LIKES

Living In the KnowlEdge Society

Santa Clara University

Santa Clara University Workshop

Nov. 29-Dec. 1

Agenda Nov 29– Dec 1

Nov. 29 (Thursday)

5:30-7:00 pm Reception

Nov. 30 (Friday)

7:30-8:30 am Breakfast and registration

8:30-9:30 am Welcome and Keynote Speech by Larry Rowe, FXPAL

9:30-10:30 am Breakout session 1: Defining key terms & identifying non-computing disciplines that would benefit from the teaching of computing skills and concepts (I)

10:30-11:00 am Tea break

11:00-12:00 noon Breakout session 2: Defining key terms & identifying non-computing disciplines that would benefit from the teaching of computing skills and concepts (II)

12:00-1:00 pm Lunch

1:30-3:30 pm Breakout session 3: Identifying skills for a knowledge society

3:30-4:00 pm Tea break

4:00-5:15 pm Breakout session 4: Developing connections between non-computing disciplines, computing & IT disciplines

5:45-8:00 pm Dinner at Fiorillos Restaurant

Dec.1 (Saturday)

7:30-8:30 am Breakfast and registration

8:30-9:30 am Keynote Speech by James Frew

9:30-10:30 am Breakout session 5a: Mapping the needs of non-computing disciplines with the skills and computing concepts taught by computing disciplines (I)
Breakout session 5b: Evaluating the list of computing concepts (Group 1 and Group 2 in computer lab).

10:30-11:00 am Tea break

11:00-12:00 noon Breakout session 6a: Mapping the needs of non-computing disciplines with the skills and computing concepts taught by computing disciplines (I). Same inputs, charge, procedures, and deliverables as 5a.
Breakout session 6b: Evaluating the list of computing concepts (Group3, Group 4, and Group 5 in computer lab). Same inputs, charge, procedures, and deliverables as Session 5b.

12:00-1:00 pm Lunch

1:30-3:30 pm Breakout session 7: Mapping the needs of non-computing disciplines with the concepts & skills taught by computing and IT disciplines (II)

3:30-4:00 pm Tea break

4:00-5:15 pm Concluding session: Report outcomes achieved

5:45-8:00 pm Dinner at Wong's Kitchen Restaurant

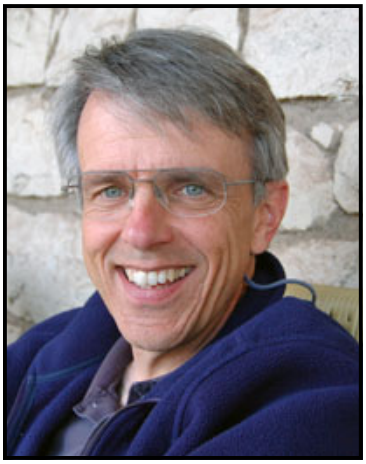
Keynote Speakers

Lawrence A. Rowe

Recently named President of FX Palo Alto Laboratory, which is a leading edge multimedia research organization established by Fuji Xerox. Prior to accepting this position, he was a Professor of Electrical Engineering and Computer Science at U.C. Berkeley for over twenty-five years. He was the founding director of the Berkeley Multimedia Research Center (BMRC), which explored the application of multimedia technology to education and research. BMRC developed the Berkeley Lecture Webcasting System that produces over twenty live/on-demand podcasts and webcasts viewed by over 2M people per semester.

Professor Rowe is both a researcher and entrepreneur. He is known for his research on MPEG-1 video encoding/decoding, Internet webcasting, distributed collaboration, database application development tools, and database management systems.

James Frew



Associate Professor in the Donald Bren School of Environmental Science and Management at the University of California, Santa Barbara (UCSB), and a principal investigator in UCSB's Institute for Computational Earth System Science (ICESS). His research is centered on applications of computing technology to environmental science, particularly involving digital geolibraries and Earth science workflow management.

Dr. Frew received his Ph.D. in Geography from UCSB in 1990. As part of his doctoral research, he developed the Image Processing Workbench, an open-source set of software tools for remote sensing image processing, currently used for instruction and research at UCSB and elsewhere. He has served as both the Manager and the Acting Director of the Computer Systems Laboratory (ICESS' predecessor), and as the Associate Director of the Sequoia 2000 Project, a 3-year $14M multi-campus consortium formed to investigate large-scale data management aspects of global change problems. He was a co-PI on the Alexandria Project (part of NSF's Digital Libraries Initiative), where he directed the development of the Alexandria Digital Earth Prototype (ADEPT) testbed system. Dr. Frew also served on the National Research Council's Committee on Earth Science Data Utilization (CESDU).

Dr. Frew currently leads the Earth System Science Server project (part of the Federation of Earth Science Information Partners), and serves on several NASA advisory committees. During the 2005-2006 academic year he

Researchers

PI Edward A. Fox (Virginia Tech)
Dr. Fox has served as PI or co-PI on 100 research grants. In addition to his courses (e.g., information retrieval, digital libraries) at Virginia Tech, Dr. Fox has taught about 70 tutorials in about 25 countries. He has given about 60 keynote/banquet/international invited/distinguished speaker presentations, about 140 refereed conference/workshop papers, and over 250 additional presentations. He has co-authored/edited 13 books, 83 journal/magazine articles, 37 book chapters, and many reports. Fox holds a Ph.D. and M.S. in Computer Science from Cornell, and a B.S. from M.I.T. Since 1983 he has been at Virginia Tech, where he directs the Digital Library Research Laboratory.

Co-PI Bob Beck (Villanova)
Dr. Beck is professor and chair of the Villanova University Department of Computing Sciences. He has a B.S. in Mathematics from Harvey Mudd College and a Ph.D. in Mathematics from the University of Pennsylvania. His early experiences in computing include writing the simulation of a "teaching machine" for IBM. He teaches courses in programming languages and human computer interaction as well as courses at the interface of computing and biology and an innovative introductory course for non-technical majors.

Co-PI Ed Carr (North Carolina A & T State University)
Mr. Carr is an assistant professor (adjunct) in the Department of Computer Science, North Carolina A&T. He holds an M.S. in Applied Mathematics from Western Carolina University and an M.S. in Computer Science from North Carolina A&T. His research areas are in constraint satisfaction problems, interconnection networks, graph theory, combinatorics, Hamiltonian cycles in directed graphs, vertex transitive graphs, and block designs.

Co-PI Wingyan Chung (Santa Clara University)
Wingyan Chung is an assistant professor in the Department of Operations and Management Information Systems of Santa Clara University. He received a Ph.D. degree in management information systems from The University of Arizona, and MS in IT management and BBA in business administration from The Chinese University of Hong Kong. His research interests include business intelligence, data and text mining, Web analysis and mining, infomation visualization, and human-computer interaction.

Co-PI Carlos Evia (Virginia Tech)
Dr. Evia is an assistant professor of Professional Writing in the English Department at Virginia Tech. He is also a member of the leadership team of the Virginia Tech Center for Innovation in Construction Safety and Health. He received his Ph.D. in Technical Communication and Rhetoric from the Department of English at Texas Tech University in May 2004. He also holds a Master's in Computer Systems from Universidad La Salle, in Mexico City, and an B.A. in Communication from the Instituto de Ciencias Sociales de Mérida, in Yucatan, Mexico.

Co-PI Patrick Fan (Virginia Tech)
Dr. Weiguo (Patrick) Fan is an associate professor of information systems and computer science at Virginia Tech. He received his Ph.D. in Information Systems from the Ross School of Business, University of Michigan, Ann Arbor, in July 2002, a M. Sce in Computer Science from the National University of Singapore in 1997, and a B. E. in Information and Control Engineering from the Xi'an Jiaotong University, P.R. China, in 1995.

Co-PI Steve Sheetz (Virginia Tech)
Dr. Sheetz has a Ph.D. from the University of Colorado. His specializations are object-oriented software engineering, software measurement and psychology of programming.

Co-PI Christopher Zobel (Virginia Tech)
Dr. Zobel is an Associate Professor of Business Information Technology in the Pamplin College of Business. He holds a Ph.D. in Systems Engineering from the University of Virginia, the M.S. in Mathematics from the University of North Carolina at Chapel Hill, and the B.A. in Mathematics from Colgate University. His primary research interests are in the areas of intelligent decision support systems, knowledge engineering, large-scale stochastic decision problems, heuristic problem solving, and computer-based simulation.

Postdoctoral researcher Ryan Richardson (Virginia Tech)
Dr. W. Ryan Richardson is a postdoctoral researcher on the LIKES (Living in the KnowlEdge Society) project. He has a Ph.D. from the Department of Computer Science at Virginia Tech. He holds a B.A. in computer science from Bellarmine University in Louisville, Kentucky, and a M.S. in computer science from Virginia Tech.

Vision

The vision for the LIKES project is to build a community that will define the way to make systemic changes in how computing concepts are taught in both computing-related disciplines and the disciplines of the broader workforce and society. Revitalizing education in computing-related disciplines is necessary to reach a broader audience of potential students and produce a larger number of professionals with the computing competencies and skills that are imperative to designing and building the innovations of the future. More people are needed in all computing-related disciplines, e.g., computer science, information systems, and information technology, to maintain our competitiveness and ensure the health, security, and prosperity of the nation in the face of outsourcing and globalization.

However, it is not sufficient to increase the numbers of computing professionals. The needs of the Knowledge Society also require improvements in the computing competencies and skills of people in all disciplines. This is due to the pervasive and growing needs for computing in society. Many jobs require workers to have the knowledge and abilities to apply computing concepts to accomplishing individual, group, organizational, and societal goals. Yet, most students from non-computing related disciplines have limited opportunities to learn computing concepts. If anything, they only learn rudimentary uses of searching for information, creating reports/presentation and communicating through email. This "computing as simple tool" emphasis is not capable of leveraging the intellectual capabilities of these students. Providing them with the knowledge of computing concepts has the potential to transform their thinking about what they are capable of doing.

Objectives

Each workshop will include a virtual community that is involved prior to the workshop to evaluate the planned activities and enhance the effectiveness of the workshop, then to collaborate on developing reports of the results of the workshops.

The objectives for the first goal of identifying the problems existing in other disciplines include: 1) Identifying different approaches to delivering university core courses across the nation; 2) Identifying disciplines from the university core classes; 3) Recruiting willing faculty from the core disciplines; 4) Working with faculty from the core disciplines to identify the problems they face in teaching key ideas in their domain that they believe could be enhanced by using computer-based tools. The result of this workshop will be an initial list of problems to be addressed and a virtual of community of faculty from computing and other disciplines collaborating to identify problems that can benefit from the application of computing concepts.

The objectives for the second goal of identifying computing concepts and then mapping the concepts to the problems identified include: 1) Bringing together a group with expertise in computing concepts; 2) Reviewing model curriculums for computer science, information systems, and information technology to ensure that the entire range of computing concepts are included; 3) Filling in the cells of the matrix to show the types of tools and modules to be created. This is one of the most important activities of the proposed community building project.

Workshops

#	Title (dates are tentative)	Location
1	Defining Problems and Applications of the Knowledge Society. (Nov-Dec, 2007)	SCU
2	Identifying Computing Concepts for the Knowledge Society. (April, 2008)	NC A&T
3	Learning in the Knowledge Society (October, 2008)	VT
4	Building the Knowledge Society (February, 2009)	Villanova

Wireless Network Access in SCU

Connecting to the Network

If you want to connect your laptop to the SCU wireless network, please use the following information (effective between Nov. 30 and Dec. 2.)

Open a Web browser to see the login page (Enter "SCUWireless" as the passphrase when trying to connect):

Then, on the authentication page, enter the following information.
Username: omisconf
Password: wifiAtSCU
(the password is case sensitive)

If you use Windows XP, you will be asked to download and install a "Cisco Clean Access Agent" after you log on.

More details on configuring your wireless connection are available at: http://it.scu.edu/information/Network/

Using Computers in Kenna Hall

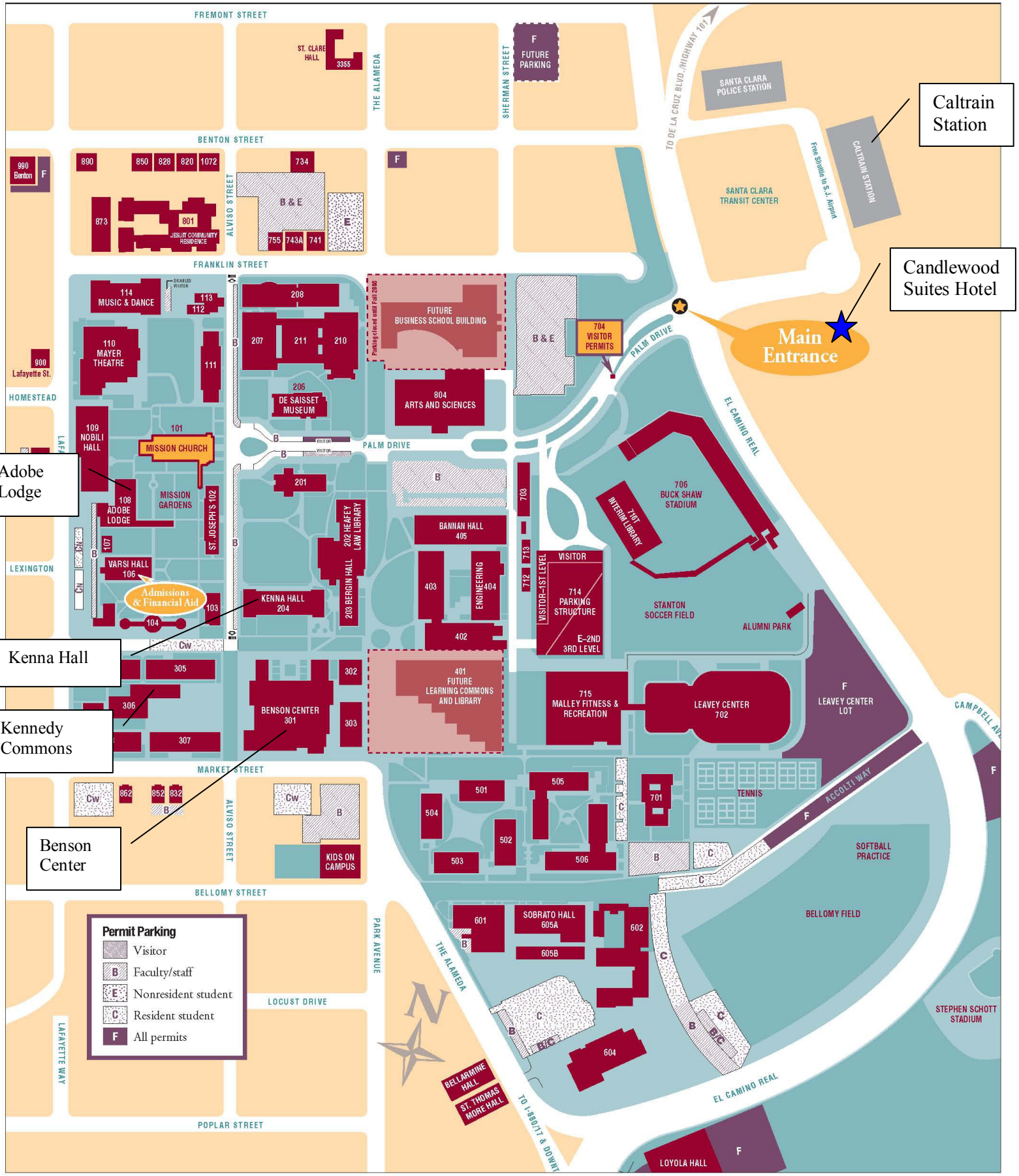
Use the following information to log on the computers in Kenna Hall Room 102 (PC Lab)

Username: student
Password: kenna102
(check the "Workstation only" box)

The Angel Web site is http://angel.scu.edu/. Your Angel username is the same as your email address and the password has been emailed to you. If you don't have an account in Angel, click the "Request an account" and following the instruction to set up an account.

