

How might changes in technology influence buildings for the 21st century law school

Creating eLearning Environments
From the Convergence of
Computing, Communication, and Cognition

Jack M. Wilson

**J. Erik Jonsson Distinguished Professor of Physics,
Engineering, Information Technology, and Management**

Chairman of the Board, LearnLinc Corporation

- Is Learning the "Killer App" of the next generation of computing?

ABA/CLE - Center for Continuing Legal Education - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss

Address <http://www.abanet.org/cle/home.html> Go Links >>

ABA
CLE

ABA Center for Continuing Legal Education

MCLE	CALENDAR	BOOKS & TAPES	LINKS	CLE-NOW!
CLEarence CLASSICS	SOUNDBYTES	ABA-CLE ON DEMAND		

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- First we thought the PC was a calculator
 - Then we thought it was a typewriter
 - with multimedia we thought that it was a TV
 - Now, with the World Wide Web.....
we've realized it's a **brochure**.
- Douglas Adams, Author Hitchhiker's Guide to the Galaxy

- It is the worlds best communication tool
combined with what will be the
- World's Largest Library
Creating the First and Only
- Global Continuous Learning Environment

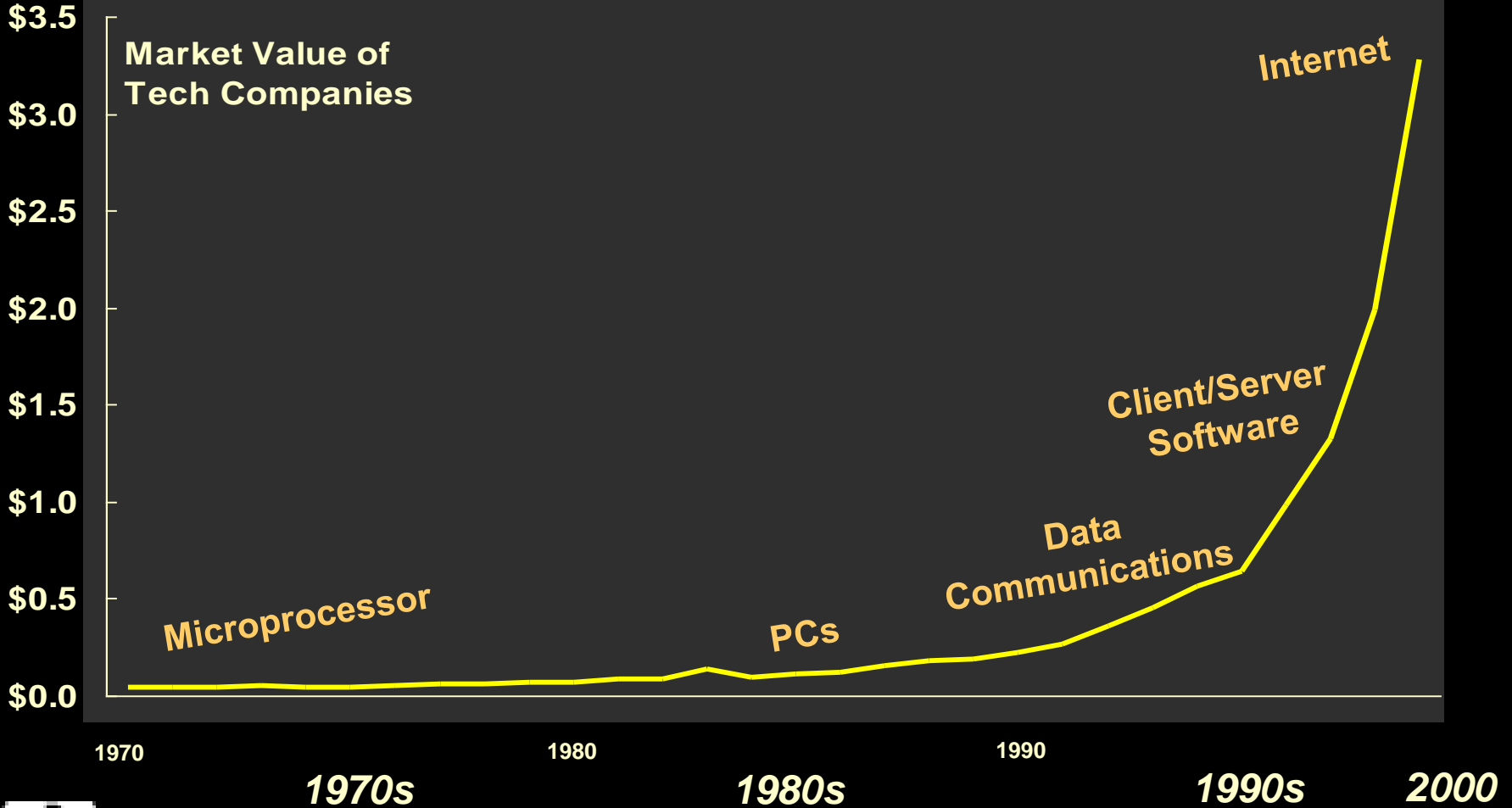
Relentlessly changing
the way we

LearnLinc

- Labor
- Live
- Love
- and Learn

The Internet Tsunami

\$ Trillions



AMERICAN BAR ASSOCIATION

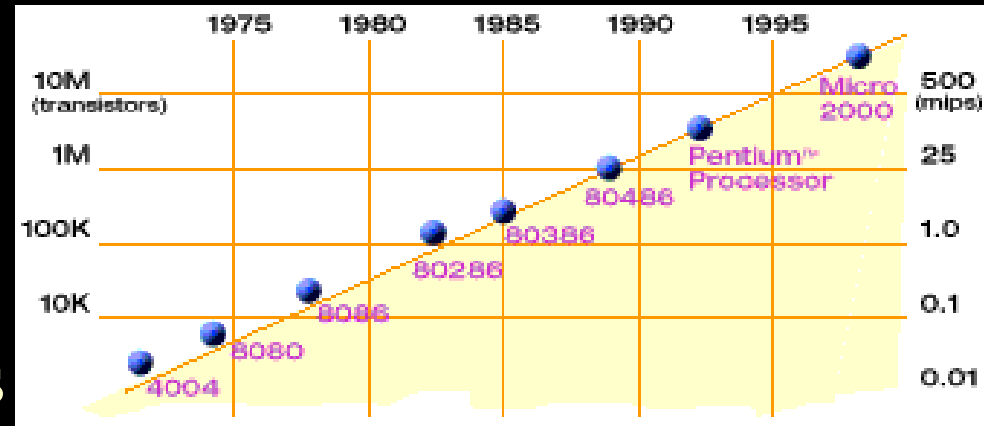
Changing the landscape of industry

Top 40 US-Traded Tech. Comp.		Top 40 US-Traded Tech. Comp.	
4/9/1999 Market Value (\$B)		4/9/1999 Market Value (\$B)	
* Microsoft	469.7	* TSMC	32.1
Intel	204.8	* SAP	31.1
* Cisco Systems	189.7	* Amazon.com	30.1
IBM	167.5	EDS	26.1
* America Online	159.2	* Auto. Data Processing	25.9
* Lucent Tech.	158.6	Applied Materials	23.8
* Dell	105.8	* eBay Inc.	23.0
Nokia	80.4	* Tellabs	21.4
Hewlett-Packard	69.0	* Ascend Communications	20.6
* EMC	66.1	* At Home Corp.	20.3
* Sun Microsystems	53.2	* Computer Associates	18.9
Motorola	49.5	* First Data Corp.	18.2
Northern Telecom	49.0	* STMicroelectronics	16.1
Ericsson	45.5	* Micron Technology	11.3
Texas Instruments	42.1	* Priceline.com	11.1
* Compaq	40.9	* Gateway 2000	10.9
* Yahoo!	40.8	* E*Trade Group	10.8
Siemens	40.6	Computer Sciences Corp.	9.3
Xerox	39.0	* Linear Technology	8.7
* Oracle	37.8	* 3Com	7.8

* IPO since 1980

Source: Frank Quattrone
Credit Suisse First Boston

- Moore's Law:
CPU performance
doubles every 18 months



- Bandwidth law:
Bandwidth is doubling even faster!
- Metcalf's Law:
the value of a network scales as n^2 where n is the number of persons connected.

- OLD Paradigm:
Physical Capital / Resources

- NEW Paradigm:
Knowledge / Intellectual Capital

– Frank P. Quattrone
Managing Director
Head of CSFB Technology Group
Credit Suisse/First Boston

- The Internet's pace of adoption eclipses all other technologies that preceded it.
 - Radio was in existence 38 years before 50 million people tuned in;
 - TV took 13 years to reach that benchmark.
 - The Internet crossed that line in 4 years, once it was opened to the general public.

