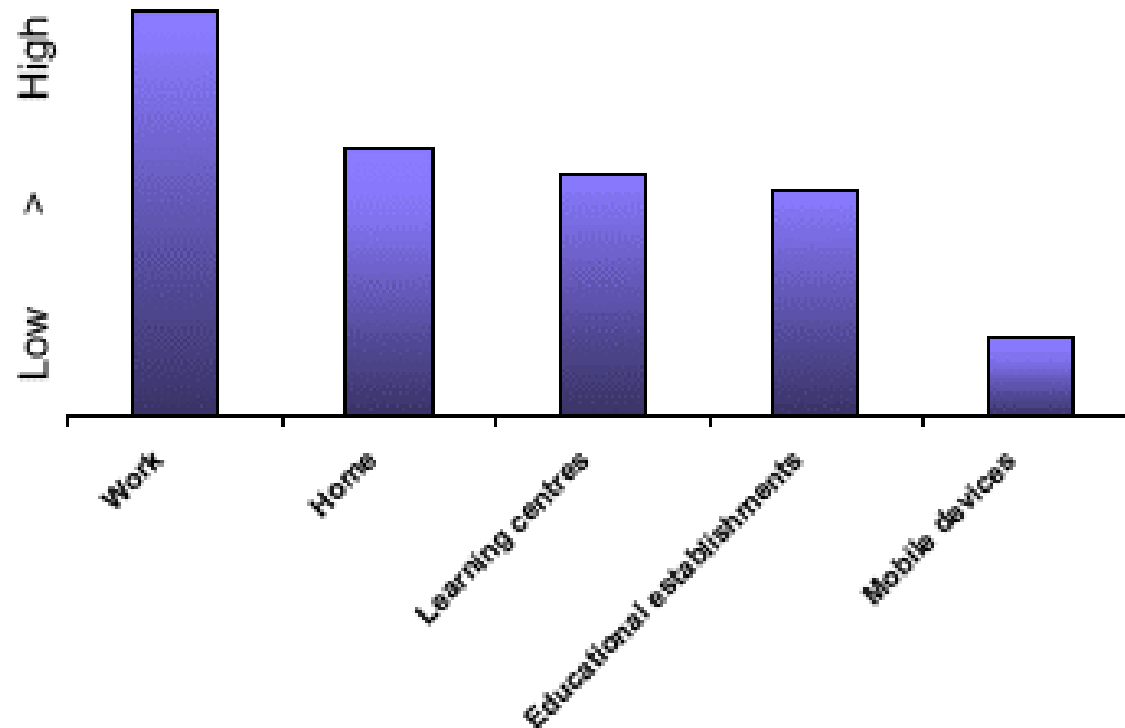
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# BEAR Assessment Principles

## Quality Assessments ...

- Begin with a Developmental Perspective.
- Align with Instruction.
- Produce Quality Evidence.
- Provide Information to Improve Learning Outcomes.

# Principle 1: Developmental Perspective

## Case Study: NetPASS

- Cisco Network Academy Program

- Certification program

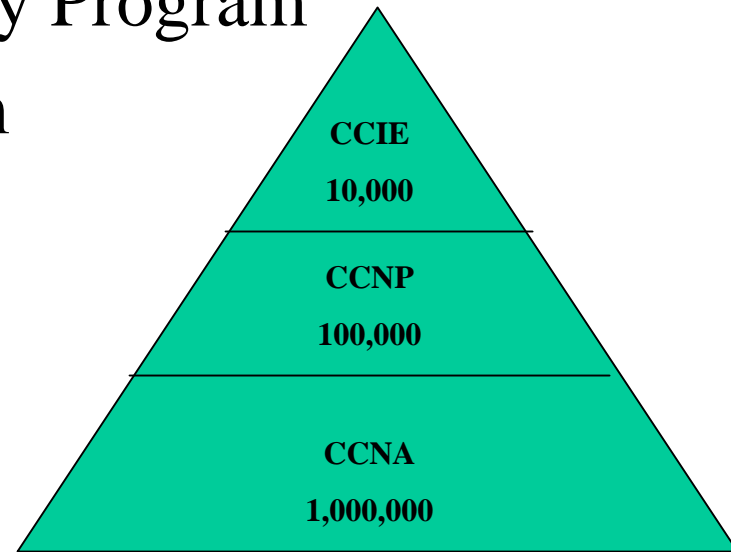
- Who uses NetPASS?