More details on configuring your wireless connection are available at: http://it.scu.edu/information/Network/wireless/. Clean Access Agent installation instructions can be found at http://it.scu.edu/NTG/ NAC/nac-ccaagent.htm.

Santa Clara University Map



Santa Clara Restaurants Map

Fiorillos Restaurant
638 El Camino Real, Santa Clara, CA 95050
(408) 984-0414

Wong's Kitchen
1221 Franklin Mall, Santa Clara, CA 95050
(408) 243-1590

Kennedy Commons
Santa Clara University

Candlewood Suites Hotel
(408) 241-9305

Restaurants & Coffee Shops near SCU

Restaurants

Quiznos Sub
495 El Camino Real, Santa Clara, CA (.03 miles)
408-985-2253

Fiorillo's Restaurant
638 El Camino Real, Santa Clara, CA (.12 miles)
408-984-0414

Mondo Burrito
3300 the Alameda, Santa Clara, CA (.21 miles)
408-260-9596

Henry's Fresh Mexican Grill
787 Franklin St, Santa Clara, CA (.22 miles)
408-249-2922

Blimpie Subs & Salads
1345 Coleman Ave, Santa Clara, CA (.36 miles)
408-727-2800

Togo's
1000 Lafayette St # A, Santa Clara, CA (.37 miles)
408-249-4723

Stuft Pizza
700 Bellomy St, Santa Clara, CA (.37 miles)
408-296-1600

Mc Donald's
1451 Coleman Ave, Santa Clara, CA (.37 miles)
408-748-8961

Penang Village
1290 Coleman Ave, Santa Clara, CA (.39 miles)
408-980-0668

Round Table Pizza
2615 the Alameda, Santa Clara, CA (.41 miles)
408-248-9123

Cluck University Chicken Co
2565 the Alameda, Santa Clara, CA (.44 miles)
408-241-2582

Taco Bell
2555 the Alameda, Santa Clara, CA (.45 miles)
408-244-3397

Jack In the Box
911 El Camino Real, Santa Clara, CA (.53 miles)
408-244-0255

El Chalateco
2323 the Alameda, Santa Clara, CA (.53 miles)
408-243-1357

Choi's Kitchen
930 El Camino Real, Santa Clara, CA (.54 miles)
408-260-0303

C & J's Sports Bar
1550 Lafayette St, Santa Clara, CA (.55 miles)
408-423-9013

Subway Sandwiches & Salads
1171 Homestead Rd #120, Santa Clara (.55 miles)
408-247-2191

Fast Pizza Delivery
341 Lafayette St # 104, Santa Clara, CA (.55 miles)
408-246-1800

Wong's Kitchen
1221 Franklin Mall, Santa Clara, CA (.59 miles)
408-243-1590

Coffee Shops

Starbucks
495 El Camino Real, Santa Clara, CA (.03 miles)
408-248-7343

Smoke This
2271 the Alameda, Santa Clara, CA (.56 miles)
408-247-6653

Coffee On the Patio
1305 N Bascom Ave, San Jose, CA (1.00 miles)
408-296-1112

Gateway Cafe
2025 Gateway Pl # 126, San Jose, CA (1.52 miles)
408-452-1889

It's A Grind Coffee House
90 Skyport Dr # 130, San Jose, CA (1.56 miles)
408-451-9724

Emergency Numbers

	On Campus	Off Campus
Fire, Police, Ambulance	911	911
Campus Ministry	4372	408-554-4372
Campus Safety	4444	408-554-4444
Counseling Center	4172	408-554-4172
Cowell Student Health Center	4501	408-554-4501

	Off Campus
Kaiser Hospital	408-236-4400
O'Connor Hospital	408-947-2666
Rape Crisis Center	408-287-3000
San Jose Medical	408-977-4444
Santa Clara Valley Medical Center	408-885-6950
Suicide Hotline (off campus)	408-279-3312

About Santa Clara University

Located in the heart of California's Silicon Valley, Santa Clara University offers a rigorous undergraduate curriculum in the arts and sciences, business, and engineering. It has nationally recognized graduate and professional schools in business, law, engineering, pastoral ministries, and counseling psychology and education.

The 8,377-student, Catholic, Jesuit university has a 155-year tradition of educating the whole person for a life of service and leadership. This diverse community of scholars, characterized by small classes and a values-oriented curriculum, is dedicated to educating students for competence, conscience, and compassion.

LIKES SCU Workshop Sessions Script

NOV. 30 (FRIDAY)

8:30-9:30 am - Welcome and Keynote Speech 1

Introduce mission of LIKES, introduce speaker and topic, relate topic to mission.

9:30-10:30 am - Breakout session 1

PURPOSE: Defining key terms and identifying non-computing disciplines that would benefit from the teaching of computing skills and concepts (I)

INPUT: List of core courses by discipline.

CHARGE: In this session we are attempting to identify the issues, concepts, and ideas important for non-computing disciplines that will benefit from the application of computing concepts. The input for this session is a list of disciplines and their associated core courses from several universities. Our goal is to use the ideas stimulated by reviewing the disciplines and courses to identify a set of issues, concepts, and ideas from these disciplines where students can obviously benefit from learning how to apply related computing concepts.

PROCEDURES: We will divide into teams of two. Work for 15 minutes reviewing the discipline/course list and brainstorming ideas. Then switch groups and brainstorm ideas in a different pair for 10 minutes. Then switch again and work for 10 more minutes. The group will then come together to summarize the results generated by the pair exercise to form a response for the group to be presented in the next session. This group process will include 10 minutes for combining the lists from the paired teams, followed by 10 minutes to expand the list of concepts across disciplines, then followed by 10 minutes to prioritize lists of items the group will present to the workshop.

The first paired session starts with a brainstorming session of 5 minutes intended to identify a breadth of issues without considering or limiting them by their computability or other criteria. Each pair will respond to the question: “What are the broad range of ideas

of these disciplines that are addressed by these courses?" (both people generate ideas and take notes) Next, each pair works for 10 minutes discussing the ideas generated and attempting to expand the list. Participants move onto the next pair with as long a list of ideas as possible.

The second paired session starts with comparing and combining the lists from the previous pairs. The new pair then attempts to expand the combined list. Each pair responds to the question: "What ideas or issues are related to items on the combined list?" Participants move onto the next pair with a list that has 50% more items than the incoming list.

The third paired session starts with comparing and combining the lists from the previous pairs. The new pair then attempts to sort the list into sets of high, medium, and low priority. Each pair responds to the question: "Which of these ideas or issues are most important to the discipline and/or society at large?" Participants move on to the next workshop session with the list of sorted items.

DELIVERABLES: List of key issues, concepts, and ideas sorted by priority.

10:30-11:00 am - Tea break

11:00-12:00 noon - Breakout session 2

PURPOSE: Defining key terms and identifying non-computing disciplines that would benefit from the teaching of computing skills and concepts (II)

INPUT: List of key issues, concepts, and ideas.

CHARGE: In this session we will combine the results of the first session for all groups and identify a set of categories that covers the set of issues, concepts, and ideas identified. Each group will present their list. During this process we are attempting to identify the issues, concepts, and ideas that were identified by multiple groups and those that are unique but interesting from a breadth of appeal or depth of coverage perspective. Then we will try to identify a set of category definitions that capture the meanings shared by the multiple issues, concepts, and ideas identified by all groups.

PROCEDURES: Each group will have 5 minutes to present their list of key issues, concepts, and ideas. For the next 10 minutes the entire workshop will systematically define a master list of the issues, concepts, and ideas identified. Then, in the next 20 minutes we will use a round-robin process asking each group to recommend a category that would contain a set of similar concepts, continuing until a complete set of categories is identified. The categories and the ideas they represent will be used in the next session of the workshop.

DELIVERABLES: A shared list (one the attendees can agree is important) of key issues, concepts, and ideas from non-computing disciplines and a list of categories that group similar issues, concepts, and ideas.

12:00-1:00 pm - Lunch

1:30-3:30 pm - Breakout session 3

PURPOSE: Identifying computing concepts for a knowledge society

INPUTS: Categories of non-computing concepts and ideas, Model curricula from computing disciplines, Spreadsheet for recording computing-concept category relationships.

CHARGE: In this session we are attempting to identify the key computing concepts needed for knowledge workers in non-computing disciplines. These computing concepts are related to the categories of issues, concepts, and ideas identified in the morning sessions. The model curricula of the computer science, information systems, and information technology disciplines provide a succinct yet broad collection of computing concepts currently taught to undergraduates in computing disciplines. Our goal is to integrate the responses from the morning processes of identifying non-computing discipline issues, concepts, and categories that group them by similarity, with summaries of the computing concepts contained in model computing curricula to identify the computing concepts that are implied from the categories, issues, concepts, and ideas previously defined. This process is intended to identify the set of potential computing concepts that will be relevant to students of non-computing disciplines.

PROCEDURES: The procedures for this session consist of two parts, the first part is a series of participant exercises (done in pairs) and the second part is a group process to combine the result of the paired exercises.

We will divide into teams of two. Work for 20 minutes to reviewthe computing concepts in the computing curricula and to attempt to identify the categories of similar issues, concepts, and ideas that benefit from the computing concepts identified in the curricula. Then switch groups and brainstorm ideas in a different pair for 20 minutes. Then switch again and work for 20 more minutes. The group will then come together to summarize the results generated by the pair exercise to form a response for the group to be presented in the next session.

There will be three pairs per group and three pairings in this session. The following matrix shows the individual pairings and identifies the curricula each pair will evaluate in a pairing activity. This approach provides for each participant to evaluate each curriculum with a different partner such that no person works with another person or on the same curriculum more than once during this session.

Pairing	Pair 1	Pair 2	Pair 3
First	I1, I2, with CS	I3, I4 with IS	I5, I6 with IT
Second	I1, I3, with IT	I2, I5, with IS	I4, I6, with CS
Third	I1, I6, with IS	I2, I4, with IT	I3, I5, with CS

This process results in each computing concept of each curriculum being assigned categories by three different pairs, such that each individual has the opportunity to evaluate each curriculum.

During each pairing, the participants will attempt to identify the categories of issues in which a student in a non-computing discipline can benefit by learning the computing concepts identified in a model curriculum. Participants will respond to the question:

"What categories of non-computing issues, concepts, and ideas benefit from the knowledge represented by this computing concept?"

The group will then come together and combine the results of the pair exercises to identify the categories of concepts that can be supported by the computing concepts from each computing discipline. The group will spend 15 minutes identifying the categories for each computing concept in the CS curriculum, followed by 15 minutes identifying the categories for each computing concept in the IS curriculum, and then 15 minutes identifying categories for each computing concept in the IT curriculum. Lastly, the group will have 15 minutes to attempt to identify the computing concepts that are related to the most disciplines.

DELIVERABLES: List of knowledge worker computing concepts and the categories of non-computing issues, ideas, and concepts that need them, listed by computing discipline curriculum.

3:30-4:00 pm - Tea break

4:00-5:00 pm - Breakout session 4

PURPOSE: Developing connections between non-computing disciplines and computing disciplines

INPUTS: List of knowledge worker computing concepts and the categories of non-computing issues, ideas, and concepts that need them, listed by computing discipline curriculum from Session 3; Discipline spreadsheet for recording categories.

CHARGE: In this session we will systematically use the results of the mapping of computing discipline computing concepts to the categories of non-computing disciplines' concepts to identify the list of non-computing disciplines that are related to each computing discipline.

PROCEDURES: Each group will be assigned a computing discipline and work as a group to enter the categories in the cells for their discipline for each non-computing discipline. This

process will continue for 30 minutes. Then each group will present the results of their assignments to the entire workshop.

DELIVERABLES: Matrix of non-computing disciplines as rows with computing disciplines as columns. Each cell contains the categories of issues, concepts, and ideas from the non-computing discipline with the matching computing concepts of the computing discipline.

5:45-8:00 pm – Dinner

DEC. 1 (SATURDAY)

7:30-8:30 am - Breakfast and registration

8:30-9:30 am - Keynote Speech 2

9:30-10:30 am - Breakout session 5a

PURPOSE: Mapping the needs of non-computing disciplines with the skills and computing concepts taught by computing disciplines (I)

INPUTS: List of computing concepts, Categories of non-computing concepts and issues, Matrix of computing and non-computing disciplines

CHARGE: In this session we are attempting to identify the range of computing concepts relevant for each of the categories of non-computing concepts, issues, and ideas. This session is motivated in part by the desire to identify the computing concepts with the broadest possible impacts to ensure that those concepts become elements of the LIKES project. The question to ask ourselves for each category of non-computing concepts is: "What computing concepts are relevant for this category of non-computing concepts?" Computing concepts should be selected from the list developed in a previous session and the categories of non-computing concepts also come from a previous session. Our goal is

to use the mapping of computing concepts to categories of non-computing concepts for two purposes. First, this mapping is needed to identify the computing concepts that can make the largest difference for advancing the broader society aspect of the LIKES project. Second, associating computing concepts with as many categories of non-computing concepts as possible provides a reservoir of varied and interesting problem domains that can be drawn upon by computing disciplines when teaching the computing concept. This is a substantive benefit of the LIKES project.