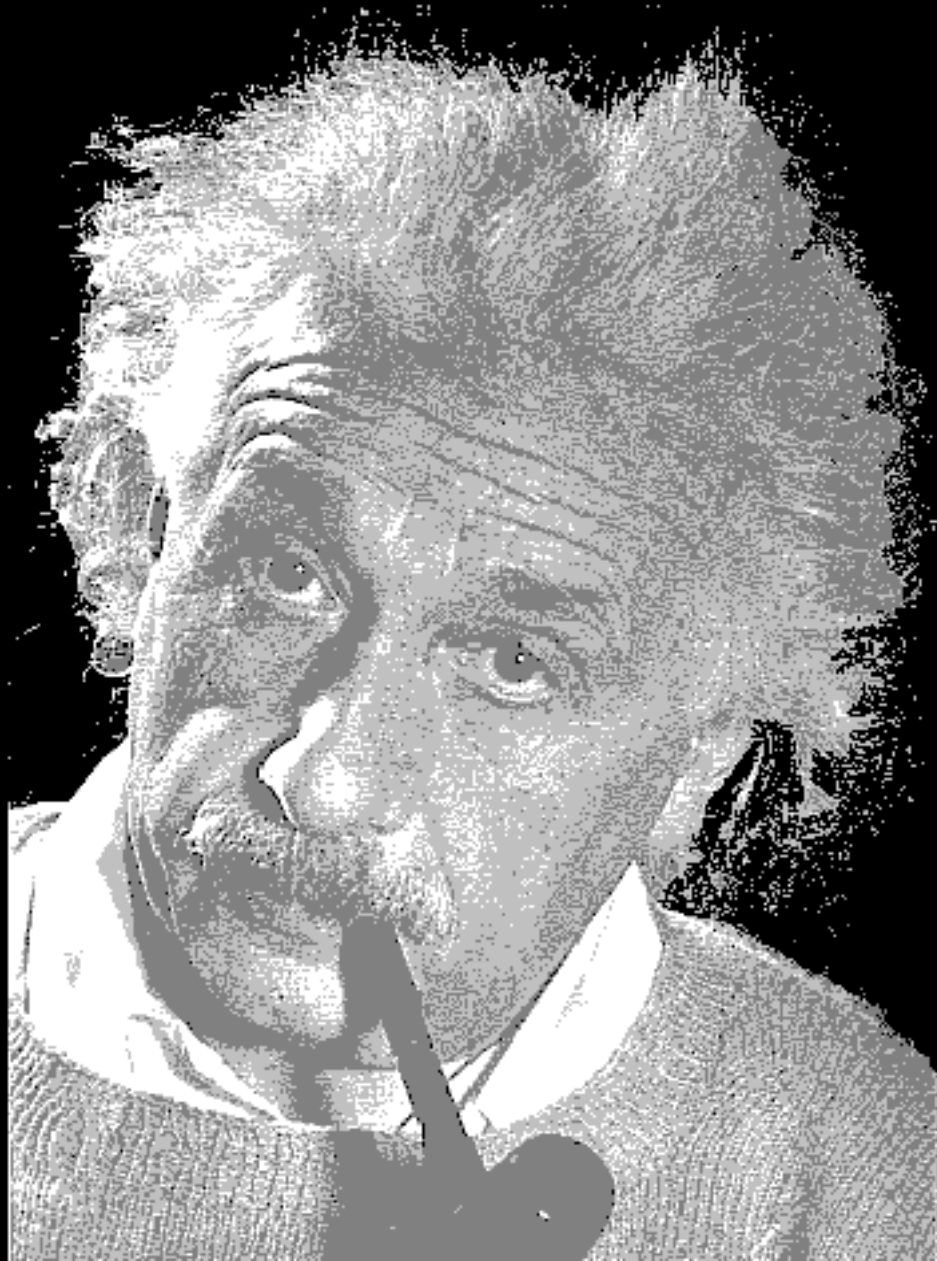
- In 1994, 3 million people were connected to the Internet. By the end of 1997, more than 100 million people were using the Internet.
- Internet Traffic is doubling every 100 days.
- registered domain names grew from 26,000 in July 1993 to 1.3 million in July 1997.
- Over same period, the number of hosts expanded from under 1.8 million to 19.5 million.

Internet Tsunami -what next? LearnLinc

- Consumer electronics companies, media giants, phone companies, computer companies, software firms, satellite builders, cell phone businesses, Internet service providers, television cable companies are aggressively investing to build out the Internet.
- Within the next five years, the vast majority of Americans should be able to interact with the Internet from their television sets, or watch television on their PCs, and make telephone calls from either device

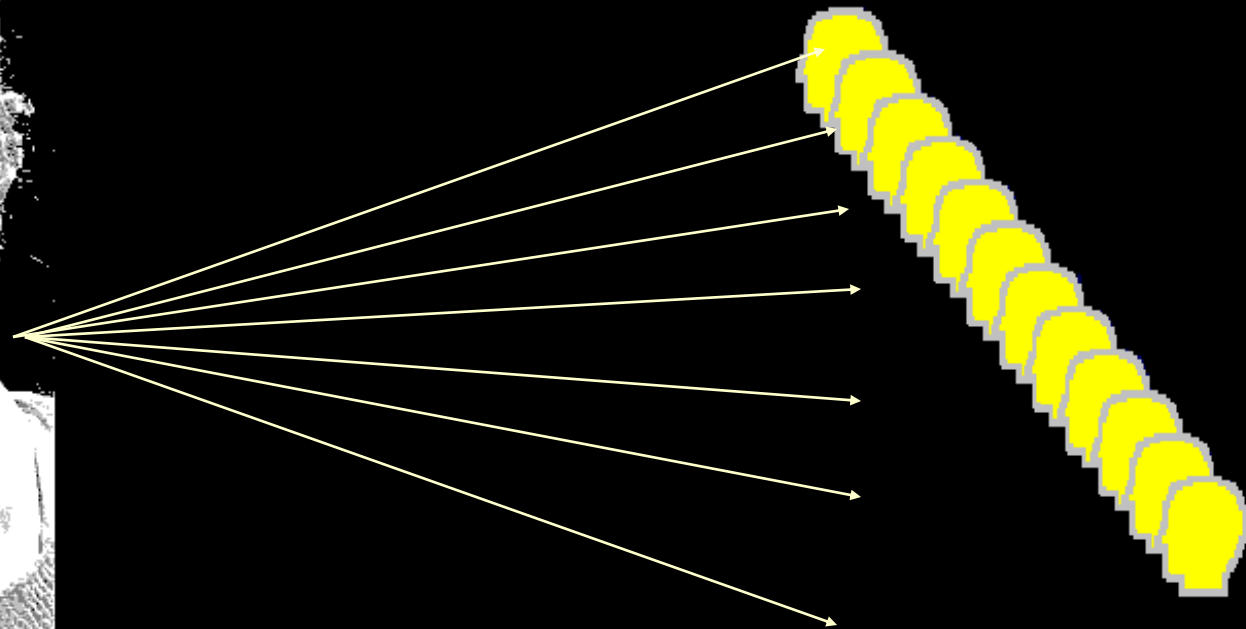
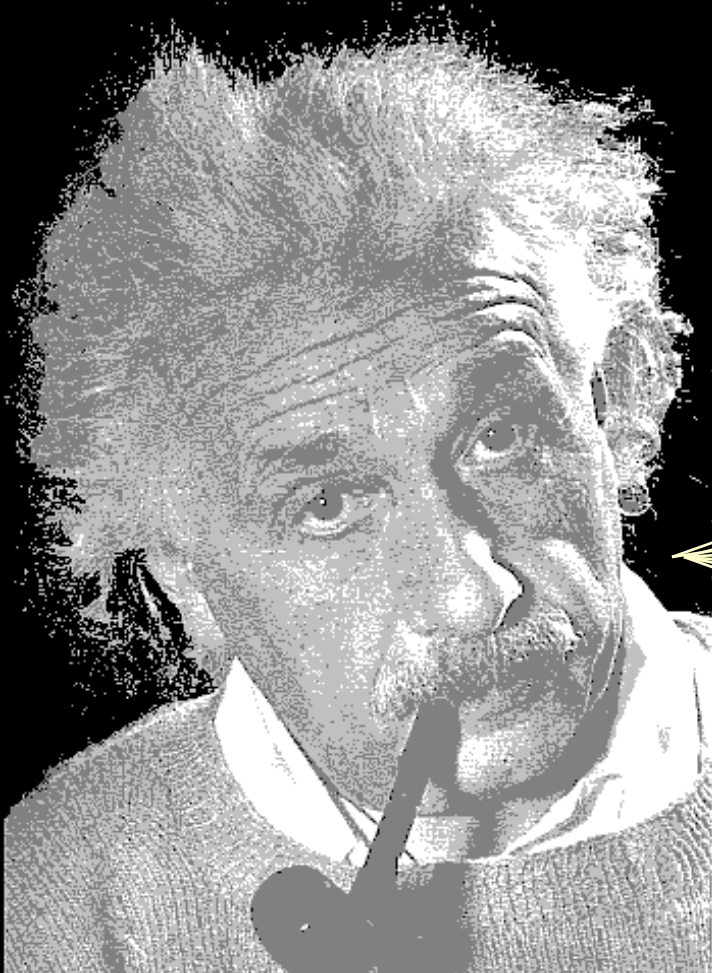


- Chris Galvin, President Motorola:
 - We are not hiring any more graduates with four year degrees.
 - We want employees with forty year degrees
- Every graduate needs a lifetime warrantee!