- 1.6 million students

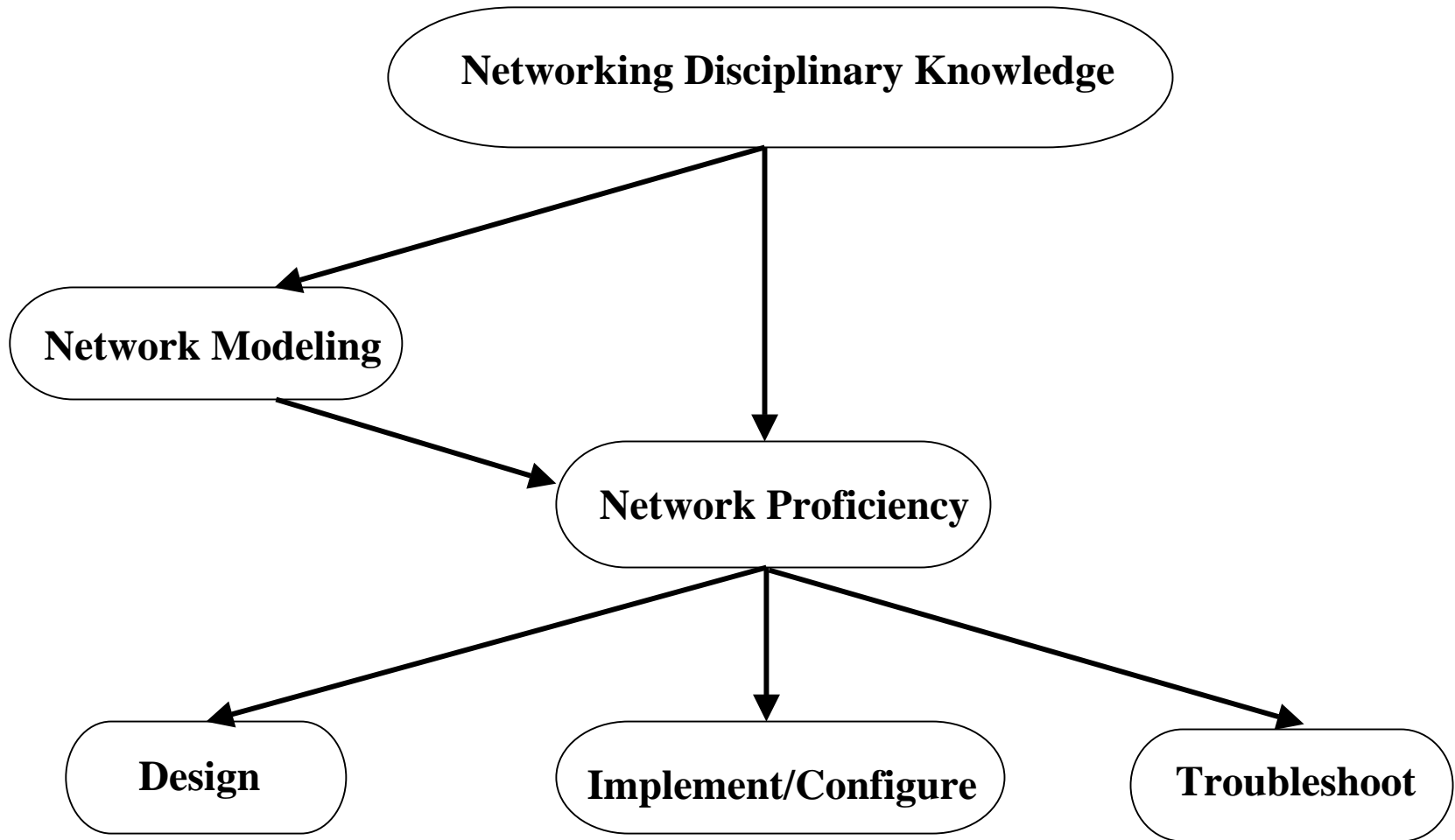
- 10,000 Academies

(high schools, community colleges, CBO)

- 150 Countries



# Evidence Centered Design (ECD): Student Model



# Developmental Perspective: Hierarchical Structure

Students can use TCP/IP utilities to troubleshoot network connectivity problems (*four layers defined by the Department of Defense*)

Students can identify the cause of connectivity at the physical, data link and network layers of the OSI model (*first three of the seven layers defined by the International Standards Organization*).

Students can use a systematic approach to identify and solve network problems.

# Establishing Construct Validity

- Evidence Centered Design (ECD)
  - Four process model (student, task, evidence, assembly)
- Performance assessments
  - Hands-on
  - Real equipment
  - Necessary for building mental model
  - Reliability
- Levels of Proficiency - Certification

# Principle 2: Align with Instruction

## Case Study: Quantum Tutors

QuickTime™ and a  
TIF (LZW) decompressor  
are needed to see this picture.

Case study: Quantum Chemical Reactions Tutor developed  
by Quantum Simulations, Inc.

# Case Study: Quantum Tutors

- Uses a pedagogical approach called cognitive apprenticeship.
- Allows student to work with their own examples, instead of the system generating the problems.
- Uses *model tracing* a technique developed by the Pittsburgh Advanced Cognitive Tutor group.
- Adds a system-generated list of common questions.

QuickTime™ and a  
TIFF (LZW) decompressor  
are needed to see this picture.

# Principle 3: Obtaining Quality Evidence

## Case Study: FOSS Self-Assessment System

- Established 1986
- One million student base
- FOSS Force and Motion science curriculum.
- Measures gap between student ability and difficulty of assessment tasks to decide what hints to give students.
  - Estimate student ability on task (using Rasch modeling)
  - Task analysis