PROCEDURES: We will divide into teams of two. Each team of two will be assigned a subset of categories of non-computing concepts to ensure that all categories are evaluated. Work for 15 minutes taking each the categories of computing concepts from day 1 and attempting to identify items from the list of computing concepts that apply to the category. Then switch groups and brainstorm ideas in a different pair for 15 minutes. Then switch again and work for 15 more minutes. The group will then come together to summarize the results generated by the pair exercises to form a response for the group to be presented in the next session. This group process will be 15 minutes and consist of combining the lists of computing concepts for each category from the paired teams.

During each pairing participants should systematically consider each of their categories of non-computing concepts and identify the items from the list of computing concepts that are associated with the category. (concepts should be recorded in the category spreadsheet)

The second paired session starts with identifying any categories assigned to the first pairs that were not evaluated by them. After systematically evaluating these remaining categories, the new pair will attempt to expand the computing concepts associated with each category.

The third paired session starts with identifying any categories assigned to the first pairs that were not evaluated by them or the second pairs. After systematically evaluating these remaining categories, the new pair will attempt to expand the computing concepts associated with each category.

DELIVERABLES: List of computing concepts for each category of non-computing concepts.

9:30-10:30 am - Breakout session 5b

PURPOSE: Evaluating the list of computing concepts (Group 1 and Group 2 in computer lab).

INPUTS: List of computing concepts.

CHARGE: In this session we are attempting to identify the computing concepts that are most important to society, that may be easiest for students to learn, and identify potential relationships between learning these concepts. First, it would be useful to know which computing concepts and skills may be the most important to the advancement of society. In times of limited resources, it may be necessary to select only some computing concepts for implementation efforts. Perhaps selecting concepts by their perceived value to society is an ideal way to focus resources. Second, it would be useful to know which computing concepts are easiest for students to learn. The easiest to learn categories may be candidates for early implementation or for delivery through distance learning techniques. Finally, some computing concepts may be easier to learn after (or before) learning other computing concepts. It would be useful to know which concepts are related to learning other concepts.

PROCEDURES: We will use the computer lab. Each participant will use a computer to respond to two sets of surveys/polls. The first set of polls will take 15 minutes to identify the relative importance of the computing concepts to society. Participants will respond to a poll where they indicate the relative importance of each concept. The responses of the participants will be averaged and the results will be displayed to the participants. The participants will then verbally discuss the relative importance assigned to the concepts. For example some participants may say why one concept that was rated highly important by the group really is not so important or vice versa. Participants will then respond to a second poll about the importance of the computing concepts and the average importance ratings of the concepts will be displayed. The group will discuss the resulting ratings of the categories.

The second series of polls will take 15 minutes to identify the computing concepts that are the most “easy to learn.” Participants will respond to a poll where they indicate the

relative ease of learning of each computing concept. The responses of the participants will be averaged and the results will be displayed to the participants. The participants will then discuss the relative ease of learning determined for the computing concepts. For example, some participants may say why one concept that was rated as easy to learn by the group, may not be so easy to learn under some circumstances. Participants will then respond to a second “easy to learn” poll and the average easy to learn ratings of the concepts will be displayed. The group will discuss the resulting ratings of the concepts.

In the third activity of this session, participants will spend 15 minutes identifying relationships among the computing concepts. Each participant will have a whiteboard page with the concepts arranged in a circle, and the line tool will be open on the whiteboard page. Each participant will draw a line to connect concepts they perceive to be related. For each pair a participant identifies he/she will complete the following sentence: Learning of concept _____ has a positive (blue line) or negative (red line) influence on learning the computing concept(s) _____. Then connect the concepts on the whiteboard using the appropriate line color and arrowhead to show the direction of the influence. The last 15 minutes of this session will be a group process where a shared whiteboard will be used to record relationships suggested by and generally agreed on by participants.

DELIVERABLES: Ranking of computing concepts by importance to society, Ranking of computing concepts by ease of learning, Map of learning relationships among computing concepts.

10:30-11:00 am - Tea break

11:00-12:00 noon - Breakout session 6a

PURPOSE: Mapping the needs of non-computing disciplines with the skills and computing concepts taught by computing disciplines (I)

Same inputs, charge, procedures, and deliverables as Session 5a.

11:00-12:00 am - Breakout session 6b

PURPOSE: Evaluating the list of computing concepts (Group3, Group 4, and Group 5 in computer lab).

Same inputs, charge, procedures, and deliverables as Session 5b.

12:00-1:00 pm - Lunch

1:30-3:30 pm - Breakout session 7

PURPOSE: Mapping the needs of non-computing disciplines with the concepts and computing concepts taught by computing and IT disciplines (II)

INPUTS: List of computing concepts, Categories of non-computing concepts and issues, Matrix of computing and non-computing disciplines

CHARGE: In this session we are attempting two things. First we want to identify how the categories of non-computing concepts, issues, and ideas can be used to enhance the education of the students in computing disciplines. This is motivated in part by the desire to bring problem domains more closely into teaching computing concepts so that students in computing disciplines make better connections to “real-world” problems as they are learning computing concepts. For example, designing a database to track aid distribution after a natural disaster may have more meaning to students than designing a database to model a more esoteric problem, e.g., tracking video game scores by player. This involves transposing the matrix of categories of non-computing concepts and lists of computing concepts and attempting to identify those non-computing concepts that may be useful for teaching advanced computing concepts, i.e., for students in computing disciplines.

PROCEDURES: Identifying interesting problems for the computing concepts involves transposing the matrix of categories of non-computing concepts by lists of computing concepts. We will divide into teams of two. Each team of two will be assigned a subset of computing concepts to ensure that all computing concepts are evaluated. Work for 15 minutes taking each concept on the list of computing concepts from day 1 and using the categories of non-computing concepts to which it was assigned in the previous session and attempt to identify sample problems implied by the category of non-computing

concepts that could be used when teaching the computing concept. Then switch groups and brainstorm ideas in a different pair for 15 minutes. Then switch again and work for 15 more minutes, this time using the list of professions, businesses, and government agencies as an aid to suggest problems useful for teaching computing concepts. The group will then come together to summarize the results generated by the pair exercises to form a response for the group. This group process will be 15 minutes and consist of combining the lists of computing concepts for each category from the paired teams.

During each pairing participants should systematically consider each of their computing concepts and identify the items suggested by the list of categories of non-computing concepts that were previously associated with the category. (sample problems should be recorded in the category spreadsheet)

The second paired session starts with identifying any computing concepts assigned to the first pairs that were not evaluated by them. After systematically evaluating these remaining concepts, the new pair will attempt to expand the potential problems associated with a computing concept by looking at related computing concepts for problems already associated with those concepts.

The third paired session starts with dividing the list of professions among the three pairs. Each pair then attempts to identify additional problems associated with the computing concept using the list of professions, businesses, and government agencies. The group will then come together for 15 minutes to summarize the problems identified by the pairs for each of the computing concepts.

Next, the group will evaluate the combined results of the workshop. This will involve reviewing the various deliverables from previous sessions, recommending elements of the results to emphasize in the report, and suggesting an agenda for continuing communication after the workshop. The group will prepare a 10 minute summary that they will present at the concluding workshop session.

DELIVERABLES: List of problems for computing concepts derived from categories of non-computing disciplines. Review of results of the workshop, list items to emphasize in the workshop report, and recommendations for continuing communications.

3:30-4:00 pm - Tea break

4:00-5:15 pm - Concluding session

PURPOSE: Reporting of outcomes achieved

INPUTS: Outputs of previous sessions: List of computing concepts for categories of non-computing concepts; List of professions, businesses, and organizations; Matrix of computing and non-computing disciplines; Rankings of computing concepts.

CHARGE: In this session we are attempting to use the results of previous sessions to summarize what was learned at the workshop. Items to be reviewed will include the following: The list of categories of non-computing concepts; the list of computing concepts; the rankings of computing concepts; the list of computing concepts by category of non-computing concepts. The group will discuss various approaches for evaluating the results and discuss the primary findings to be highlighted in the workshop report.

PROCEDURES: Each group will have 10 minutes to present what they believe are the primary results of the workshop and to suggest what to emphasize in the report. We will then have 25 minutes to combine the views of the groups to provide guidance for report development.

DELIVERABLES: Guidelines for emphasizing aspects of the workshop report and recommendations for continuing communication.

5:45-8:00 pm - Dinner

Group Assignment

* Indicates group leader for facilitating procedures.

Friday

Group 1
*Bob Beck (CS)
Suzanne Schaefer (CS)
Craig Stephens, SCU (Bio)
Mialisa Moline (C&W)
Mehren Sahami (CS)
Matthew Jockers (Eng)
John Hoffman (Industry)

Group 2
*Patrick Fan (IT)
Jerry Suits (Chem)
James Frew (Geog)
Ellen Spertus (CS)
Dickie Selfe (Writing)
David Tauck, SCU (Bio)
Ghaleb Abdulla (CS)

Group 3
Ed Fox (CS)
Kelly Detweiler, SCU (Art)
Richard Plant (Bio)
Ken Williams (CS)
Shelby McIntyre, SCU (Marketing)
Tim Hesterberg (Stats)
*Chris Zobel (IT)

Group 4
*Steve Sheetz (IT)
Jarom McDonald (Eng)
Nancy Cheng (Architecture)
Ryan Richardson (CS)
Narendra Agrawal, SCU (IT)
Ge Wang (Music)
Chaiho Kim (IT)

Group 5
*Carlos Evia (Writing)
Jill Pellettieri (Modern Languages)
Judith Kirkpatrick (English)
Norm Chonacky (CS)
Ed Carr (CS)
Wingyan Chung, SCU (IT)

Saturday

Group 1
Chris Zobel (IT)
Suzanne Schaefer (CS)
Jerry Suits (Chem)
James Frew (Geog)
Jarom McDonald (Eng)
*Steve Sheetz (IT)
Ge Wang (Music)

Group 2
*Ed Carr (CS)
Craig Stephens, SCU (Bio)
Ellen Spertus (CS)
Kelly Detweiler, SCU (Art)
Richard Plant (Bio)
Nancy Cheng (Architecture)
Patrick Fan (IT)

Group 3
*Carlos Evia (Writing)
Mehren Sahami (CS)
David Tauck, SCU (Bio)
Ken Williams (CS)
Ryan Richardson (CS)
Matthew Jockers (Eng)
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*Ed Fox (CS)
Mialisa Moline (C&W)
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Norm Chonacky (CS)

Group 5
*Bob Beck (CS)
Wingyan Chung, SCU (IT)
Dickie Selfe (Writing)
Ghaleb Abdulla (CS)
Tim Hesterberg (Stats)
Judith Kirkpatrick (English)
Jill Pellettieri (Modern Languages)

Curriculum Materials

Computer Science Body of Knowledge (2001)
The Information Technology Body of Knowledge (2005)

Undergraduate Core Curricula

Virginia State University and Polytechnic Institute
Villanova University
Boston College
Wake Forest University
Bucknell University
Santa Clara University

Figure 5-1. Computer science body of knowledge with core topics underlined

DS. Discrete Structures (43 core hours)
- DS1. Functions, relations, and sets (6)
- DS2. Basic logic (10)
- DS3. Proof techniques (12)
- DS4. Basics of counting (5)
- DS5. Graphs and trees (4)
- DS6. Discrete probability (6)

PF. Programming Fundamentals (38 core hours)
- PF1. Fundamental programming constructs (9)
- PF2. Algorithms and problem-solving (6)
- PF3. Fundamental data structures (14)
- PF4. Recursion (5)
- PF5. Event-driven programming (4)

AL. Algorithms and Complexity (31 core hours)
- AL1. Basic algorithmic analysis (4)
- AL2. Algorithmic strategies (6)
- AL3. Fundamental computing algorithms (12)
- AL4. Distributed algorithms (3)
- AL5. Basic computability (6)
- AL6. The complexity classes P and NP
- AL7. Automata theory
- AL8. Advanced algorithmic analysis
- AL9. Cryptographic algorithms
- AL10. Geometric algorithms
- AL11. Parallel algorithms

AR. Architecture and Organization (36 core hours)
- AR1. Digital logic and digital systems (6)
- AR2. Machine level representation of data (3)
- AR3. Assembly level machine organization (9)
- AR4. Memory system organization and architecture (5)
- AR5. Interfacing and communication (3)
- AR6. Functional organization (7)
- AR7. Multiprocessing and alternative architectures (3)
- AR8. Performance enhancements
- AR9. Architecture for networks and distributed systems

OS. Operating Systems (18 core hours)
- OS1. Overview of operating systems (2)
- OS2. Operating system principles (2)
- OS3. Concurrency (6)
- OS4. Scheduling and dispatch (3)
- OS5. Memory management (5)
- OS6. Device management
- OS7. Security and protection
- OS8. File systems
- OS9. Real-time and embedded systems
- OS10. Fault tolerance
- OS11. System performance evaluation
- OS12. Scripting

NC. Net-Centric Computing (15 core hours)
- NC1. Introduction to net-centric computing (2)
- NC2. Communication and networking (7)
- NC3. Network security (3)
- NC4. The web as an example of client-server computing (3)
- NC5. Building web applications
- NC6. Network management
- NC7. Compression and decompression
- NC8. Multimedia data technologies
- NC9. Wireless and mobile computing

PL. Programming Languages (21 core hours)
- PL1. Overview of programming languages (2)
- PL2. Virtual machines (1)
- PL3. Introduction to language translation (2)
- PL4. Declarations and types (3)
- PL5. Abstraction mechanisms (3)
- PL6. Object-oriented programming (10)
- PL7. Functional programming
- PL8. Language translation systems
- PL9. Type systems
- PL10. Programming language semantics
- PL11. Programming language design

Note: The numbers in parentheses represent the minimum number of hours required to cover this material in a lecture format. It is always appropriate to include more.