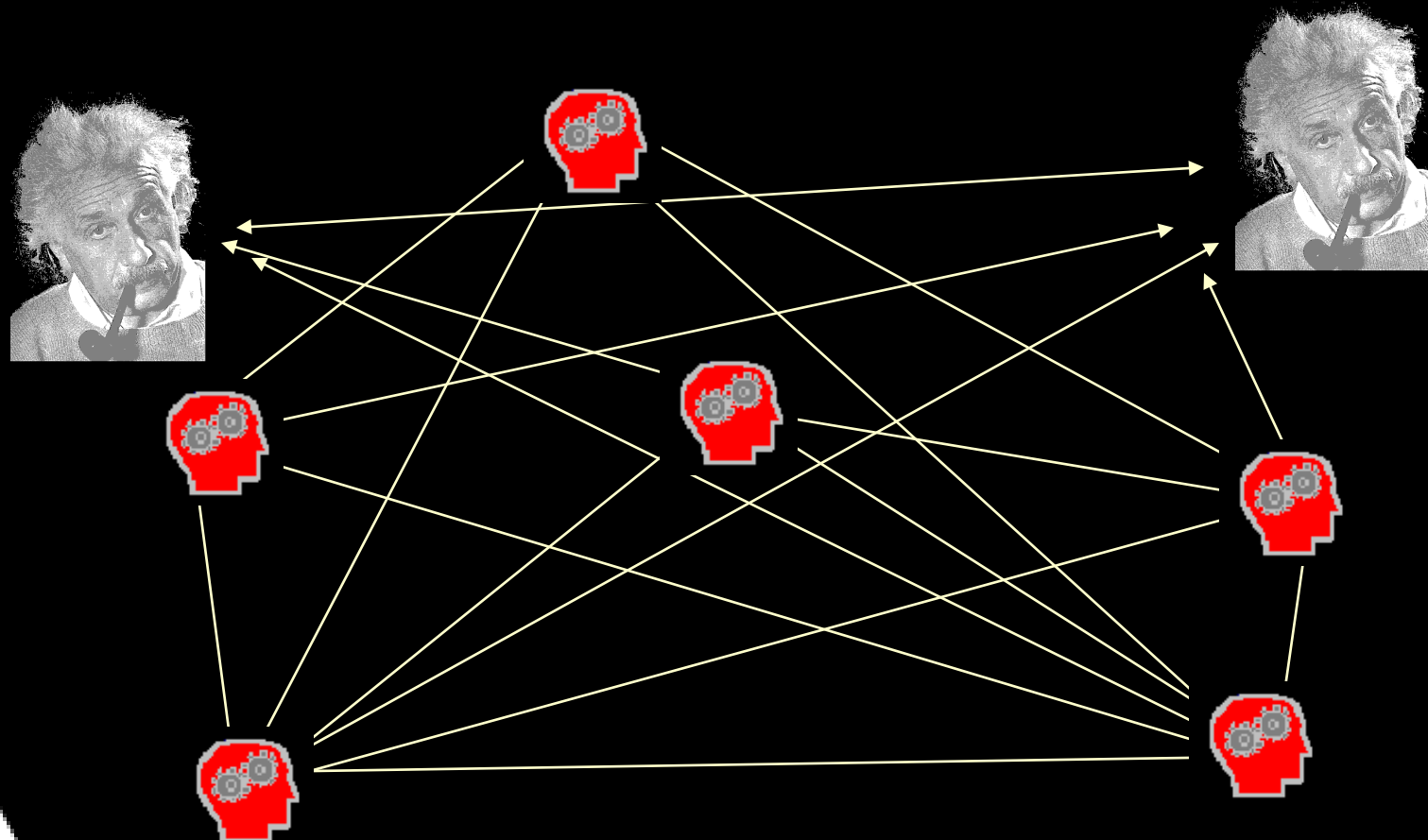
- Will the Web or a CD-ROM Replace your <Blank> Instructor?