# Research & Evaluation

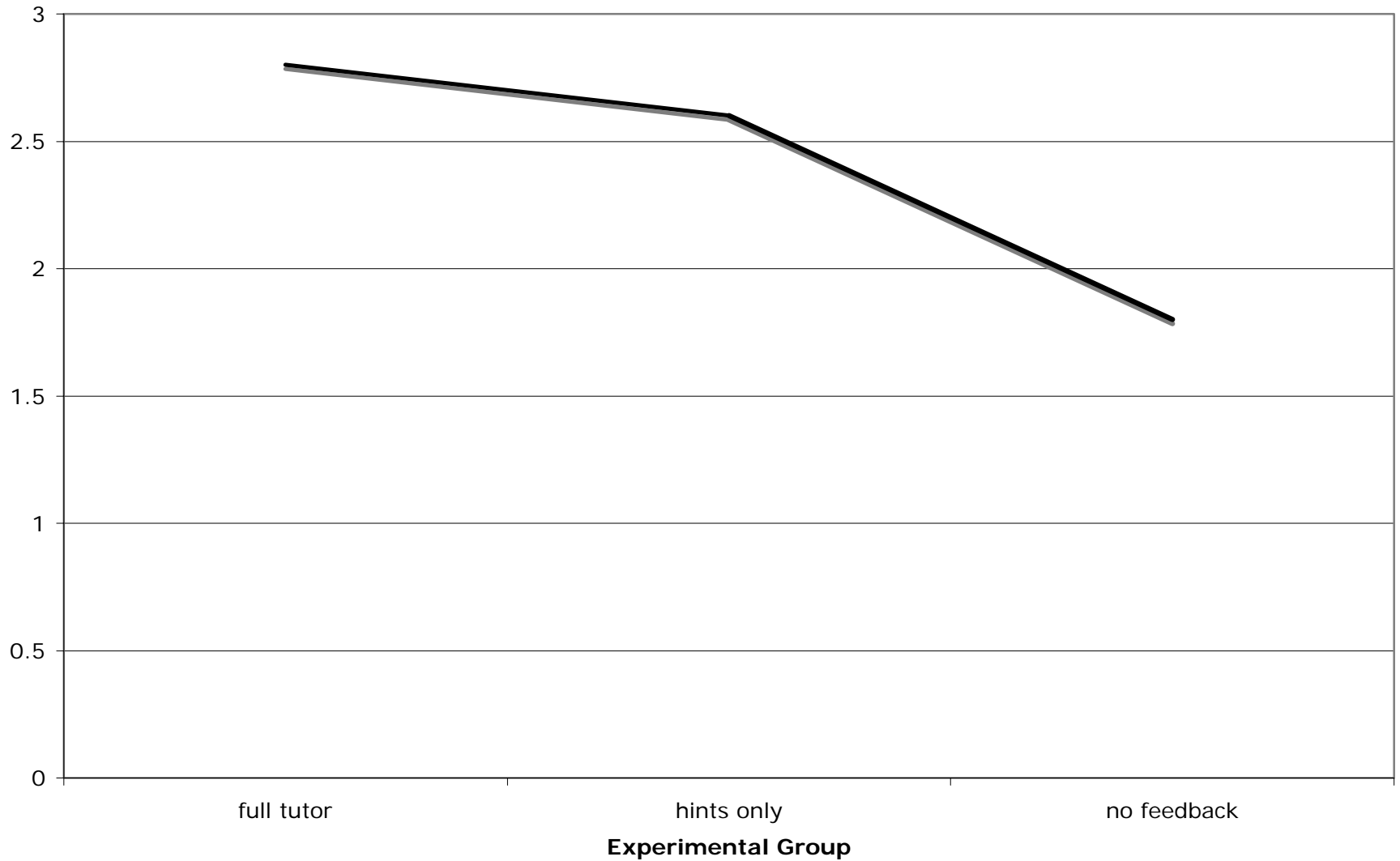
Three part study involving three versions of the system. Versions are:

- Error feedback and hints.
- Error feedback and no hints.
- Offered no help.

# Results

- Statistically significant higher learning gains