HC. Human-Computer Interaction (8 core hours)
- HC1. Foundations of human-computer interaction (6)
- HC2. Building a simple graphical user interface (2)
- HC3. Human-centered software evaluation
- HC4. Human-centered software development
- HC5. Graphical user-interface design
- HC6. Graphical user-interface programming
- HC7. HCI aspects of multimedia systems
- HC8. HCI aspects of collaboration and communication

GV. Graphics and Visual Computing (3 core hours)
- GV1. Fundamental techniques in graphics (2)
- GV2. Graphic systems (1)
- GV3. Graphic communication
- GV4. Geometric modeling
- GV5. Basic rendering
- GV6. Advanced rendering
- GV7. Advanced techniques
- GV8. Computer animation
- GV9. Visualization
- GV10. Virtual reality
- GV11. Computer vision

IS. Intelligent Systems (10 core hours)
- IS1. Fundamental issues in intelligent systems (1)
- IS2. Search and constraint satisfaction (5)
- IS3. Knowledge representation and reasoning (4)
- IS4. Advanced search
- IS5. Advanced knowledge representation and reasoning
- IS6. Agents
- IS7. Natural language processing
- IS8. Machine learning and neural networks
- IS9. AI planning systems
- IS10. Robotics

IM. Information Management (10 core hours)
- IM1. Information models and systems (3)
- IM2. Database systems (3)
- IM3. Data modeling (4)
- IM4. Relational databases
- IM5. Database query languages
- IM6. Relational database design
- IM7. Transaction processing
- IM8. Distributed databases
- IM9. Physical database design
- IM10. Data mining
- IM11. Information storage and retrieval
- IM12. Hypertext and hypermedia
- IM13. Multimedia information and systems
- IM14. Digital libraries

SP. Social and Professional Issues (16 core hours)
- SP1. History of computing (1)
- SP2. Social context of computing (3)
- SP3. Methods and tools of analysis (2)
- SP4. Professional and ethical responsibilities (3)
- SP5. Risks and liabilities of computer-based systems (2)
- SP6. Intellectual property (3)
- SP7. Privacy and civil liberties (2)
- SP8. Computer crime
- SP9. Economic issues in computing
- SP10. Philosophical frameworks

SE. Software Engineering (31 core hours)
- SE1. Software design (8)
- SE2. Using APIs (5)
- SE3. Software tools and environments (3)
- SE4. Software processes (2)
- SE5. Software requirements and specifications (4)
- SE6. Software validation (3)
- SE7. Software evolution (3)
- SE8. Software project management (3)
- SE9. Component-based computing
- SE10. Formal methods
- SE11. Software reliability
- SE12. Specialized systems development

CN. Computational Science (no core hours)
- CN1. Numerical analysis
- CN2. Operations research
- CN3. Modeling and simulation
- CN4. High-performance computing

Figure 6-2. Coverage of core units
Imperative-first introduction
Traditional topic-based approach

	CS111 I. Intro to Programming	CS112 I. Data Abstraction	CS115. Discrete Structures	CS210 T. Algorithm Analysis	CS220 T. Computer Architecture	CS225 T. Operating Systems	CS230 T. Net-centric Computing	CS260 T. Artificial Intelligence	CS270 T. Databases	CS280 T. Social and Prof Issues	CS290 T. Software Development	CS490. Capstone Project	Total	Extra hours
DS1. Functions, relations, and sets			6										6	
DS2. Basic logic			10										10	
DS3. Proof techniques			9	3									12	
DS4. Basics of counting			5										5	
DS5. Graphs and trees		2		4									6	+2
DS6. Discrete probability			6										6	
PF1. Fundamental programming constructs	9												9	
PF2. Algorithms and problem-solving	3			3									6	
PF3. Fundamental data structures	6	6		3									15	+1
PF4. Recursion		5											5	
PF5. Event-driven programming							2				4		6	+2
AL1. Basic algorithmic analysis		2		2									4	
AL2. Algorithmic strategies				6									6	
AL3. Fundamental computing algorithms	2	4		6									12	
AL4. Distributed algorithms						3							3	
AL5. Basic computability	1			6									7	+1
AR1. Digital logic and digital systems			3		3								6	
AR2. Machine level representation of data	1				3								4	+1
AR3. Assembly level machine organization	2				9								11	+2
AR4. Memory system organization and architecture					5								5	
AR5. Interfacing and communication					3								3	
AR6. Functional organization					7								7	
AR7. Multiprocessing and alternative architectures					3								3	
OS1. Overview of operating systems						2							2	
OS2. Operating system principles						2							2	
OS3. Concurrency						6							6	
OS4. Scheduling and dispatch						3							3	
OS5. Memory management						5							5	
NC1. Introduction to net-centric computing							2						2	
NC2. Communication and networking							7						7	
NC3. Network security							3						3	
NC4. The web as an example of client-server computing							3						3	
PL1. Overview of programming languages	1	1											2	
PL2. Virtual machines		1											1	
PL3. Introduction to language translation		2		2									4	+2
PL4. Declarations and types	1	2											3	
PL5. Abstraction mechanisms	2	1											3	
PL6. Object-oriented programming	3	7					2						12	+2
HC1. Foundations of human-computer interaction									2		6	2	10	+4
HC2. Building a simple graphical user interface											2		2	
GV1. Fundamental techniques in graphics	2										2		4	+2
GV2. Graphic systems											1		1	
IS1. Fundamental issues in intelligent systems								1					1	
IS2. Search and constraint satisfaction								5					5	
IS3. Knowledge representation and reasoning								4					4	
IM1. Information models and systems									3				3	
IM2. Database systems									3				3	
IM3. Data modeling									4				4	
SP1. History of computing	1									1			2	+1
SP2. Social context of computing										3			3	
SP3. Methods and tools of analysis										2			2	
SP4. Professional and ethical responsibilities										3			3	
SP5. Risks and liabilities of computer-based systems										2			2	
SP6. Intellectual property									3	3			6	+3
SP7. Privacy and civil liberties									2	2			4	+2
SE1. Software design	2	2									2	4	10	+2
SE2. Using APIs		2									3	3	8	+3
SE3. Software tools and environments	1	2									2	3	8	+5
SE4. Software processes												2	2	
SE5. Software requirements and specifications	1										2	2	5	+1
SE6. Software validation	1										1	3	5	+2
SE7. Software evolution											2	2	4	+1
SE8. Software project management											2	3	5	+2
	39	39	39	35	33	21	19	10	17	16	29	24		

Figure 6-3. Coverage of core units
Objects-first introduction
Compressed approach

	CS111 O. OO Programming	CS112 O. OO Design	CS115. Discrete Structures	CS210 C. Algorithm Analysis	CS220 C. Computer Architecture	CS226 C. OS and Networking	CS262 C. Info+Knowledge Mgmt	CS292 C. Software Dev and Practice	Total	Extra hours
DS1. Functions, relations, and sets			6						6	
DS2. Basic logic			10						10	
DS3. Proof techniques			9	3					12	
DS4. Basics of counting			5						5	
DS5. Graphs and trees				4					4	
DS6. Discrete probability			6						6	
PF1. Fundamental programming constructs	7	2							9	
PF2. Algorithms and problem-solving	2	2		3					7	+1
PF3. Fundamental data structures	3	8		3					14	
PF4. Recursion	2	3							5	
PF5. Event-driven programming		2				2		2	6	+2
AL1. Basic algorithmic analysis		2		2					4	
AL2. Algorithmic strategies		2		6					8	+2
AL3. Fundamental computing algorithms	3	3		6					12	
AL4. Distributed algorithms						3			3	
AL5. Basic computability	1			6					7	+1
AR1. Digital logic and digital systems			3		3				6	
AR2. Machine level representation of data					3				3	
AR3. Assembly level machine organization					9				9	
AR4. Memory system organization and architecture					5				5	
AR5. Interfacing and communication					3				3	
AR6. Functional organization					7				7	
AR7. Multiprocessing and alternative architectures					3				3	
OS1. Overview of operating systems						2			2	
OS2. Operating system principles						2			2	
OS3. Concurrency						6			6	
OS4. Scheduling and dispatch						3			3	
OS5. Memory management						5			5	
NC1. Introduction to net-centric computing						2			2	
NC2. Communication and networking						7			7	
NC3. Network security						3			3	
NC4. The web as an example of client-server computing						3			3	
PL1. Overview of programming languages		2							2	
PL2. Virtual machines		1							1	
PL3. Introduction to language translation				2					2	
PL4. Declarations and types	2	1							3	
PL5. Abstraction mechanisms	1	2							3	
PL6. Object-oriented programming	8	4				2			14	+4
HC1. Foundations of human-computer interaction		1					4	2	7	+1
HC2. Building a simple graphical user interface								2	2	
GV1. Fundamental techniques in graphics	2							2	4	+2
GV2. Graphic systems								1	1	
IS1. Fundamental issues in intelligent systems							1		1	
IS2. Search and constraint satisfaction							5		5	
IS3. Knowledge representation and reasoning							4		4	
IM1. Information models and systems							3		3	
IM2. Database systems							3		3	
IM3. Data modeling							4		4	
SP1. History of computing	1								1	
SP2. Social context of computing								3	3	
SP3. Methods and tools of analysis								2	2	
SP4. Professional and ethical responsibilities								3	3	
SP5. Risks and liabilities of computer-based systems	1							2	3	+1
SP6. Intellectual property							3		3	
SP7. Privacy and civil liberties							2		2	
SE1. Software design	2	2						4	8	
SE2. Using APIs	1	1						3	5	
SE3. Software tools and environments	2							1	3	
SE4. Software processes								2	2	
SE5. Software requirements and specifications		1						3	4	
SE6. Software validation		1						2	3	
SE7. Software evolution								3	3	
SE8. Software project management								3	3	
Total core hours per course	38	40	39	35	33	40	29	40		

The Information Technology Body of Knowledge

ITF. Information Technology Fundamentals (33 core hours)
- ITF1. Pervasive Themes in IT (17)
- ITF2. Organizational Issues (6)
- ITF3. History of IT (3)
- ITF4. IT and Its Related and Informing Disciplines (3)
- ITF5. Application Domains (2)
- ITF6. Applications of Math and Statistics to IT (2)

HCI. Human Computer Interaction (20 core hours)
- HCI1. Human Factors (6)
- HCI2. HCI Aspects of Application Domains (3)
- HCI3. Human-Centered Evaluation (3)
- HCI4. Developing Effective Interfaces (3)
- HCI5. Accessibility (2)
- HCI6. Emerging Technologies (2)
- HCI7. Human-Centered Software Development (1)

IAS. Information Assurance and Security (23 core hours)
- IAS1. Fundamental Aspects (3)
- IAS2. Security Mechanisms (Countermeasures) (5)
- IAS3. Operational Issues (3)
- IAS4. Policy (3)
- IAS5. Attacks (2)
- IAS6. Security Domains (2)
- IAS7. Forensics (1)
- IAS8. Information States (1)
- IAS9. Security Services (1)
- IAS10. Threat Analysis Model (1)
- IAS11. Vulnerabilities (1)

IM. Information Management (34 core hours)
- IM1. IM Concepts and Fundamentals (8)
- IM2. Database Query Languages (9)
- IM3. Data Organization Architecture (7)
- IM4. Data Modeling (6)
- IM5. Managing the Database Environment (3)
- IM6. Special-Purpose Databases (1)

IPT. Integrative Programming & Technologies (23 core hours)
- IPT1. Intersystems Communications (5)
- IPT2. Data Mapping and Exchange (4)
- IPT3. Integrative Coding (4)
- IPT4. Scripting Techniques (4)
- IPT5. Software Security Practices (4)
- IPT6. Miscellaneous Issues (1)
- IPT7. Overview of programming languages (1)

NET. Networking (20 core hours)
- NET1. Foundations of Networking (3).
- NET2. Routing and Switching (8)
- NET3. Physical Layer (6)
- NET4. Security (2)
- NET5. Application Areas (1)
- NET6. Network Management

PF. Programming Fundamentals (38 core hours)
- PF1. Fundamental Data Structures (10)
- PF2. Fundamental Programming Constructs (9)
- PF3. Object-Oriented Programming (9)
- PF4. Algorithms and Problem-Solving (6)
- PF5. Event-Driven Programming (3)
- PF6. Recursion (1)

PT. Platform Technologies (14 core hours)
- PT1. Operating Systems (10)
- PT2. Architecture and Organization (3)
- PT3. Computing infrastructures (1)
- PT4. Enterprise Deployment Software
- PT5. Firmware
- PT6. Hardware

SA. System Administration and Maintenance (11 core hours)
- SA1. Operating Systems (4)
- SA2. Applications (3)
- SA3. Administrative Activities (2)
- SA4. Administrative Domains (2)

SIA. System Integration and Architecture (21 core hours)
- SIA1. Requirements (6)
- SIA2. Acquisition/Sourcing (4)
- SIA3. Integration (3)
- SIA4. Project Management (3)
- SIA5. Testing and QA (3)
- SIA6. Organizational Context (1)
- SIA7. Architecture (1)

SP. Social and Professional Issues (23 core hours)
- SP1. Professional Communications (5)
- SP2. History of Computing (3)
- SP3. Social Context of Computing (3)
- SP4. Teamwork Concepts and Issues (3)
- SP5. Intellectual Properties (2)
- SP6. Legal Issues in Computing (2)
- SP7. Organizational Context (2)
- SP8. Professional and Ethical Issues and Responsibilities (2)
- SP9. Privacy and Civil Liberties (1)

WS. Web Systems and Technologies (21 core hours)
- WS1. Web Technologies (10)
- WS2. Information Architecture (4)
- WS3. Digital Media (3)
- WS4. Web Development (3)
- WS5. Vulnerabilities (1)
- WS6. Social Software

Total Hours: 281

Notes:
1. Order of Knowledge Areas: Fundamentals first, then ordered alphabetically.
2. Order of Units under each Knowledge Area: Fundamentals first (if present), then ordered by number of core hours.