- The mainframe approach



ATION

- Distributed Collaborative Model

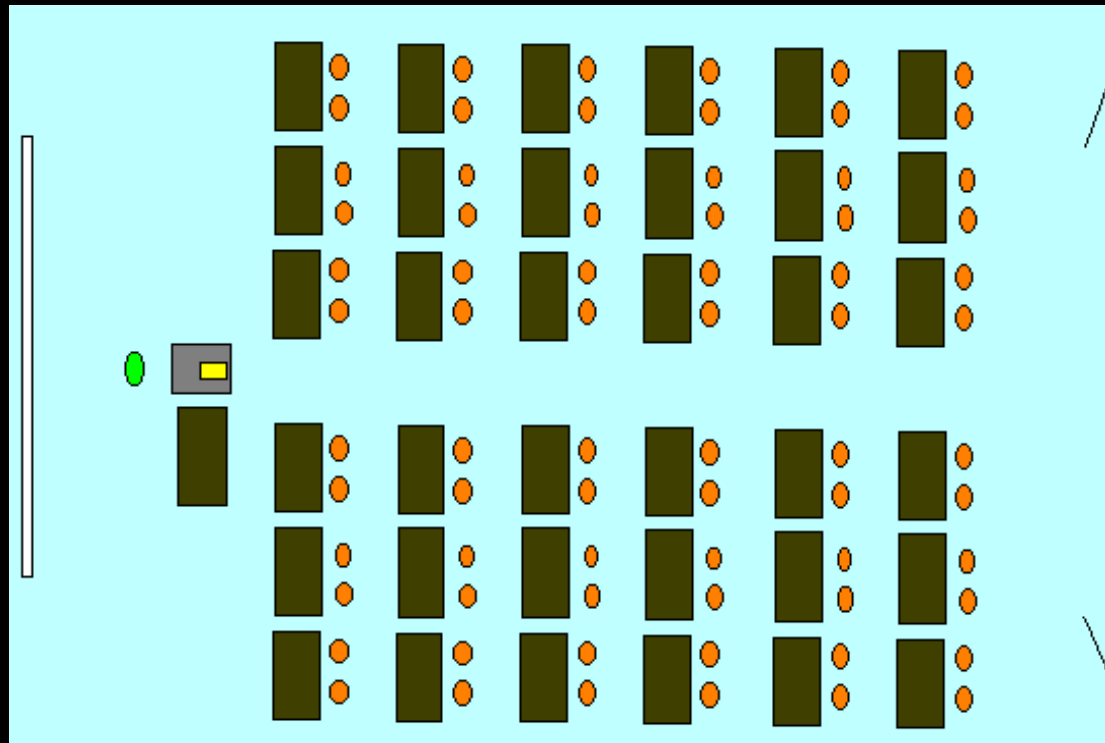


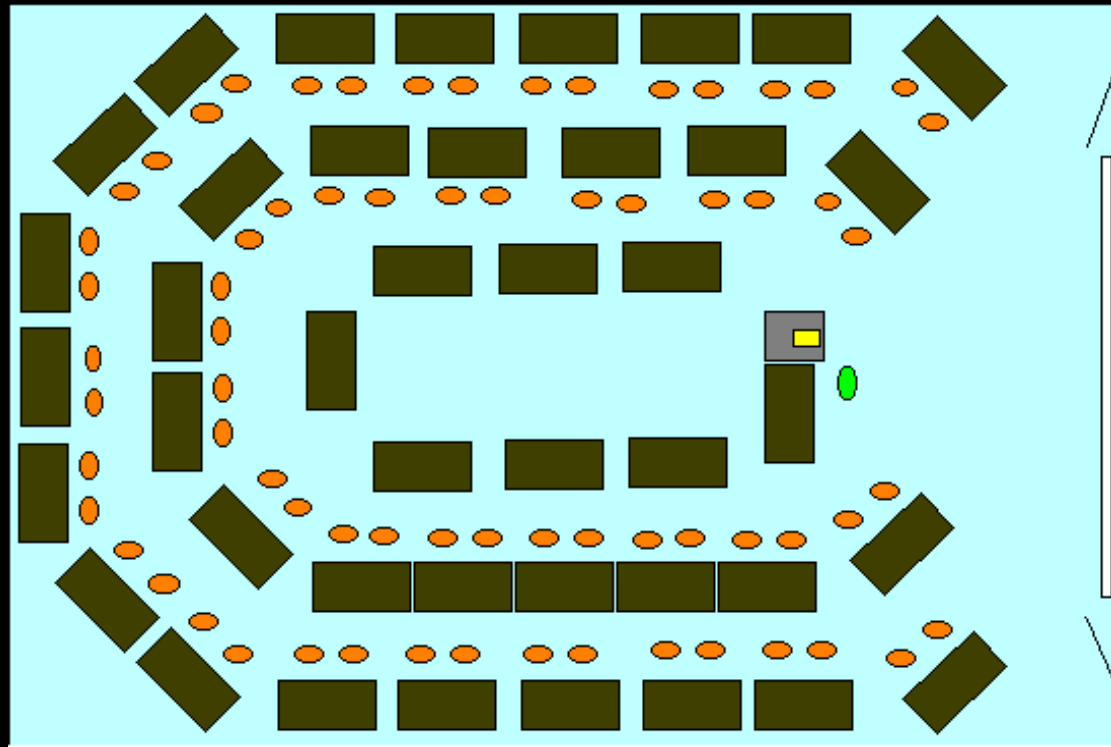
**Faculty working very
hard while the
students listen (rest?).**

Students working very hard while the faculty listen (rest?).



Faculty working very hard while the students listen (rest?).





Traditional

- Credit Hours: 4
- Contact Hours 6
 - 2 Hours Lecture
 - 2 Hours Recitation
 - 2 Hours Lab

Studio

- Credit Hours: 4
- Contact Hours 4



The Studio Classroom

- Hesburgh Award 1995
- Boeing Award 1995
- Pew Prize 1997
- Pew: \$8.8 Million in 1999.



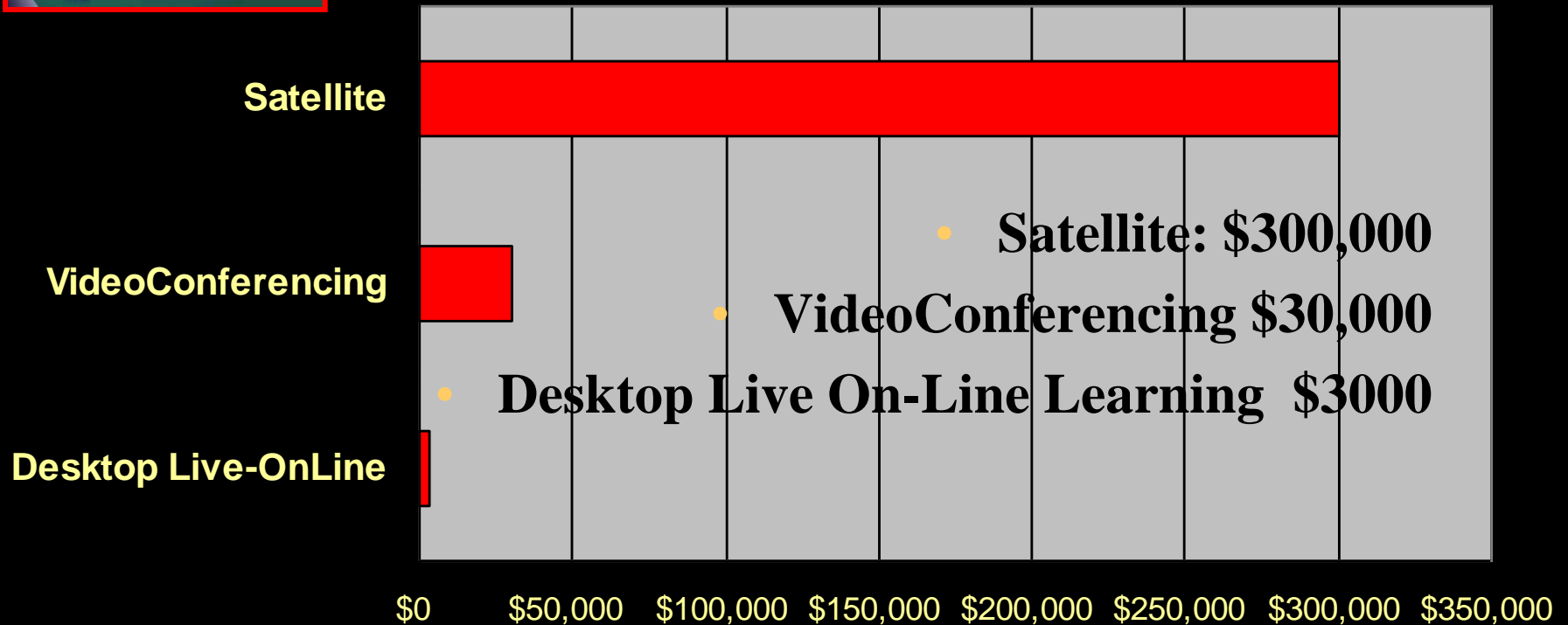
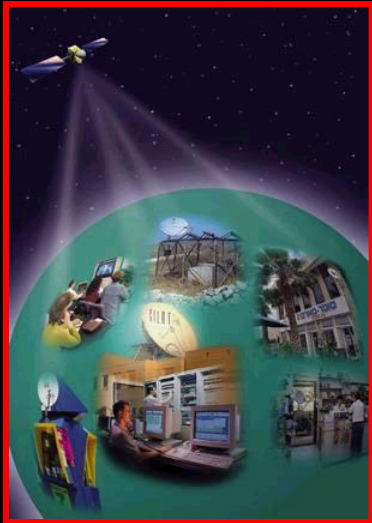
- Texts
- Interactive Texts
- Access to Databases
- Full Motion Video
- Data Acquisition/Analysis/Visualization
- Collaboration
- Live Links to Experts

- The "Client-Server" model.
- Connecting students, instructors, and resources into a rich interacting community of learners.
- Peer Teaching
- Cooperative Learning
- Student-student as well as student-instructor and student-resource interactions
- Synchronous as well as asynchronous
- Video/Audio/ and Multimedia interactions
- The real "World Wide Web"

- 10 Years +
- '93 Telecon "Best Distance Learning Program"
- '96 USDLA Industry-University Collaboration
- 1066 Students in Credit/Degree Courses(\$99)
- Several hundred more in short courses
- Bringing education to the workplace
 - (GM, IBM, Lockheed Martin, AT&T, Lucent, Con Ed, GE, UTC, Pratt & Whitney, Ford, Intel, Applied Materials, Matsushita, Bugle Boy, Albany International, Key Bank, +++++)