- Mean scores for the full tutor group were almost a full logit higher than the no help group.
- Ceiling effect in the “instructional design” of partial system

**Plot of Mean Learning Gains for Each Experimental Group**



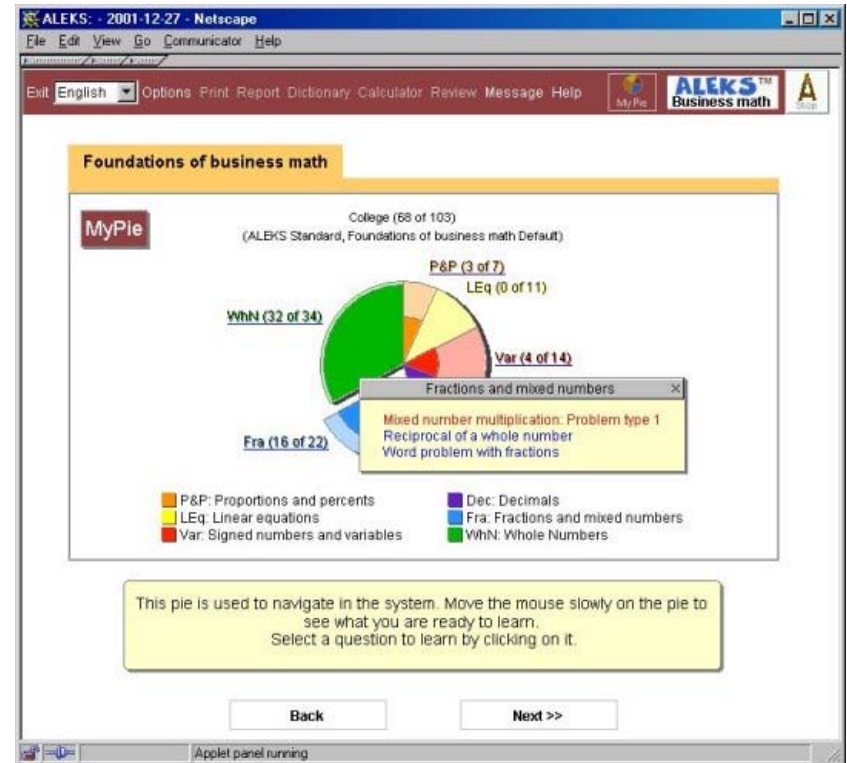
# Principle 4: Information to Improve Learning Outcomes