Figure 5-1. IT body of knowledge with core topics underlined

Introductory Courses

Course #	Title	Description	Units Covered
IT 101	IT Fundamentals	Introduces students to the academic discipline of IT. Pervasive IT themes; IT history; Organizational issues; Relationship of IT to other computing disciplines	Pervasive themes in IT; Organizational issues; History of IT; IT and its Related and Informing Disciplines; Application Domains; Applications of Math and Statistics to IT
IT/CS 130	Programming Fundamentals	Introduces students to the basics of programming, including data structures, programming constructs, object-oriented programming, algorithms and problem solving, event-driven programming, and recursion.	Fundamental data structures and programming constructs; Object-oriented programming; Algorithms and problem solving; Event-driven programming; Recursion; Overview of programming languages
IT/CS 150	Computer Architecture	Principles of computer hardware and low-level software, including logic circuits, assembly language, I/O, storage, program execution	Architecture and organization; Computing infrastructures
IT/CS 160	Operating Systems	Basics of computer operating systems, including configuration, file systems, security, administration, interfacing, multitasking, performance analysis	Operating systems

Intermediate Courses

Course #	Title	Description	Units Covered
IT 210	IT Systems	Introduction to the basic components of IT systems, including networking, web systems, databases, scripting, system administration and maintenance, and system integration	Foundations of networking; Database systems; Data administration; Database administration; Web technologies; Scripting techniques; Integrative coding; Applications; Integration; History of computing
IT 250	Web Systems	Introduction to web technologies and systems, including hypertext, self-descriptive text, web page design, web navigational systems, and digital media	Web technologies; Information architecture; Digital media; Web development; Vulnerabilities
IT 330	Networking	Builds a deeper understanding of how networks work, including the topics of LANs, WANs, service providers, packets, hubs, routers, switches, Internet protocols	Routing and switching; Physical layer; Security; Application Areas
IT 350	Databases	Builds a deeper understanding of how databases work, including the topics of database theory and architecture, data modeling, normalization, query languages, security, and Web applications	Data organization and retrieval; Data modeling; Database query languages; Database systems; Information models and systems; Properties of data; Specification of data requirements; Data and database administration
IT 370	Human-Computer Interaction	Introduction to the basic concepts of human-computer interaction, including human factors, performance analysis, cognitive processing, usability studies, environment, and training	Human factors; HCI aspects of application domains; Human-centered evaluation; Developing effective interfaces; Emerging technologies; Human-centered software; Accessibility
ENGL 310	Professional Communication	Introduction to written and oral technical and professional communication, including proposals, reports, presentations, formal papers	Professional Communications

Advanced Courses

Course #	Title	Description	Units Covered
IT 410	Information Assurance & Security	Introduction to the concepts of data security, including policies, attacks, vulnerabilities, encryption, information states, and forensics	Security mechanisms; Fundamental aspects; Security services; Information states; Threat analysis model; Vulnerabilities; Attacks; Policy; Operational issues; Forensics; Security domains
IT 480	IT Capstone I	IT senior project-first semester, including project proposal, feasibility studies, intellectual property, teamwork, budgets, schedule management	Requirements; Acquisition/ sourcing; Integration; Project management; Architecture; Teamwork concepts and issues; Intellectual properties; Organizational context
IT 481	IT Capstone II	IT senior project-second semester, including teamwork, professional communications (reports and presentations), design implementation, testing	Testing and QA; Organizational context; Professional communications; Teamwork concepts and issues;
IT 490	Professional Ethics	Covers all the areas of ethics in the computing profession	Professional and Ethical Issues and Responsibilities; Privacy and Civil Liberties

Virginia Tech: Core Curriculm Areas

Area	Goals
1. Writing and Discourse	1. Understand the use of words as basic tools of thought; 2. Engage in defining, developing, and understanding ideas through the process of writing; 3. Understand modes of verbal discourse that are central to college-level academic work, such as argument, interpretation, analysis, and metaphor; 4. Develop clear and effective prose through attention to style, grammar, and other elements of composition; 5. Engage in planning, inventing, editing, and revising as elements of the writing process; 6. Read texts and write analytical and interpretive prose as a reciprocal means of expanding powers of understanding and imagination; and 7. Participate in verbal discussion of texts and ideas as an essential element of discourse and communication.
2. Ideas, Cultural Traditions, and Values	1. Examine some of the formative ideas and cultural traditions that have shaped Western experience; 2. Study classic and contemporary texts that have influenced or exemplified currents in Western thought and imagination; 3. Gain an understanding of some aspects of human achievement and experience that have been persistently overlooked in mainstream Western culture, including those of women, minorities, and non-Western peoples; 4. Analyze creative works of various mediums both in the arts and technology from the viewpoints of cultural meanings and influence; 5. Gain acquaintance with historical traditions and with humanistic methods of studying and interpreting them; Consider the contributions of philosophical, ethical, or religious systems to human life; 6. Recognize how the interaction of tradition and innovation nourishes both individuality and community; 7. Gain critical and appreciative perspective upon one's own culture by studying other historical periods and other cultural traditions; 8. Study the life, thought, and creative activity of men and women of achievement in various fields of human endeavor.
3. Society and Human Behavior	1. Examine distinctive quantitative and qualitative modes of inquiry appropriate to the scientific study of societal institutions, patterns of culture, and human behavior; 2. Understand specific patterns and processes that affect the organization of society and the relationship between the individual and society; 3. Investigate institutions, systems, and ideologies in the realms of government, family, community, economy, education, science, religion, and other dimensions of culture; 4. Investigate human psychological and developmental processes through quantitative and qualitative methodologies; 5. Compare alternative theories about human society, culture, and behavior; 6. Examine patterns that involve inclusion and exclusion pertaining to race, class, community, gender and ethnic identity, and other forms of social grouping.

4. Scientific Reasoning and Discovery	1. Understand how, in the natural sciences, knowledge is created, developed, and changed through experimentation and reasoning; 2. Participate in scientific experimentation through laboratory and field exercises; 3. Understand successive experimentation as a means of replicating, controlling variables, explaining error, and building explanatory models; 4. Practice problem-solving using quantification, statistical analysis, and/or data manipulation; 5. Understand the basic scientific methods, concepts, and principles that pertain to one or more of the sciences; Examine from a scientific perspective some of the major potentialities and constraints associated with the environment and human society, including the various roles that can be played by technology; 6. Understand the contributions of men and women to scientific knowledge and achievement.
5. Quantitative and Symbolic Reasoning	1. Increase basic competence in quantitative reasoning and problem solving, starting at an appropriate entry level; 2. Understand some fundamental principles of reasoning that are involved in mathematics or logic; 3. Understand quantitative and symbolic reasoning through the study of significant applications of mathematical sciences.
6. Creativity and Aesthetic Experience	1. Participate in cultural events and activities on campus, in both popular and classical arts; 2. Understand how the artists or designers who produce these events and works have shaped their ideas; 3. Examine intuitive and metaphorical thought processes and their relationship to the human imagination and other intellectual abilities; 4. Explore the interaction of art and society, including the contributions of diverse groups to cultural life, such as women and members of minority groups; 5. Study selected classic works of fine and applied arts; 6. Participate in interpretive discussions, lectures, and demonstrations led by artists, designers, architects, musicians, and/or performers; 7. Explore connections between the arts and other forms of design and creativity.
7. Critical Issues in a Global Context	Goals 1-4 apply to all courses in Area 7. The remaining goals will be addressed to varying degrees, depending on the content of the course. 1. Examine an issue or a group of related issues whose influence on contemporary life extends beyond the boundaries of the United States and significantly involves other societies, cultures, and geographical locations; 2. Develop an informed understanding of the context of the critical issues under study, including relevant historical, technological, cultural, and/or scientific factors; 3. Learn how to interpret and evaluate controversial issues of the day from several distinctive and differing points of view, using appropriate information from varied sources; 4. Relate contemporary events at home and abroad to the subject matter of the course; 5. Gain an informed understanding of the crucial national and international role played by technology with respect to selected critical issues; Examine the root causes and influences of such dynamics as racism, ethnic prejudice, sexism, and other forms of social exclusion; 6. Develop an understanding of the culture, the state of technological and economic development, and the values of a particular society or people outside the United States; 7. Examine the role of ethical thinking and action in relation to issues in such areas as technological development, political policy, the environment, and social and economic patterns.

Villanova University
College of Liberal Arts and Sciences
Core Curriculum Requirements

Areas		**Course #**	**Title or *Description of courses***
Augustine and Culture		ACS 1000	Traditions in Conversation
		ACS 1001	Modernity and Its Discontents
English		ENG 1050	The Literary Experience
			Some advanced literature course
Ethics		ETH 2050	Ethical Traditions and Contemporary Life
Fine Arts			*Some course in Theater, Studio Art, Art History, English, Rhetoric/Performance, Media/Film Studies*
Foreign Language			*Complex two-semester requirement depending on student's background*
History		HIS 1040	Themes in Pre-Modern World History
	or	HIS 1050	Themes in Modern World History
			Some advanced history course
Math/Computing			*One course in mathematics and one course in either mathematics or computing*
Philosophy		PHI 1050	Introduction to Philosophy
			Some advanced philosophy course
Science			*Some two-course sequence in one of Astronomy, Biology, Chemistry, Environmental Science, or Physics*
Social Science			*One intro/advanced combination in a single discipline plus one course in a different discipline. Disciplines are Criminology, Economics, Geography, Political Science, Psychology, and Sociology*
Theology		THL 1050	Christian Theology: An Introduction
	or	THL 1051	Christianity in History
			Some advanced theology course

Boston College

Arts		*one course in fine arts, music, or theatre*
Cultural Diversity		*one course that fills the diversity requirement*
History -2		*two semesters of history*
Literature - 1		*one course in classics, english,germanic studies, romance language and literature, slavic and eastern langauages*
Mathematics - 1	MT 001	Math Non Calculus Core Equivalent
	MT 004	Finite Probability and Applications
	MT 005	Linear Mathematics and Applications
	MT 006	Ideas in Mathematics (Fall Topics)
	MT 007	Ideas in Mathematics (Spring Topics)
	MT 011	Math Calculus Core Equivalent
	MT 020	Survey of Calculus
	MT 100	Calculus I
	MT 101	Calculus II
	MT 102	Calculus (Math / Science Majors) I
	MT 103	Calculus (Math / Science Majors) II
	MT 190	Fundamentals of Mathematics I
	MT 191	Fundamentals of Mathematics II
Natural Sciences - 2		
Philosophy - 2	PL 001	Philosophy Core Equivalent
	HP 002	Western Cultural Tradition II
	HP 004	Western Cultural Tradition IV
	PL 070	Philosophy of the Person I
	PL 071	Philosophy of the Person II
	PL 088	Person & Social Responsibility I
	PL 089	Person & Social Responsibility II
	PL 090	Perspectives on Western Culture I
	PL 091	Perspectives on Western Culture II
	PL 160	The Challenge of Justice
	PL 281	Philosophy of Human Existence I
	Pl 282	Philosophy of Human Existence II
	UN 104	Modernism & the Arts - Perspectives II
	UN 109	Horizons of New Social Sciences - Perspectives III
	UN 119	New Scientific Visions - Perspectives IV

Social Sciences - 2	EC 001	Economics Core Equivalent
	EC 005	Microeconomics Equivalency
	EC 006	Macroeconomics Equivalency
	EC 131	Principles of Economics I - Micro
	EC 132	Principles of Economics II - Macro
	HP 031	Western Cultural Tradition V
	HP 033	Western Cultural Tradition VII
	PO 001	Political Science Core Equivalent
	PO 041	Fudamental Concepts of Politics I
	PO 042	Fudamental Concepts of Politics II
	PO 051	American National Government
	PO 061	American Politics I: Organization of Power
	PO 091	Indroduction to Comparative Politics
	PO 500	Introduction to International Studies
	PS 001	Psychology Core Equivalent
	PS 011	The Psychobiology of Mental Disorders
	PS 021	Psychology of Art and Creativity
	PS 039	Psychological Perspectives on Social Justice
	PS 050	Idea of Insanity
	PS 045	Fundamentals of Humanistic Psychology
	PY 030	Child Growth and Development
	PY 031	Family, School and Society
	SC 001	Introductory Sociology
	SC 003	Introductory Anthropology
	SC 004	Social Science Core Equivalent
	SC 022	Sociology of Crime and Punishment
	SC 028	Love, Intimacy, and Human Sexuality
	SC 030	Deviance and Social Control
	SC 03`1	Extraordinary Groups
	SC032	Business and Society
	SC 041	Race Relations
	SC 043	Introduction to African American Society
	SC 049	Social Problems
	SC 053	Utopias and Dystopias
	SC 063	Women and Work
	SC 072	Inequality in America
	SC 078	Sociology of Health and Illness
	SC 079	Social Psychology
	SC 084	Mass Media in American Society
	SC 092	Peace of War: United States - Third World
	SC 093	Comparative Social Change
	SC 097	Death and Dying
	UN 109	Horizons of New Social Sciences - Perspectives III

Theology - 2	HP 001-2	Western Cultural Tradition I & II
	HP 003-4	Western Cultural Tradition III & IV
	TH 001-2	Biblical Heritage I & II
	TH 016-7	Introduction to Christian Theology I & II
	TH 023-4	Indroduction to Catholicism I & II
	TH 088-9	Person and Social Responsibility I & II
	TH 090-1	Perspectives on Western Culture I & II
	TH 161-2	Religious Quest: Comparative Perspectives I & II
Writing - 1	EN 004	English Core Equivalent: Writing
	EN 005	English Core Equivalent: Literature
	EN 010	First Year Writing Seminar
	EN 119	The Craft of Writing
	HP 001-4	Western Cultural Tradition I
	EN 052	Introduction to College Writing

Wake Forest University
Undergraduate Admissions
Core Curriculum Requirements

First Year Seminar		
English Composition	ENG 111	Writing Seminar
Foreign Language		*one course at the literature level*
History - 1	HST 101	Western Civ to 1700
	HIST 102	Europe & World in Modern Era
	HIST 104	World Civ. Since 1500
	HST 107	Middle East & the World
Religion - 1	REL 101	Introduction to Religion
	REL 102	Introduction to the Bible
	REL 103	Intro to Christian Tradition
	REL 104	Intro to Asian Religions
Philosophy - 1	PHI 111	Basic Problems of Philosophy
	PHI 112	Intro to Philosophical Ideas
	PHI 115	Intro to Philosophy of Religion
	PHI 160	Intro to Moral & Political Philosophy
	PHI 161	Medical Ethics
	PHI 164	Contemporary Moral Problems
English Literature - 1	ENG 160	Intro to British Literature
	ENG 165	Studies in British Literature
American Literature - 1	ENG 170	Intro to American Literature
	ENG 175	Studies in American Literature
Foreign Literature - 1		*one course at the literature level beyond the basic requirement*
Fine Arts and Performing Arts		*one course in art, music, theatre, or dance.*
Social Sciences - 3 (no more than one from any group)	ANT 111	Peoples & Cultures of World
	ANT 112	Introduction to Archeology
	ANT 113	Intro to Biological Anthropology
	ANT 114	Intro to Cultural Anthropology
	ANT 150	Introduction to Linguistics
	ECN 150	Introduction to Economics
	POL 113	American Gov't & Politics
	POL 114	Comparative Gov't & Politics
	POL 115	Political Theory
	POL 116	Internation Politics
	PSY 151	Introductory Psychology
	SOC 151	Principles of Sociology
	SOC 152	Social Problems
	SOC 153	Contemporary Families
	SOC 154	Sociology of Deviant Behaviour
	COM 100	Intro to Communications & Rehtoric
	COM 110	Public Speaking

Natural Sciences, Math, Computer Science
(three course, two different departments.)