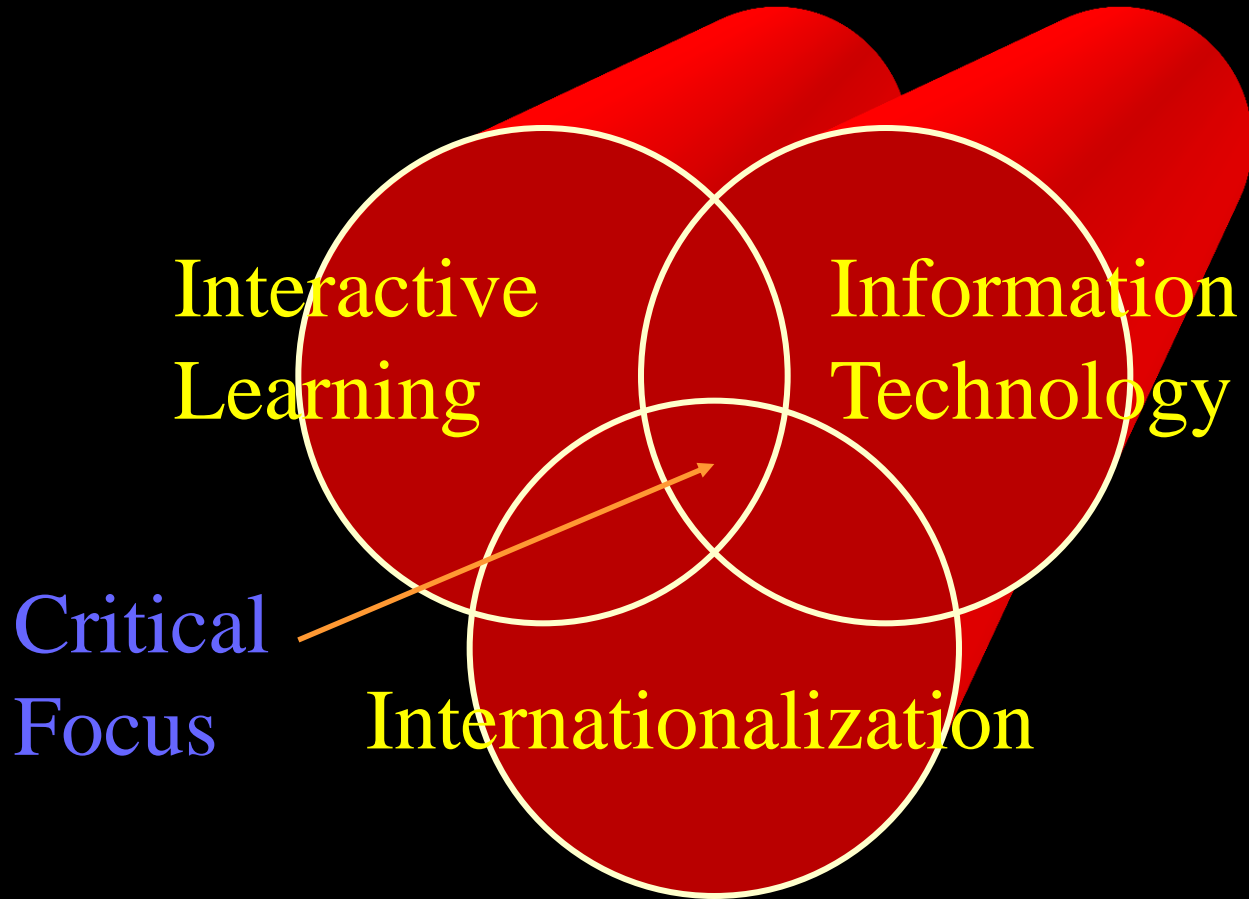
- Satellite Video
- ISDN Videoconferencing
- CD-ROM Creation
- Mail out materials
- World Wide Web materials
- ILINC **LearnLinc**
 - Desktop Video (multicast)
 - Network based materials management
 - Classroom management
- Software Spin Off: ILINC

The Scale of Change



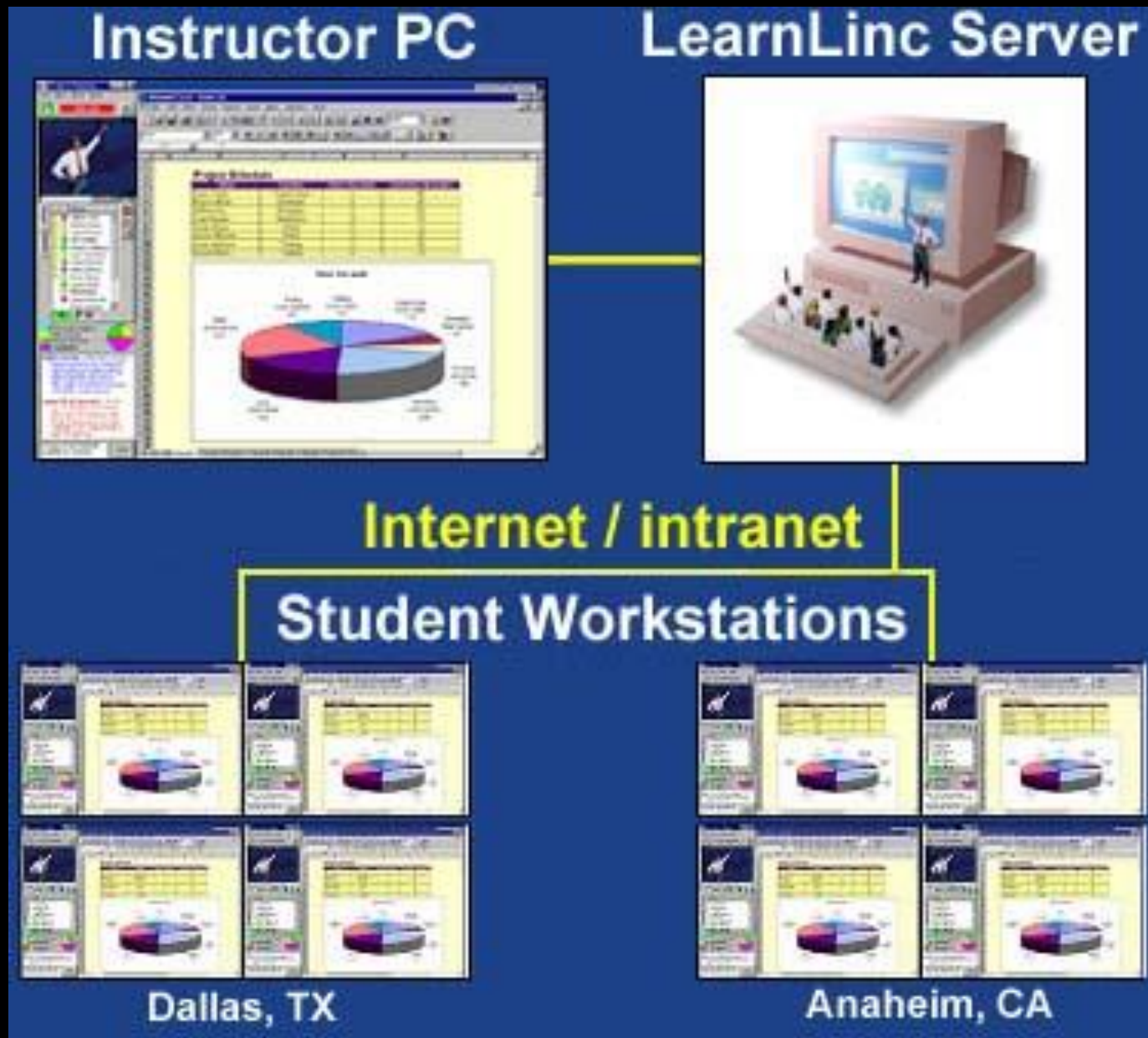
Why not pure asynchronous training?

- The mantra is “anytime any place training.”
- Why not just put everything on the web and let everyone learn on their own?
- Because it does not work in many cases.
 - Asynchronous Learning may work in cases:
 - highly motivated learners
 - discretionary (non mission critical) learning
 - Can asynchronous be part of the mix? YES!
 - 80/20 model of asynchronous/synchronous ed.



Critical
Focus


- ILINC **LearnLinc** distributed learning system
 - Video-audio-collaboration-synchronous-asynchronous
- founded in 1994 by one faculty (Wilson) and two alums (Bernstein and Usluel)
- RPI Research joint with AT&T and Bell Labs
- Began in incubator
- Moved to Tech Park
- Bootstrap start-up and two rounds of venture including one with Intel.



Project Planning ...

File Edit View Insert Format Tools Data Window Help

ON AIR



Live from Detroit, Michigan

Mute

Participants

Name
Jolene Wall
Dennis Bates
Luke Hansen
Jill Donnelly
Darren Stahlman
Laura Sheehan
Suzie Drexel
Brian LaRosa
Owen Carter
Karen Meyer
Mick Brady
Janice Marcola
Robin Jacobs

9 25

Not much progress
 Still working
 Almost finished
 Completed

Robin Jacobs: Welcome to project planning with Excel. During the next two hours, we'll cover the basic functions of Excel as they apply to tracking resources, schedules, and expenses.

Jolene Wall (private): Hi, I'm new to the class and I don't have a lot of experience with Excel. Can you give me some advice I can study outside of class to catch up?

I'll make review materials available to everyone.