## Case Study: ALEKS

- Math tutoring system, using computer-based, authentic student input item responses .
- Calculates individual proficiency levels within various content, called the student's "knowledge state."
- Displays reports with results and insight into what the results of the assessment mean in instructional terms.

# Reports & Instruction: Student's View

- Visual and numerical representation of personal results
- Holistic view of self within content area
- Presented in tandem with instructional recommendations



# Teacher's View: Entire Class

- Able to view summary and details of class performance
- Includes percent of students understanding individual skills within content
- Suggests what should be taught next and methods for instruction

The screenshot shows the ALEKS Teacher's View interface for the course "Foundations of Business Math / Math 103" by Dr. Clark. The interface includes a navigation bar with "File", "Edit", "View", "Go", "Communicator", and "Help" menus. Below the navigation bar, there are options for "Exit", "English", "Print", "Results & Progress", "Message", and "Help". The course title "Foundations of Business Math / Math 103" and "Dr. Clark" are displayed, along with a "Course Report" button. A dropdown menu for "Select students who have been assessed" is set to "anytime", with a "Graph" button next to it. The interface shows "Number of Students: 14" and "Reports Selected: 12". A yellow bar highlights the course title "Foundations of Business Math". Below this, there is a "MyPie" section with a pie chart titled "Mastery of College (62 of 103) (ALEKS Standard, Foundations of Business Math Default)". The pie chart is divided into six segments: P&P (Proportions and percents), LEq (Linear equations), Var (Signed numbers and variables), Dec (Decimals), Fra (Fractions and mixed numbers), and WhN (Whole Numbers). A legend below the pie chart identifies each segment with its corresponding color and label. Below the pie chart, there is a "Display mode:" dropdown menu set to "Average (learning)" and a "Graph" button. The interface also displays a list of skills and their mastery percentages, categorized into "Whole Numbers" and "Fractions and mixed numbers".

Foundations of Business Math / Math 103  
Dr. Clark

Select students who have been assessed: anytime [Graph]

Number of Students: 14 Reports Selected: 12

Foundations of Business Math

MyPie

Mastery of College (62 of 103)  
(ALEKS Standard, Foundations of Business Math Default)

Legend:

- P&P: Proportions and percents
- LEq: Linear equations
- Var: Signed numbers and variables
- Dec: Decimals
- Fra: Fractions and mixed numbers
- WhN: Whole Numbers

Display mode: Average (learning) [Graph]