BIO 101	Bio & The Human Condition
BIO 111	Biological Principles
BIO 112	Comparative Physiology
BIO 113	Evolution & Ecological Biology
CHM 108	Everyday Chemistry
CHM 120	Phy & Chem of Enviornment
CHM 122	Intro to Organic Chemistry
CSC 101	Overview of Comp Sci
CSC 108	Intro to Programming
CSC 111	Introduction to Computer Science
CSC 112	Fundementals of Comp. Science
PHY 109	Astronomy
PHY 110	Introductory Physics
PHY 113	General Physics I
PHY 114	General Physics II
PHY 120	Phy & Chem of Enviornment
MTH 109	Elementary Probability & Stats
MTH 111	Calculus / Analytic Geom I
MTH 112	Calculus / Analytic Geom II
MTH 113	Multivariable Calculus
MTH 117	Discrete Mathematics
MTH 121	Linear Algebra I

Bucknell University
College of Arts and Sciences Curricula
Core Curriculum Requirements

Humanities - 4	*students pick four courses from the following: (no more than two in one department)* art, art history, Chinese, classics, dance, East Asian studies, English, French, German, Greek, history, humanities, Japanese, Latin, Latin American studies, music, philosophy, reltion, Russian, Spanish, theatre, some women's and gender studies.
Social Sciences - 2	*students pick two courses from the following: (in two different departments)* anthropology, economics, education, some environmental studies, some geography, international relations, linguistics, management, political science, psychology, sociology, some women's and gender studies.
Natural Sciences and Mathematics - 3	*two natural science laboratory course and one other in natural sciences, mathematics, or computer science from the following:* astronomy, biology, chemistry, computer science, some environmental studies, some geography, geology, mathematics, physics.
Perspectives on the Natural and Fabricated Worlds - 1	General Biology Population / Community Biology Ancient Cities Ancient Technology Intro to Mincrocomputer Enviornment Life, Universe and Engineering Intro to Enviornmental Studies Environment Pollution / Control Intro to Ecological Design Environmental Policy / Politics Human Impact on Environment Economic Geography Political Geography Marine Environment The Dynamic Earth Evolutions of the Earth Environmental Geology Engineering Geology History of Science 1500 -1800 History of Science II Women, Science, Technology Intro to Information Systems Development Modern Philosophy God, Nature and Knowledge Environmental Ethics Medicine and Society Sociology of Medicine AIDS

Perspectives on Human Diversity - 1	Cultural Antropology
	Urban Anthropology
	Field Research - Local Community
	Ritual, Myth, and Meaning
	Japanese Culture and Society
	Peoples / Cultures - Andean World
	Native Americans - Past / Present
	Women and the Penal System
	Chinese I
	Chinese II
	Roman Civilization
	Greek History
	East Asian Civilization
	Passion / Perversion: Japan Film
	Japanese Culture and Society
	Social Foundation of Education
	Gender Issues in Education
	Philosophy of Education
	Teach in Diverse Enviornments
	Teaching of Social Studies
	Intro Women & Gender Studies
	Modern Auteurs
	History of Secuality
	Science Fiction
	Exploring French
	Building Proficiency in French
	Communicating in Context
	Europe in Age of Globalization
	Cultural Geography
	Gender and Geography
	Intensive Elementary German
	Everyday Life Germany - Elem II
	German Conversation / Composition
	Women, Science, Technology
	International Relations of Europe
	Elementary Italian II
	Italian Civilization
	Japanese I
	Japanese II
	World Philosophy
	Comparative Politics
	Russian Politics
	Int'l Relations of Europe
	Cognitive Aging
	Introduction to the Bible
	Judaism / Christianity / Islam
	Intro to Asian Religions
	Hinduism and Film
	Judaism in Film
	Introduction to Sociology
	Medicine and Society
	Remaking America: Latin Am. Immig.
	Sociology of Medicine
	Grammar / Composition / Conversation
	Spanish American Literature
	Spanish Civilization

Santa Clara University: Core Curriculum

Theme 1: Laying Foundations

2 English Composition
1 Religious Studies, Introductory Level
1 United States
2 Western Culture
1 Mathematics
Second Language (excluding Engineering Majors)

Theme 2: Reaching Out

1 World Cultures/Societies: Area Studies Regional
1 Religious Studies, Intermediate Level
1 Social Sciences
1 Technology
1 Mathematics and 1 Natural Science OR 2 Natural Science

Theme 3: Integrating for Leadership

1 Ethics
1 Religious Studies, Advanced Level, after completing 88 units
1 Third Writing Course

College and School

Arts and Sciences

1 Ethnic Studies/Women's and Gender Studies
1 Fine Arts
+1 World Cultures/Societies
Second Language

B.A. Degree

+1 Western Culture

B.S. Degree

+1 Math/Natural Science, to total two each in Math and Natural Science

Business

+2 additional Economics
Contemporary American Business
Global and Cultural Environment of Business
Intro to Business Computing
Leadership Competency
2 Accounting
2 Data Analysis
1 Information Systems
1 International Business
5 Business Core Courses
Second Language *(Proficiency through the 002 level or equivalent.)*

Engineering

+7 Mathematics/Natural Science

Solving Problems with Tools and Collaboration

LIKES Workshop
Santa Clara University
November 30, 2007

Lawrence A. Rowe
FX Palo Alto Laboratories

Outline

Organize our thinking about the future

Digital literacy in the 21st century

Requirements for a computer science education

Living and working in the future

Organize Our Thinking

Digital Literacy
- What should a well-educated citizen know about computing and information technology?

Computer Science Education
- What should a well-educated computer science bachelor's graduate know about computing and information technology?

Working in the 21st Century
- What skills are important for members of the workforce?

Digital Literacy in the Past

1950's-60's: "Batch Processing Era"
- Understand computer capabilities
  Financial/accounting, election predictions, rocket flight trajectories, etc.
- Work with experts who program and operate a computer

1970's-80's: "Interactive Computing Era"
- Use computers and applications
  Word processing, spreadsheets, desktop publishing, personal accounting, etc.
- Know how to operate a PC

1990's-2000's: "Internet Era"
- Understand networks of computers
- Use remote computers and applications to communicate
  Web, email, eCommerce, banking, IM, blogs, social networks, telephony, etc.
- New media entertainment
  Audio, video, and massively multiplayer online games

An Anecdote about the Future

Kids view the world differently because it is all they know

Never underestimate people's ability to learn and use tools

Understanding Media and Tools

Before the computer and Internet…
- Printing press/copier – publish material for others to read
- Radio/TV – broadcast audio/video for others to listen and watch
- Typewriter – allows individual to produce readable papers
- Telephone – allows individual to talk to someone at a distance

After the computer and Internet…
- Widely available tools for creating and publishing content
  As the tools got better, more people could do it (e.g., typesetting, photography, drawings, videos, etc.)
- Dramatic reduction of cost to communicate with people at a distance
  More than just audio, now includes video, images, shared experiences, etc.

Everyone can publish and broadcast

Tools Amplify our Abilities

Computer enables development of tools

- Spreadsheets, word processing, order processing systems, on-line airline/travel scheduling systems, etc.

What tools are needed?

- Better tools to author content
  Web pages, videos, interactive multimedia documents, games, etc.
- Better tools to work with remote people
  Face-to-face interaction still better than remote audio/video conference
- Better tools to discover knowledge
  Learn things that you want to know about
- Better tools to solve problems
  Diagnose a situation and change state to achieve a goal
- Better tools to customize my environment
  Allow me to control information/interaction presented to me

Tool Characteristics

WYSIWYG interfaces

- Direct manipulation of visual representation of object being manipulated

Simplify work required by people

- Abstract operations that represent task to be accomplished

Automate as much as possible

- Trade computation for human manipulation and memory
- Semi-automate if necessary

Assumes tool builder can anticipate all actions user wants to perform

Alternative: Programming!

Vast majority of computer users do not program

- Use programs to author content or complete a task, not automate a repetitive task
- Even kids do not program – use computer as a tool for entertainment

Some people do limited programming

- Examples: spreadsheet scripting, report writers, macro recorders, etc.
- Equipment allows user to "program behaviors" (e.g., start dishwasher at 2 AM, water zone 2 once every other day for 10 minutes, etc.)
- Customizing tool to your environment

Need higher level tools – "automatic programming"

- Common abstractions plus algorithms to fill-in details or find re-usable code fragments
- Re-examine research on
  programming-by-demonstration, automatic program creation (theorem proving), tools for finding useful code/libraries and incorporating them into your application, etc.

Need more training on basic programming concepts

- Assignment, iteration, procedure calls, parameter passing, map functions, etc.

Digital Literacy for the 21st Century

Understand and use Internet

Use tools to author content and solve problems

Automate repetitive tasks through programming

Customize on-line environment to improve productivity

Outline

Organize our thinking about the future

Digital literacy in the 21st century

Requirements for a computer science education

Living and working in the future

CS Education in the Past

1950's-60's: "Batch Processing Era"

- Computer architecture, low-level programming, operating systems, data structures, compilers, formal language theory, algorithm analysis, etc.
  Fortran, Basic, Cobol, Lisp(?), IBM mainframes

1970's-80's: "Interactive Computing Era"

- Computer architecture design, object-oriented programming, OS, DBMS, graphics, artificial intelligence, algorithm design and analysis, compilers, software engineering, etc.
  C/C++, Pascal, Fortran, Lisp/Scheme, minicomputers and PC's

1990's-2000's: "Internet Era"

- OS, computer networks, scripting languages, programming, user-interfaces, graphics, algorithm design and analysis, web page authoring and services, DBMS, AI, software engineering, distributed programming, cluster computing, etc.
  Java/C#, Scheme/Lisp, Perl/Python/Ruby, Javascript/PHP, Ruby-on-Rails/.net2, PC's, clusters, and networked computers

Common Features

Learn fundamental principles
- Operating systems: resource management, interprocess communication, file systems, etc.
- Computer networks: communication technologies, protocol architectures, network operations, etc.
- Algorithm design and analysis

Learn common application development paradigm
- Programming, debugging, and software engineering

Learn several languages and systems
- Changed over time to higher level languages
- Changed from single-user batch processing to multiple-user interactive applications

Analogy with the Past - Electricity

Early manufacturing companies located close to transportation hub and power source
- Typically near flowing water and navigable river or ocean

Development of electricity and motors meant companies could be located elsewhere
- Various types of motors (e.g., steam, sterling, and electrical) lead to different requirements for power

Companies produced own electricity until early 1900's

Electric power grid first proposed by Tesla in 1888
- Common generation plants provided power that could be transmitted to local distribution systems
- Widely deployed world-wide between 1900-1930

***KEY OBSERVATION**: Privately owned equipment replaced by shared resource*

How Computing is Changing

Computing as a utility – analogy with electricity
- Hardware moved to a data center co-located with network centers
- Purchase resources rather than owning hardware
- Applications moving into the cloud

Everyone will program
- Remember: reading, arithmetic, and telephone operation was performed by experts until it was added to common educational curriculum

Open source and application program interfaces
- Open source: companies sell service
- Open API's: create new apps and services by interfacing to other applications and services => mashups!

Programming teams geographically distributed
- Low-cost communication traded for high-cost labor
- Changing nature of work teams

Aside: "Why Pay for Open Source?"

Pay money to save time
- I would gladly pay you for an installable software package rather than having to compile and build it myself
- I would gladly pay you to manage my computing equipment or applications rather than doing it myself or hiring someone to do it

Contribute time to save money
- It will take more time, but I would rather use an open source package and pay you for service than pay the much higher cost to a company selling a closed-source solution
- I will fix bugs in the software to insure that I can solve my specific problem without having to write the entire package

CS Education

Digital literacy
- Use Internet, author content with tools, program, and customize on-line work environment
- Learn architecture and operation of Internet systems and apps

Continue to learn fundamental concepts
- Resource management, distributed systems, programming, software engineering, etc.

Algorithm design
- Design algorithms to solve problems and implement apps & tools

Tool building
- Design and implement tools used by others

Problem solving
- Apply scientific method and other problem solving techniques
- Use end-to-end or systems optimization to improve products and operations

CS Education (cont.)

Working in teams - collaboration
- Learn about tools for working with distributed teams
- Learn best practices for working with different people from different cultures and in different time zones

Business and economics
- Must understand structure and operation of a business
  Strategy, operations, accounting, personnel, sales & marketing, etc.
- Introduction to roles different people play in the marketplace
  Developers, technical support, evangilists, public relations, analysts, management, venture capitalists, investment community, etc.

Outline

Organize our thinking about the future

Digital literacy in the 21st century

Requirements for a computer science education

Living and working in the future

Liberal Arts Education for CS Graduates

Critical thinking

- Question hypotheses and solutions
- Observe, experiment, and build models to predict and possibly control organisms, nature, or behaviors

Learn to work in geographically distributed, multicultural teams

- Many companies geographically distributed
- Learn cultures and languages to support team work
- Learn about tools for distributed collaboration

  Email, IM, newsgroups, blogs, wikis, video conferencing, databases, shared documents, etc.