Send

Microsoft Excel - Book2.xls

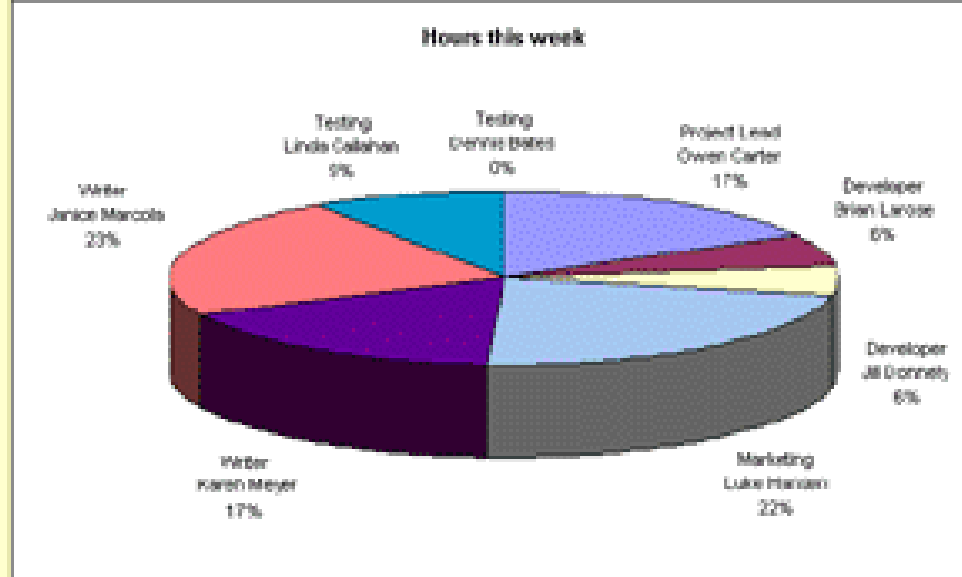
File Edit View Insert Format Tools Data Window Help

100%

117

Project Schedule			
Name	Function	Hours this week	Total hours for project
Owen Carter	Project Lead	9	80
Brian LaRosa	Developer	3	40
Jill Donnelly	Developer	3	65
Luke Hansen	Marketing	12	10
Karen Meyer	Writer	9	12
Janice Marcola	Writer	12	30
Linda Callahan	Testing	5	30
Dennis Bates	Testing	0	15

Hours this week



Name	Function	Hours this week	Percentage
Owen Carter	Project Lead	9	17%
Brian LaRosa	Developer	3	6%
Jill Donnelly	Developer	3	6%
Luke Hansen	Marketing	12	22%
Karen Meyer	Writer	9	17%
Janice Marcola	Writer	12	23%
Linda Callahan	Testing	5	9%
Dennis Bates	Testing	0	0%

Sheet1 / Sheet2 / Sheet3 / Sheet4 / Sheet5 / Sheet6 / Sheet7 / 9

LearnLinc Client [Minimize] [Maximize] [Close]

File Run Tools Help

Dr. Geoff Gamache



Live from: San Francisco, CA

Mute   

People

Name
Isaiah Beres
Owen Carter
Tom Elliot
Wally Emerson
Ben Frank
Geoff Gamache
Alicia Hoffman

Agenda

 2  25

0	<input type="radio"/> Not much progress
5	<input checked="" type="radio"/> Still working
7	<input type="radio"/> Almost finished
13	<input type="radio"/> Completed



Note: Yes. Could you please review the chapter on formating graphs in Excel?

Raise your hand when you see the AppShare window.

LearnLinc Student

LearnLinc



The screenshot displays a LearnLinc session interface. On the left, a video window shows a man in a white shirt and tie, with a red 'ON AIR' indicator. Below the video is a 'Live from: Detroit, Michigan' status and a 'Mute' button. A 'People' list shows names with colored icons, and a 'Agenda' list shows progress levels. A chat window at the bottom left contains messages from Robbin Jacobs and Julie Wail. The main area shows an Excel spreadsheet titled 'Project Schedule' with a 3D pie chart showing project roles and percentages. A yellow callout box with a lightning bolt points to the video window.

Video Window Instructor or Student

Role	Percentage
Writer (Janice Marcels)	23%
Writer (Kath Meyer)	17%
Marketing (Luke Hanson)	22%
Developer (Brian Larose)	8%
Developer (Jill Donnelly)	6%
Project Lead (Owen Carter)	17%
Testing (Linda Callahan)	0%
Testing (Dennis Bates)	0%

Chat messages:

- Robbin Jacobs: Welcome to project planning with Excel. During the next two hours, we'll cover the basic functions of Excel as they apply to tracking resources, schedules, and expenses.
- Julie Wail (private): Hi, I'm new to the class and I don't have a lot of experience with Excel. Can you give me some resources I can study outside of class to catch up?

Project Schedule

Hours per project
80
40
65
10
12
30
30
15

Role	Name	Percentage
Writer	Janice Marcels	23%
Writer	Karen Meyer	17%
Project Lead	Owen Carter	17%
Marketing	Luke Hansen	22%
Developer	Brian Larose	8%
Developer	Jill Donnelly	6%
Testing	Linda Colahan	0%
Testing	Dennis Bates	0%

Audio Controls

Live from: Detroit, Michigan

Mute

9 25

0 Not much progress
5 Still working
7 Almost finished
18 Completed

Robin Jacobs: Welcome to project planning with Excel. During the next two hours, we'll cover the basic functions of Excel as they apply to tracking resources, schedules, and expenses.

Janice 'Wail' (private): Hi, I'm new to the class and I don't have a lot of experience with Excel. Can you give me some resources I can study outside of class to catch up?

I'll make review materials available to everyone.

Send

ON AIR

Live from: Detroit, Michigan

Mute

Participants:

- Jolene 'Wai
- Dennis Bates
- Luke Hansen
- Jill Donnelly
- Darren Stohler
- Louie Sheehan
- Suzie Dierckel
- Brian LaRose
- Owen Carter
- Karen Meyer
- Mick Brady
- Janice Marcola
- Robin Jacobs

Progress:

- 0 Not much progress
- 5 Still working
- 7 Almost finished
- 18 Completed

Robin Jacobs: Welcome to project planning with Excel. During the next two hours, we'll cover the basic functions of Excel as they apply to tracking resources, schedules, and expenses.

Jolene 'Wai (private): Hi, I'm new to the class and I don't have a lot of experience with Excel. Can you give me some resources I can study outside of class to catch up?

Send

Microsoft Excel - Book2.xls

Project Schedule

Name	Function	Hours this week	Total hours for project
Owen Carter	Project Lead	9	80
Brian LaRose	Developer	3	40
Jill Donnelly	Developer	3	66
Luke Hansen	Marketing	12	10
Karen Meyer	Writer	9	12
Janice Marcola	Writer	12	30
Linda Callahan	Testing	5	30
Dennis Bates	Testing	0	15

Students

HandRaise&Response

Developer
Brian LaRose
6%

Developer
Jill Donnelly
6%

Writer
Karen Meyer
17%

Marketing
Luke Hansen
22%

The screenshot displays a LearnLinc session interface. On the left, a video feed shows a man in a white shirt and tie, with a red 'ON AIR' indicator. Below the video is a 'Live from: Detroit, Michigan' status and a 'Mute' button. A 'People' list on the left shows various participants with colored icons. A progress indicator shows 18 completed tasks. A chat window at the bottom left contains messages from Robin Jacobs and Juliea 'Wall' (private). The main area shows a Microsoft Excel spreadsheet titled 'Project Schedule' with the following data:

Name	Function	Hours this week	Total hours for project
Owen Carter	Project Lead	9	80
Brian LaRose	Developer	3	40
Jill Donnelly	Developer	3	66
Luke Hansen	Marketing	12	10
Karen Meyer	Writer	9	12
Janice Marcola	Writer	12	30
Linda			
Doreen			

Below the spreadsheet is a 3D pie chart showing the distribution of hours: Marketing (Luke Hansen) 22%, Writer (Karen Meyer) 17%, Developer (Brian LaRose) 6%, and Developer (Jill Donnelly) 6%. A large orange box with the text 'Response Summaries' is overlaid on the chart, with a lightning bolt pointing to it.

The screenshot displays a LearnLinc session interface. On the left, a video window shows a man in a white shirt and tie, with a red 'ON AIR' button and a 'Mute' control. Below the video is a list of participants including Colona Wait, Dennis Bates, Luke Hansen, Jill Donnelly, Darren Stahlman, Laura Sheehan, Suzie Dessel, Brian LaRosa, Owen Carter, Karen Meyer, Mick Brady, Janice Marcola, and Robin Jacobs. A progress indicator shows 18 completed and 25 total. A chat window at the bottom left contains messages from Robin Jacobs and a private message from Colona Wait. The main area shows a Microsoft Excel spreadsheet titled 'Project Schedule' with a table of project resources and a 3D pie chart showing the distribution of total hours.

Name	Function	Hours this week	Total hours for project
Owen Carter	Project Lead	9	80
Brian LaRosa	Developer	3	40
Jill Donnelly	Developer	3	65
Luke Hansen	Marketing	12	10
Karen Meyer	Writer	9	12
Janice Marcola	Writer	12	30
Linda Callahan	Testing	5	30
			15


Text Chat Area

Function	Percentage
Project Lead (Owen Carter)	17%
Developer (Brian LaRosa)	6%
Developer (Jill Donnelly)	6%
Marketing (Luke Hansen)	22%
Writer (Karen Meyer)	17%

Project Planning ...