Whole Numbers

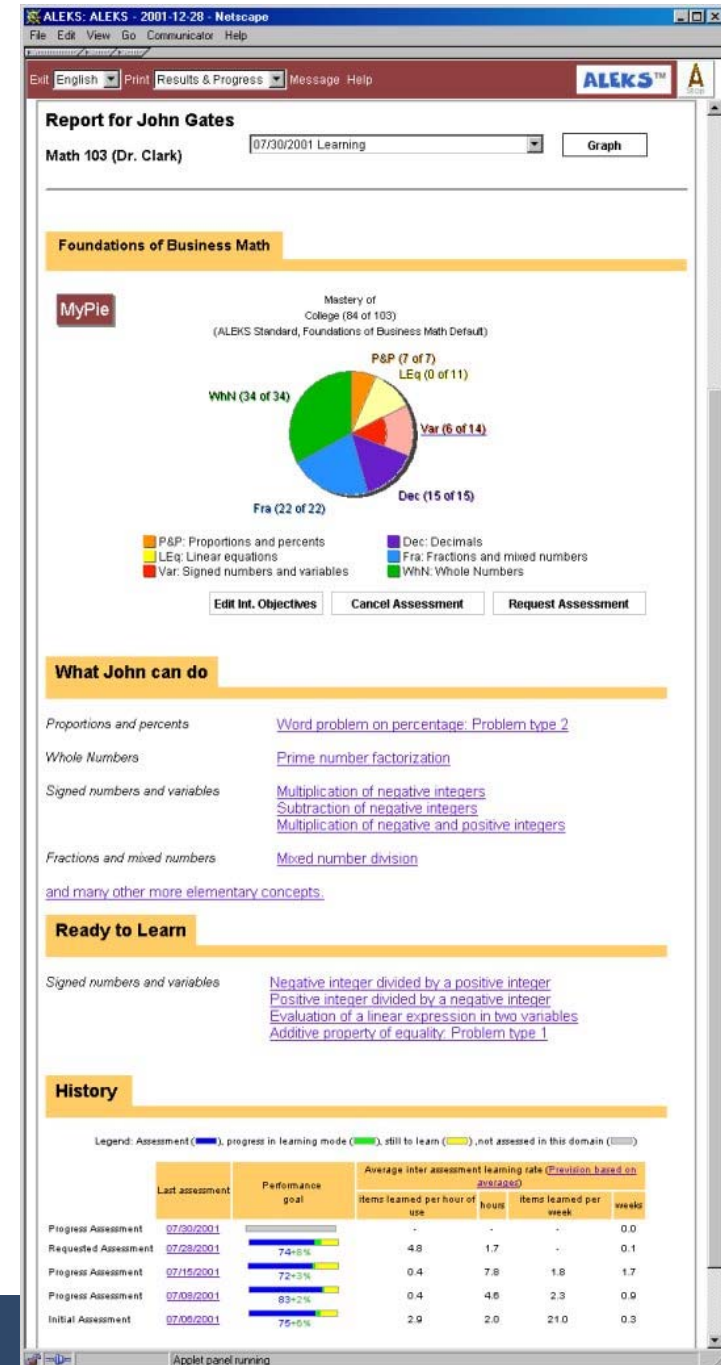
- Multiplication of large numbers (91%)
- Long division (91%)
- Rounding: Problem type 1 (91%)
- Greatest common factor (83%)
- Factors (83%)
- Numeral translation: Problem type 2 (83%)
- Rounding: Problem type 2 (83%)
- Quotient and remainder (83%)
- Least common multiple (83%)
- Word problem using division (75%)
- Prime numbers (50%)
- Prime number factorization (25%)

Fractions and mixed numbers

- Product of a unit fraction and a whole number (91%)
- Writing an improper fraction as a mixed number (83%)
- Writing a fraction in lowest terms (83%)
- Product of a fraction and a whole number (83%)
- Unit fraction multiplication (75%)
- Adding fractions with different denominators (66%)
- Ordering fractions with same numerator (66%)
- Fraction multiplication (58%)
- Adding mixed numbers with same denominator (58%)

# Teacher's View: Single student

- Provides graphical summary of one student's performance
- Separates what the student has achieved and what they are "ready to learn"
- Clicking suggests example items and instruction
- Provides history of skill development progression



# Discussant: Cathleen Kennedy

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[www.prsa.org](http://www.prsa.org)