Learn to publish and broadcast

Summary: Big Ideas

Digital literacy means…

- Use the Internet, software tools and apps
- Program to improve productivity

CS education requires…

- Understand fundamental principles of computing
- Learn architecture and operation of Internet
- Build tools and solve problems

Modern workforce needs…

- Critical thinking skills
- Problem solving skills
- Ability to work in a geographically distributed, multicultural team

Participant Profiles and Responses to LIKES Survey

Participant: Ghaleb Abdulla

Title, affiliation: Adjunct faculty at the University of the Pacific
E-mail: abdulla1@llnl.gov

Photo: 

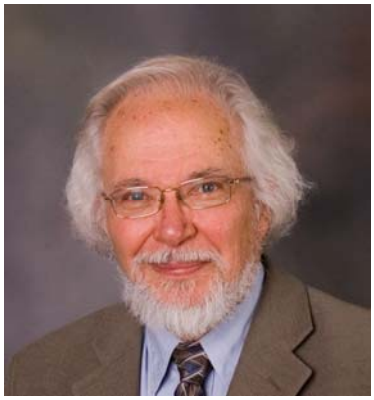
1. What do you believe is necessary for the LIKES initiative to succeed?
From looking at the objectives of the LIKES project, I think representatives from disciplines who works with computer scientists would help. Faculty from Biology, physics,
earth sciences etc. will shed give ideas on what is needed computationally to solve the research problems that they are facing.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?
I am an Adjunct faculty at the University of the Pacific and I supervise graduate students during the summer and sometimes I help them overall the duration of their graduate studies. In my job i work with scientists from physics, chemistry, biology, etc.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?
Provide advice and consult on how to develop an effective curriculum that help new graduates to start contributing in the working environment.

Participant: Bob Beck

Title, affiliation: Professor and Chair, Department of Computing Sciences, Villanova University
E-mail: robert.beck@villanova.edu

Photo: 

Participant: Ed Carr

Title, affiliation: Adjunct Assistant Professor, Department of Computer Science, North Carolina A & T State University
E-mail: corwith@ncat.edu

1. What do you believe is necessary for the LIKES initiative to succeed?

Identifying how computer science education can be immersed into other disciplines. A deeper understanding of what areas of computer science are important to other academic studies. Discovering other applications of computer science.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?

Hopefully so. I have been working for many years in exploring the overlap between Graph Theory and Computer Science. From my understanding of computational science, most if not all of my course work in Applied Mathematics provides me with a strong background. In determining hamiltonicity of certain graphs, I have used my computer programming skills to generate examples and model hamiltonian construction algorithms. Also in the late 90s, I was a consultant for an industry leader in the area of photogramitry. I helped customize windows servers and workstations to handle the demands of 3D imagery. Spatial Data Consultants specialized in aerail photography, digital surveying and mapping. Other consultant work has been in the area of hospital information technology support. The use of secure remote administration was a key issue.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?

By attending the workshops and participating in conference calls etc.

Participant: Nancy Yen-Wen Cheng

Title, affiliation: Associate Professor, Dept of Architecture, University of Oregon
E-mail: nywc@uoregon.edu

Photo: http://www.uoregon.edu/~design/nywc/gifs/chengphoto-sm.jpg

1. What do you believe is necessary for the LIKES initiative to succeed?

Students need the opportunity to understand how their specialized training links into a larger context. In teaching computing concepts in other fields and identifying the impact of the underlying theory in general, non-computer science majors could develop a broader capacity to use the computing concepts.

For the workshop, we need to identify what is working well and why, then create synergy between initiatives in different disciplines. While I am intrigued by the idea of interdisciplinary collaboration, I know that it takes dialogue and cooperation to develop the trust and understanding for successful teamwork. We need to identify very specific objectives and then devise a game plan for achieving these objectives through manageable steps. Most likely we could develop rapport in small groups – so perhaps each group take responsibility for a single step at a time.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?

I have deep experience in fostering teamwork for Internet collaborations. When teaching at University of Hong Kong (1993-1996), we set up short-term "virtual design studios" for students in partner schools in North America, Europe and Asia. We researched how digital communications could facilitate sharing of design ideas, technical methods and cultural perspectives. Since coming to Oregon in 1996, I have used the Web for both external and internal sharing, linking our students to clients, experts and peers in other schools. Most recently my classes have been using Wikis to share work and critical reflections:

- Architectural design
- Computer Graphics

Through my leadership activities with computer aided architectural design research organizations, I have a perspective on challenges of integrating digital technology into professional education. While our schools and professional offices have interest in adopting new methods, there is an inherent conservatism that comes from low budgets and the large scope and complexity of building design. Developing a stronger dialog between academia, professional practices and the software industry. This could give our students more opportunity to use their skills in action and invigorate domain-specific software development.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?

I am interested in developing LIKES collaborations where they coincide with my research and teaching and where they can lead to future funding. I study how tools and methods shape design thinking, with special interest in physical/digital hybrids. I have

been researching design process with a digital pen and paper system that generates animations. I want to develop my expertise in digital fabrication and parametric design, working more directly with carving or casting materials through computer or hybrid methods. My architectural design teaching includes sustainable design and intentional communities.

After learning more about the LIKES project, I could be more specific about how I could contribute. I appreciate the opportunity to pick everyone's brain for how to go forward.

Participant: Norman Chonacky

Title, affiliation: Research Affiliate, Yale University
E-mail: norman.chonacky@yale.edu
Photo: not provided

1. What do you believe is necessary for the LIKES initiative to succeed?

You wish to do community building with, as one goal: "Formation of new communities for enhancing ... integration (of computing concepts into non-computing disciplines)." In my experience, this requires data about the constituents from which such community will be drawn. These data should be of the type that enable you to understand these constituents - their perspectives, intellectual culture, values, and needs. Suitably designed and administered constituent surveys might provide you with such data.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?

Yes indeed. The most recent experience and probably most relevant to LIKES is the effort of a grass-roots movement of physics educators to move the undergraduate physics curriculum toward a state where computation is an integral part of every physics course. I will be glad to detail these when appropriate in the course of the workshop according to participants' interests. On the other hand, this historical effort is summarized and the latest results described in a manuscript that we have submitted, and has been accepted pending revisions, for publication in the American Journal of Physics - special issue on the theme of computational physics - slated for April 2008 publication. I can make the first draft of a white paper upon which this manuscript is based available as a "pre-print" to those wishing to see it at this time.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?

The projects that our partnership/coalition - Partnership for the Integration of Computation into Undergraduate Physics (**PICUP**) - are now in the process of designing and for which we will seek funding have some natural confluences with LIKES in terms of its goals. To the extent that these will supply part of what LIKES seeks, they might help move your initiative forward.

Participant: Carlos Evia

Title, affiliation: Assistant professor of Professional Writing, English Department, Virginia Tech
E-mail: carlos.evia@vt.edu

1. What do you believe is necessary for the LIKES initiative to succeed?
Real interdisciplinary collaboration beyond. In the liberal arts and humanities, many faculty members are suspicious of projects involving colleagues in fields from science and technology. This is a result of the use of terms like "hard" and "soft" disciplines, and the alleged superiority of academic fields that attract federal money for research. LIKES needs to see all non-Computer Science partners as valuable, and truly embrace collaboration for mutual benefit. If we ignore the differences in perception and expectative, the project will not truly involve key players outside of IT-heavy departments.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?
Yes, my background involves academic and workplace experience in technical documentation, interface design, mass communication, journalism, and web usability. Inside and outside the English department, I try to prepare students for living and working in the knowledge society. Furthermore, my Mexican-American background expands the classroom to a global environment where the knowledge society is not based on one single culture or language.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?
Maintaining a healthy balance between technology and the humanities. Successful professionals in the knowledge society need good technical knowledge as much as they need appropriate communication skills. I can help with that balance at the student, faculty, and administration level.

Participant: Weiguo (Patrick) Fan

Title, affiliation: Associate Professor of Information Systems and Computer Science, Pamplin College of Business, Virginia Tech
E-mail: wfan@vt.edu

1. What do you believe is necessary for the LIKES initiative to succeed?

Having the support from the upper administration and all related deans and dept heads. Having a solid and well-designed curriculum. Publicity.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?

Yes. Teach IS for accounting and business majors. Could be useful for other college students as well.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?

Attend meeting, contribute ideas, design curriculum to fit the students' needs.

Participant: Edward A. Fox

Title, affiliation: Professor, Department of Computer Science, Virginia Tech, PI of LIKES project
E-mail: fox@vt.edu
Photo: http://fox.cs.vt.edu/photos/Fox2002OctLowRes.jpg

1. What do you believe is necessary for the LIKES initiative to succeed?
We need a broad base of support from CS departments around the nation. They will have to take initiative in helping make sure students are prepared for the KS. We'll need a strong online community of discussion, and visibility at key CS and IT conferences, for a number of years.
2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?
The courses
CS4624 Multimedia, Hypertext, and Information Access
http://collab.dlib.vt.edu/runwiki/wiki.pl?MultiMedia
CS5604 Information Storage and Retrieval
http://collab.dlib.vt.edu/runwiki/wiki.pl?InformationStorageRetrieval
CS6604 Digital Libraries
http://collab.dlib.vt.edu/runwiki/wiki.pl?DigLib
have related topics and so I've had teaching experience in this area that relates.
3. How do you feel that you can best contribute to moving the LIKES initiative forward?
By continuing to work on the NSF LIKES grant and by continuing to move forward with activities at Virginia Tech. These include my being willing to assist others with interest in whatever ways seem most helpful.

Participant: James Frew

Title, affiliation: Associate Professor, Donald Bren School of Environmental Science and Management, University of California, Santa Barbara
E-mail: frew@bren.ucsb.edu
Photo: http://www.bren.ucsb.edu/people/Faculty/james_frew.htm
1. What do you believe is necessary for the LIKES initiative to succeed?

Not sure I can comment on this yet; I need to find out more about what the "LIKES Initiative" is...

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?

I have spent decades building and thinking about medium-to-large-scale digital libraries and Earth science data systems; and about 10 years teaching informatics and geocomputation skills to graduate students in a professional degree program.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?

I believe I have a good sense of the difference between what's fun to think about and what actually works, and an appreciation for the particular challenges of teaching computing concepts in a broadly interdisciplinary context.

Participant: Sneha Veeragoudar Harrell

Title, affiliation:

E-mail: om_sneha@berkeley.edu

Photo: 

Questions: Not answered.

Participant: Tim Hesterberg

Title, affiliation: Senior Research Scientist Insightful Corp.

E-mail: timh@insightful.com

Photo: http://home.comcast.net/~timhesterberg/TimOct01small.JPG

1. What do you believe is necessary for the LIKES initiative to succeed?

Let me put this in a larger contex. The U.S. is very strong in electronic commerce and digital entertainment, but is loosing ground in manufacturing, engineering, and perhaps in physical sciences.

I work in a statistical software company. We seem to have plenty of job candidates with CS backgrounds, but without the scientific computing background we need.

I hope that LIKES will expose undergraduates who are attracted to CS by the possibility of a computer game career, and expose then to CS applications in other disciplines.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?

I worked three years at Pacific Gas and Electric Co, in a cross-disciplinary technical group. We had some great applications of CS, Operations Research, Electrical Engineering, Statistics, and Mathematics, to applications in in electricity and gas -- optimal power flows, transmission capacity, hydroelectric scheduling, rare-event simulation for energy planning, and others.

I taught a "Mathematics Practicum" in which I recruited sizeable problems from local industry and government agencies, and supervised teams of 3-5 students working for a semester on one problem. These involved a combination of Operations Research, Math, Statistics, and CS.

My primary expertise in Statistics is in bootstrap methodology, a computer-intensive approach that substitutes Monte Carlo simulation for classical assumptions and cookbook formulas. This has great potential both in teaching -- helping students understand difficult concepts related to sampling variability -- and practice -- providing more accurate answers than classical approaches and yielding answers where classical approaches are unworkable. For teaching materials and other info see http://www.insightful.com/Hesterberg/bootstrap.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?

I look forward to sharing stories, learing from others, and figuring out what parternships make sense - between those in academia and those of us in industry.

Participant: Matthew Jockers

Title, affiliation: Academic Technology Specialist, Consulting Prof. Stanford Univ. English dept.
E-mail: mjockers@stanford.edu

Photo: 

1. Not answered.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?
Matthew Jockers is an Academic Technology Specialist and Consulting Assistant Professor in the Department of English. He also serves as a Manager of the Academic Technology
Specialist Program. Jockers's work centers on the academic uses of technology for the study and teaching of literature. He holds a doctorate degree in English / Irish-Studies and has been working in Academic Technology and Humanities Computing since 1995.

3. Not answered.

Participant: Judith Kirkpatrick

Title, affiliation: Professor, Kapi'olani Community College, University of Hawai'i
E-mail: kirkpatr@hawaii.edu
Photo: 

1. What do you believe is necessary for the LIKES initiative to succeed?

- Follow-up after the 1st conference, with thoughtful summaries, questionnaires, new opportunities and possible publication or dissemination venues for the participants. (For example, if enough of us go to EDUCAUSE, SAKAI, ASSESSMENT CONF., or some other higher-ed technology-oriented conference, we could collaborate on workshops or panels, etc.)
- Opportunity for reflection and a way for you to collect them, i.e. everyone answering a few questions throughout the two days at a wiki or a blog, for example, should be built into sessions.
- C.S. leadership to collaborate and embrace the opportunity to integrate or interrelate their curriculum into the arts and sciences. C.S. leadership needs to figure out a way to recruit talented students who may get an interdisciplinary degree, and offer courses that will complement other majors.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?

FACULTY SUPPORT
Yes. Since, 1996, I've been in the role of supporting faculty to integrate computer technology into curriculum across the disciplines, as a coordinator of our College's Information Technology Emphasis. I have developed several English courses for online delivery. I also have developed a web-based evaluation system that has been used for

anonymous student evaluation of instruction, pre-post student evaluation of technology in distance learning classes, and many other surveys where we have collected data from faculty or students. See: http://moosurvey.kcc.hawaii.edu for samples. I also have supported the development and use of a MOO (multi-user object oreinted) system for synchronous online discussion and instruction. See: http://moo.kcc.hawaii.edu

EPORTFOLIOS
I have been working with a national group that comes together at the Computers and Writing Conference each year since 1992, and actually hosted the conference twice (1997 and 2004). Additionally, I have been working with others on my campus to implement an ePortfolio system (SAKAI/OSP) that is available to all of our students to use as they and their programs decide to use it (2003-current). I am currently working with our science faculty to develop an ePortfolio for their A.S. in Natural Science degree. Our system can be seen at: http://eportfolio.kcc.hawaii.edu Let me know if you'd like guest access by emailing me at kirkpatr@hawaii.edu

SERVICE LEARNING (non-profit business) and making a civic investment in the community . . .
Additionally, since 1999, I have been working with a non-profit to support a technology center where talented college students are able to work in a service learning environment that provides good computer access to a children and a community of 2000 people living at or below the poverty line. While we have been developing the concept and the technology with second-hand donated computers, in the last year we have been awarded $1.6 million to renovate a 4400 sf area for the center and are in the middle of developing the specs for the center.