File Edit Tools Help

ON AIR



Live from: Detroit, Michigan

Mute

People

Name
Jolene 'Wal
Dennis Bates
Luke Hansen
Jill Donnelly
Darren Stahlman
Louie Sheehan
Suzie Dierzel
Brian LaRose
Owen Carter
Karen Meyer
Mick Brady
Janice Marcola
Robbin Jacobs

9 25

0 Not much progress
5 Still working
7 Almost finished
18 Completed

Robbin Jacobs: Welcome to project planning with Excel. During the next two hours, we'll cover the basic functions of Excel as they apply to tracking resources, schedules, and expenses.

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Microsoft Excel - Book2.xls

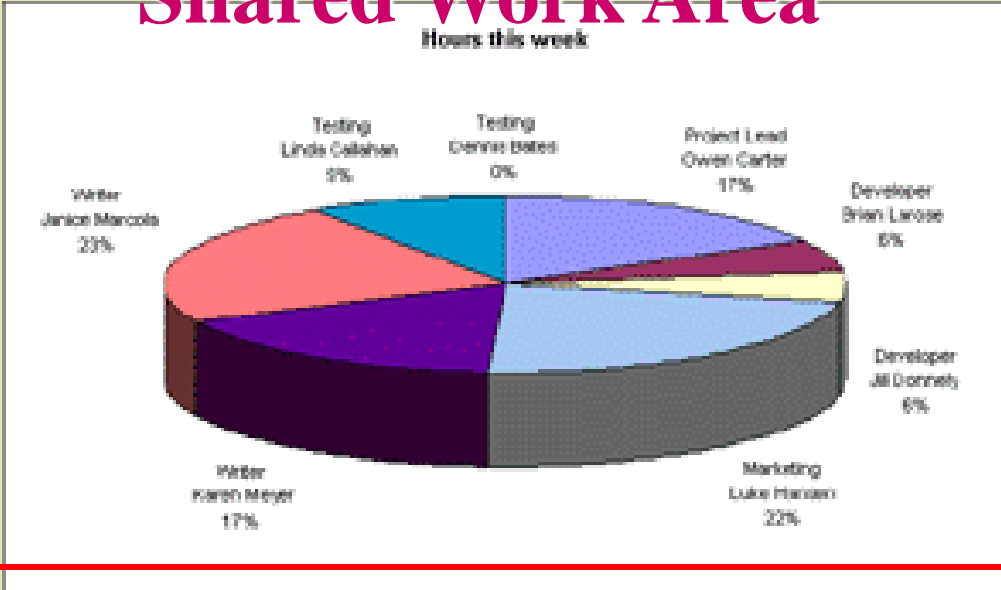
File Edit View Insert Format Tools Data Window Help

100%

Project Schedule

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Jill Donnelly	Developer	3	66
Luke Hansen	Marketing	12	10
Karen Meyer	Writer	9	12
Janice Marcola	Writer	12	30
Linda Callahan	Testing	5	30
Dennis Bates	Testing	0	15

Hours this week



Name	Function	Hours this week	Percentage
Owen Carter	Project Lead	9	17%
Brian LaRose	Developer	3	6%
Jill Donnelly	Developer	3	6%
Luke Hansen	Marketing	12	23%
Karen Meyer	Writer	9	17%
Janice Marcola	Writer	12	23%
Linda Callahan	Testing	5	9%
Dennis Bates	Testing	0	0%

Shared Work Area

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss

Address <http://fargo.dynamicapps.com/learnlinc/TLFrameset.asp> Go Links >>

TESTLINC LearnLinc

TESTING AND ASSESSMENT

Welcome, Paul Smith!

You have Instructor privileges.

You have access to the following folders:

- [Management Classes](#) [Delete Folder](#)
- [New Employee Training](#) [Delete Folder](#)
- [Office 2000 Rollout](#) [Delete Folder](#)

Select a folder to view templates and tests for a topic area, or click New Folder to add a new folder.

[New Folder](#)

Folder List
Virtual Campus
Help

Internet

Test: 2/29/2000 Employee Orientation Test

This test uses the Orientation Test Template

Testing Options

Limit test to 60 minutes

Random question order

Number of times student can take test: 2

Students can access this test...

Starting

Month Day Year Time
2 29 2000 16:24

But not after

Month Day Year Time
3 1 2000 16:24

Grade Posting Options

- Don't show results
- Show final grade only
- Show grades by question
- Show grades and answers

Show results after:

Month Day Year Time
2 29 2000 16:24

Review grades before posting

Publish

Cancel

Test: Office 2000 Overview

Karen Ling

Question	Correct Answer(s)	Student's Answer(s)	Points Available	Points Awarded
Microsoft Office 2000 includes which of the following standard software applications?	1. Word 2000 2. Excel 2000 4. FrontPage 2000	1. Word 2000 2. Excel 2000 4. FrontPage 2000	20	20
The "desktop" is a metaphor used to represent an important part of your computer's graphical user interface (GUI).	True	True	20	20
The Microsoft Office 2000 software application that you can use for word processing is called	Microsoft Word Word	Word	20	20
. Microsoft Excel, another Office 2000 software application, is used to create	spreadsheets forms graphs	graphs		
. To create your corporate intranet site, you could use	Microsoft FrontPage FrontPage	FrontPage		



- Folder List
- Virtual Campus
- Help

Test: Office 2000 Overview

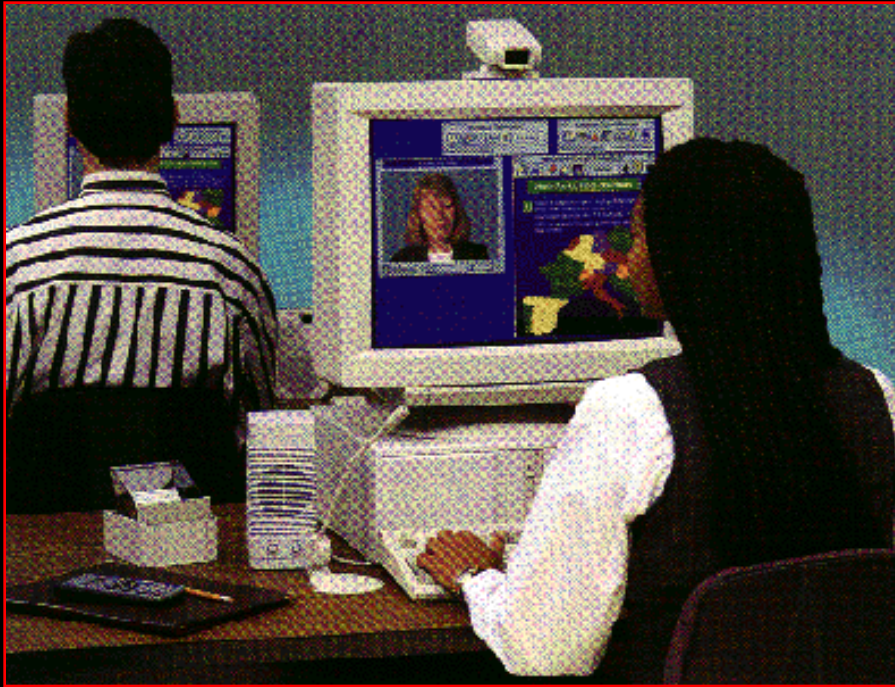
Click a student name to review individual test results.

Student	Date/Time Completed	Duration of Test (minutes)	Total Points	Awaiting Grade	
Arman Stattic	3/2/00 9:13:37 AM	1	80	No	Delete Result
Bernice Campollini	3/2/00 9:37:12 AM	5	60	No	Delete Result
Brian Mann	3/2/00 9:22:39 AM	8	100	No	Delete Result
Jude Sages	3/2/00 9:41:10 AM	1	80	No	Delete Result
Karen Ling	3/2/00 9:38:47 AM	0	100	No	Delete Result
Pamela Fraser	3/2/00 9:29:51 AM	2	73	No	Delete Result
Rumi Platek	3/2/00 9:42:58 AM	0	100	No	Delete Result

Done

View Statistics





- Hand-raising
- Floor passing
- Annotation
- Q and A
- Feedback
- Application sharing
- On-line testing and student record keeping

Vision: the virtual classroom

- Student Centered
- Web of instructors, students, and resources
- Studio model of instruction
- Peer teaching
- Live video and audio plus canned multimedia
- Synchronous (~20%) & Asynchronous instruction
- Lowered unit cost of instruction

- High Bandwidth Internet (Internet II etc.)
 - Video
 - Audio
 - Collaboration
- Regular Internet
 - Audio
 - Collaboration
 - May combine with satellite or ISDN video

- Satellite broadcast
- Hands On Exercises
- Synchronous Tutoring
- Asynchronous support

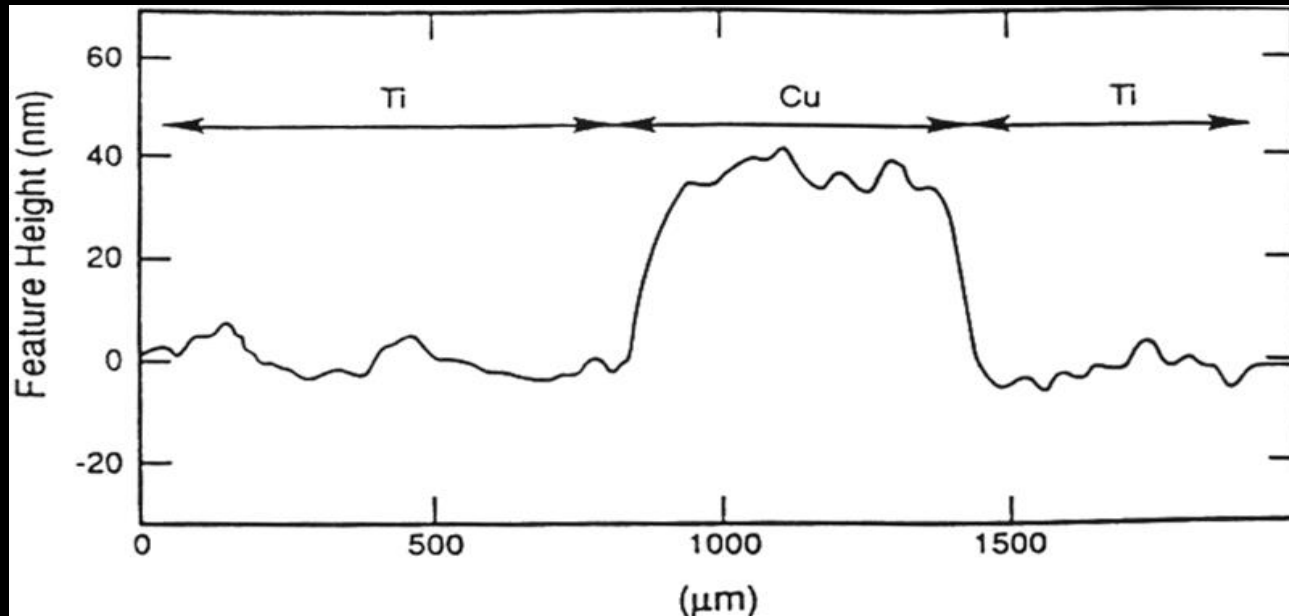
The screenshot displays the LearnLinc software interface. On the left, a 'LearnLinc Video' window shows a young woman smiling. Below it is the 'LearnLinc Floor Control' panel, which includes a list of 'Current Attendees' (James L. Lee, Nicole Smith, Susan Andrews) and buttons for 'Give the floor' and 'All hands down'. To the right, the 'European Economic Marketplace' window is open, displaying 'World Market Place Questions'. Question 4 asks the user to select a country to open a high performance car rental chain using Google National Product information found in the CIA Yearbook. Below the text is a map of Europe with various countries highlighted in different colors (yellow, green, red, purple).

Hands-On World Wide Web

- Feb 10 & 17, 1998
- 8000 participants
- 500 sites
- Most successful NTU course ever
- “The future of satellite based education.”
 - Lionel Baldwin, President, NTU

- Survival Skills for Astrophysics
- Professor Chun Ming Leung
 - Graduate Students in Astrophysics
 - Video/Audio/ **LearnLinc** Web Data Conf.
 - Both ISDN and Internet connection
 - 7 am Eastern (6 Hong Kong)
 - Student Collaborative Presentations
 - One Semester length

- RPI/Intel/Applied Mat./ Matsushita/IBM
 - New York; Osaka, Japan; California; Arizona; Texas
- Murarka, Schowalter, Duquette
 - (Introduction to Copper Metalization)
 - (Wall Street Journal article)
- Month long course to engineers and scientists in the workplace.
- Video/Audio/**LearnLinc** Web data Conf.
 - ISDN and Internet
 - ProShare, PictureTel, Panasonic multipoint



- Profilometer trace showing dishing of the titanium liner relative to the adjacent recessed copper metal. An electrochemical interaction between the copper metal and the titanium accelerated the normally low polish rate of titanium to produce the negative dishing.

- Few high school students studying math & physics
- Lack of qualified teachers
- Rural and inner cities are particularly bad
- Solution:
 - **LearnLinc** used to teach physics over the network
 - Funded by:
 - AT&T
 - Lucent
 - Bell Atlantic
 - IBM

- Introductory Calculus Physics
- Delivered via ILINC **LearnLinc**
- Cobleskill High School in rural upstate NY
- Collaborative between the physics teacher at Cobleskill and faculty and graduate students at Rensselaer



LearnLine Client

File Run Tools Help

Nichole



Live from: San Francisco, CA

Mute

People

Name

- Isaiah Beres
- Owen Carter
- Tom Elliot
- Wally Emerson
- Ben Frank
- Geoff Gamache
- Alicia Hoffman

Agenda

2 25

0 Not much progress

5 Still working

7 Almost finished

13 Completed



Note: Yes. Could you please review the chapter on formating graphs in Excel?

Raise your hand when you see the AppShare window.

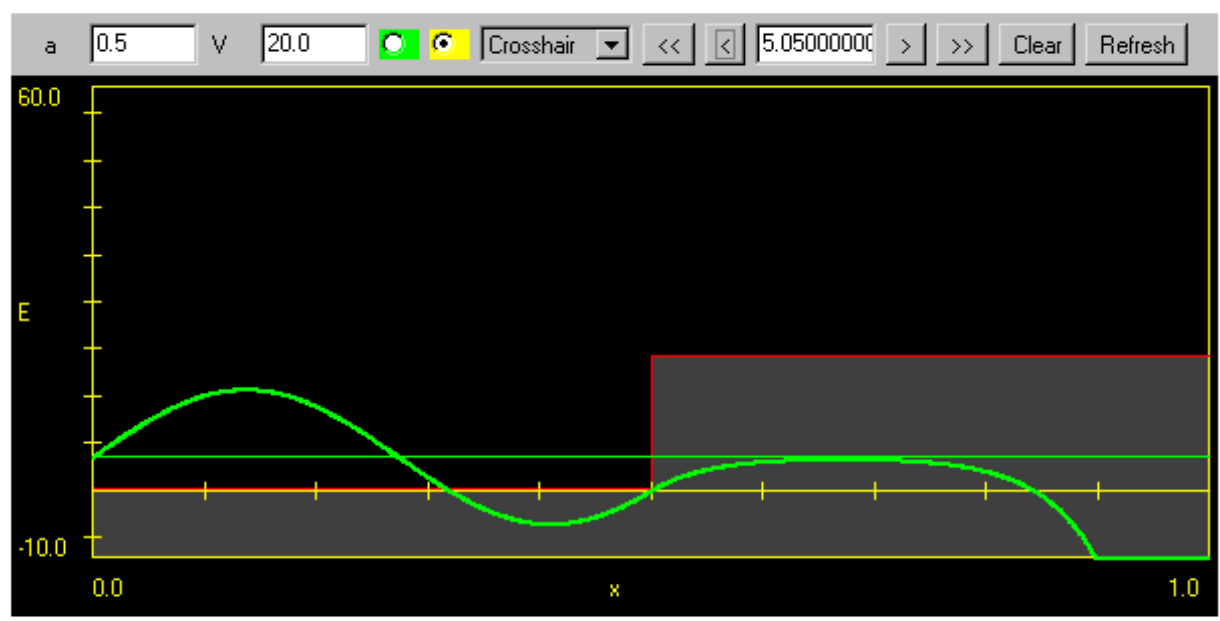
SquareWell - Microsoft Internet Explorer

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This illustrates the solution of a quantum well with an infinite wall at $x=0$ and a finite potential of 20 V at $x=0.5$ nm. - Jack Wilson



Author: Jack Wilson

Using the buttons to each side of the Energy window, you can adjust the energy of the particle in the well to see if the energy leads to a bound state. In a bound state the wavefunction will satisfy the boundry condition at infinity (on the right). It must go to zero to do that. You should find several bound states of the particle for the energy selected here.

Notice that you can select various annotation possibilities, including "Crosshair," "Derivative," "Integral," and "Chalk." You can use each one in combinations with the mouse and mouse button.

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The End

- Management and Technology
 - Gene Simons
 - North America
 - South America
 - Europe
 - Australia
 - Asia
- Face to Face first then PictureTel and Web



- MapInfo

- Founded by four undergraduates and staff member
- \$60.6 million in 1998 rev.(1999 \$70 M est.)
- NASDAQ Stock
- Develops desktop mapping software
- Offices in Beijing and Hong Kong
- Research with campus on software design collaboration across distance and culture