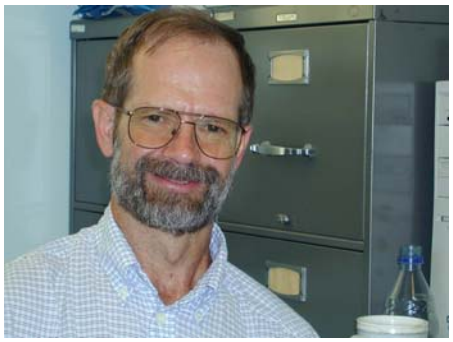
HIGH SCHOOL OUTREACH
We have been running summer bridge programs for high school juniors and seniors through an NSF grant and have included students building computers from parts and then awarding the computers to the students. We have just received another NSF (STEP) grant to have our students work with promising high school students by building computers after school in the school year and then teaching them either GIS or AUTOCAD.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?

I could best contribute to the LIKES deliverables by helping others with service learning and/or high school outreach programs that present rich experience and life-changing knowledge for the college and the high school students. Additionally, I have a lot of experience in helping faculty integrate computer technology into their curriculum. Our current plan is available at: http://www2.hawaii.edu/~kirkpatr/kite/

Participant: Richard Plant

Title, affiliation: Professor, Plant Sciences, University of California
E-mail: replant@ucdavis.edu

Photo: 

1. What do you believe is necessary for the LIKES initiative to succeed?
That depends on how you define success. I would say that it will succeed if the participants form the beginnings of a network that can effect positive change in the way topics related to information technology are taught.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?
I teach, do research, and advise students in geographic information systems and geospatial analysis, which is a topic that is at the intersection between technology, the life sciences, and the social sciences.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?
Hopefully by drawing on my experience working with non-technologically oriented students who are trying to learn to effectively use sophisticated computer software.

Participant: Ryan Richardson

Title, affiliation: Postdoctoral researcher, Department of Computer Science
E-mail: ryanr@vt.edu

1. What do you believe is necessary for the LIKES initiative to succeed?
CS faculty at institutions all over the US need to work with faculty, department heads, and curriculum committees in other departments to find opportunities to teach CS and IT-related concepts in courses outside of those offered by CS. With declining enrollment in CS and IT, but increasing demand for computing-savvy professionals in the workforce, we need to make sure students learn vital computing concepts whether they are CS/IT majors or not.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish?
I have taught and been a teaching assistant for several CS courses, including the writing intensive CS course at VT. Prior to coming to VT, I worked as a contractor writing database code for a major corporation for 2 years. From this experience, I learned the importance of working with technical writers who actually understood the underlying software.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?
By introducing a LIKES-themed set of core courses here at Virginia Tech, and also by seeing that the LIKES workshops attract as vibrant and diverse a group of educators as possible.

Participant: Dickie Selfe

Title, affiliation: Director, CSTW Ohio State University
E-mail: selfe.3@osu.edu
Photo: the one he provided is terrible

1. What do you believe is necessary for the LIKES initiative to succeed?
* Buy-in from department chairs, deans, and advisory boards
* Some funding for curriculum design and extended faculty prof. development institutes
* A willingness to tie CS curriculum to computing publics of all types
* A departmental service that constantly interviews very young to pre-college computer users about their interests and experiences.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?

I have years of experience with bullets 2, 3, & 4 above.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?

Help design an "institutional change model" for the items above.

Participant: Ellen Spertus

Title, affiliation: Research scientist Google
E-mail: ellen.spertus@gmail.com
Photo: http://spertus.com/ellen/ellen.jpg

1. What do you believe is necessary for the LIKES initiative to succeed?
I don't know.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?

I have been a computer science professor at Mills College since 1998 and a software engineer and research scientist at Google since 2004.

3. How do you feel that you can best contribute to moving the LIKES initiative

forward?

By combining my industry and teaching experience to identify important computer science concepts and how to teach them. (One area that I did not appreciate until gaining industry experience is building massively scalable systems.)

Participant: Jerry Suits

Title, affiliation: Assoc Prof of Chemical Education, Univ of Northern Colorado
E-mail: jerry.suits@unco.edu

Photo: 

1. What do you believe is necessary for the LIKES initiative to succeed?
First of all, a common vision based on a crucial need that is shared by most of the participants. In this case, it might be to help students (who represent our future society that is as of yet not fully defined) learn how to make qualitative changes in the way they do things that involves knowledge acquisition, integration, and distribution to everyone who needs that knowledge to solve both practical/applied problems (e.g., economy-based problems) and more theoretical/philosophical problems (e.g., how do we create a more just society that limits population growth and over-consumption of resources). Second, having a vision is necessary but it is not sufficient unless it contains a cohesive conceptual and procedural framework (e.g. participants must agree on terminology-- what a term means, how is it used appropriately, what does it not mean-- close associations that have different meanings). Third, the coherent vision must be implemented within a network that provides appropriate feedback loops to ensure that knowledge is being used in a productive manner.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?

YES! For the last 25 years I have been trying to use technology to help students learn chemistry (i.e., first year college chemistry courses) in a more meaningful way. The problem is that many students perceive that chemistry is very difficult because it is multi- dimensional with a vocabulary that rivals a foreign language course, mathematics applied to solve problems based upon chemical principles, understanding of abstract entities and processes at the molecular level, and hands-on laboratory experiences that illustrate chemical principles. I have developed, implemented and evaluated (1)

simulations of chemical phenomena, (2) animations of molecular processes, (3) interactive problem-solving tutorials, (4) computer- interfaced chemistry experiments, and (5) use of "clickers" to engage students in active learning in a lecture setting.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?

As a chemist/chemical educator I need technological tools that provide opportunities for students to interact with chemical phenomena by their decisions needed to establish experimental parameters, and by the feedback they receive from those phenomena (i.e., a database that contains a variety of possible chemicals, their properties and processes). I would like to guide IT developers in a direction that allows more student/user interactivity both at the "script" level and at the user's level (which usually involves seeing animated graphics). Flexibility is a key word. If learning technologies are designed to allow greater user flexibility in exploring a knowledge domain, then students can learn in a much more meaningful manner. Overall, I believe I can be a representative of disciplines that have complex needs for learning technologies.

Participant: David Tauck

Title, affiliation: Associate Professor of Biology, Santa Clara University
E-mail: dtauck@scu.edu
Photo: not provided

1. What do you believe is necessary for the LIKES initiative to succeed?

Bringing faculty with expertise in computer science and information technology together with their colleagues in other disciplines may lead to the creation of more useful pedagogical tools which could then advance the LIKES initiative. Unless those of us who use educational technology share our needs with those who create it, the available products may not enhance our teaching or improve student learning. Similarly, if we are unaware of current technology we cannot imagine possible applications of available tools or conceive of ideas for new ones. Dialog between the creators and users of these tools will help the LIKES initiative to succeed.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?

*No, however, although I lack skills in computing and information technology, my academic career has evolved with the personal computer and internet; I use both daily in my laboratory, classroom, office and home. *

3. How do you feel that you can best contribute to moving the LIKES initiative forward?

Realistically, my only hope of making even the slightest contribution to moving the LIKES initiative forward is by participating in this workshop and

establishing relationships with colleagues in computer science and information technology. Perhaps this will influence the calculus-based physics textbook for life science students that a colleague and I are writing and thereby indirectly support the LIKES initiative, but that's a long shot.

Participant: Ge Wang

Title, affiliation: Assistant Professor of Music, Stanford University, CCRMA
E-mail: ge@ccrma.stanford.edu
Photo: http://ccrma.stanford.edu/~ge/bio/ge-1e.jpg

1. What do you believe is necessary for the LIKES initiative to succeed?

I feel this great initiative will succeed if participants can truly move forward at their respective institutions and try out ideas fostered at the workshops, and have a productive way to then publish, share, and evaluate the results. Then perhaps another iteration!

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish?

Yes! I was a founding developer, co-director, and a principal instructor in the PLOrk: Princeton Laptop Orchestra (I am to start a Stanford Laptop Orchestra as well). This was a special environment where we taught music, composing, programming, and live musical performance in a truly integrated fashion. We've encountered much success in motivating students to learn about computing/programming through music, and vice versa! Have published on this ("Laptop Orchestra as Classroom", Wang, Trueman, Smallwood, Cook, to appear in Computer Music Journal). I am definitely looking to expand this into both traditional CS and Music curriculums.

The laptop orchestra also uses a new programming language for music, called ChucK (http://plork.cs.princeton.edu/), of which I am the chief designer and implementer. My PhD advisor and co-author, Perry Cook, and I designed ChucK to be educational to both students learning to program, and those learning about computer music. We've now offered 4 different courses featuring the laptop orchestra and ChucK as a primary platform for learning. We are continuing to work on the pedagogical aspects of both.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?

I'd first like to present our work with the pedagogial aspects of the ChucK audio programming language and the laptop orchestra, to the workshop, and to present our strategies of integrating computing into music, and vice versa - fundamentally using each advantageously to enforce the learing of the other. I look forward to learning what others are doing in their curriculum, and to participating in brainstorming of creative and feasible ideas that we can try as a community in the next 1-2 years.

Participant: Chris Zobel

Title, affiliation: Associate Professor, Dept. of Business Information Technology - Virginia Tech
E-mail: czobel@vt.edu

Photo: 

1. What do you believe is necessary for the LIKES initiative to succeed?

The LIKES initiative is about revitalizing computing education - this is a much bigger goal than simply defining new pedagogies, integrating new computing concepts into a few classrooms, and creating a forum in which new ideas about computing education can be discussed. To be effective, I believe the initiative requires long-term active participation and interaction - there needs to be a sustainable community defined around the idea, not just a collection of independent individuals who are each pushing a small corner of the envelope. The community cannot operate in a vacuum, however - an extremely important component of the success of the initiative is the understanding of people outside the community of the value and significance of what the initiative is seeking to provide.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?

Much of the course content in my academic department (Business Information Technology) is associated with the application of computing concepts to problem-solving in a business environment - from an applied standpoint, but with theoretical underpinnings, we seek to teach the students how to use technology to support better decision-making.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?

I would like to help facilitate the growth of the LIKES community - I will be actively participating in the four LIKES Workshops and am very interested in working with others in both industry and academia to collaboratively identify good existing practices in computing education, to innovate new techniques and applications, and to publicize the benefits and results of the community's efforts.

Participant: Mark Howison

Title, affiliation: PhD student, UC Berkeley Graduate School of Education
E-mail: mark.howison@gmail.com

1. What do you believe is necessary for the LIKES initiative to succeed?

Broad engagement of academics and practitioners from computer science, the physical sciences, and the humanities, especially music, digital art and new media.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?

I can think of two specific learning experiences that relate to LIKES' objectives. First, I've recently taken a course on agent-based modeling, as substantiated through the NetLogo programming/modeling environment. By offering a "low threshold, high ceiling" environment for modeling, NetLogo allows users with varying levels of computational literacy to address research questions in a wide range of disciplines, including those typically considered to be non-computing. Second, my readings of James Paul Gee and David Williamson Schaffer's books on the use of video games, and more specifically "epistemic games," as rich learning environments suggest opportunities for radically transforming current educational norms to take better advantage of computing technologies.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?

As a second year graduate student in the learning sciences at UC Berkeley's Graduate School of Education, my research interests lie in designing and evaluating cognitive artifacts and learning environments that foster computational literacy. I see this fitting most closely with the LIKES objective of delivering new pedagogies in computing education.

Participant: Tim Hesterberg
Affiliation: Insightful Corporation
Email: timh@insightful.com

1. What do you believe is necessary for the LIKES initiative to succeed?

Let me put this in a larger context. The U.S. is very strong in electronic commerce and digital entertainment, but is loosing ground in manufacturing, engineering, and perhaps in physical sciences.

I work in a statistical software company. We seem to have plenty of job candidates with CS backgrounds, but without the scientific computing background we need.

I hope that LIKES will expose undergraduates who are attracted to CS by the possibility of a computer game career, and expose then to CS applications in other disciplines.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?

I worked three years at Pacific Gas and Electric Co, in a cross-disciplinary technical group. We had some great applications of CS, Operations Research, Electrical Engineering, Statistics, and Mathematics, to applications in in electricity and gas -- optimal power flows, transmission capacity, hydroelectric scheduling, rare-event simulation for energy planning, and others.

I taught a "Mathematics Practicum" in which I recruited sizable problems from local industry and government agencies, and supervised teams of 3-5 students working for a semester on one problem. These involved a combination of Operations Research, Math, Statistics, and CS.

My primary expertise in Statistics is in bootstrap methodology, a computer-intensive approach that substitutes Monte Carlo simulation for classical assumptions and cookbook formulas. This has great potential both in teaching -- helping students understand difficult concepts related to sampling variability -- and practice -- providing more accurate answers than classical approaches and yielding answers where classical approaches are unworkable. For teaching materials and other info see http://www.insightful.com/Hesterberg/bootstrap.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?

I look forward to sharing stories, learning from others, and figuring out what partnerships make sense - between those in academia and those of us in industry.

Participant: Mialisa Moline
Affiliation: Department of English, University of Wisconsin - River Falls
Email: mialisa.moline@uwrf.edu

1. What do you believe is necessary for the LIKES initiative to succeed?

I believe that open collaboration between faculty must take place for the initiative to succeed. Participants need to clearly understand exactly what knowledge industry seeks in new hires and what it is that students currently lack in order to formulate a clear plan for building that knowledge in willing students.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?

I teach the importance of audience and applying a user-centered approach to online communication. I have experience in building tacit knowledge through graduate coursework and teaching online. I have learned, while working in industry, that significant gaps exist in motivating employees to build new knowledge. I have also learned (while teaching at the university) that the attitudes of students toward learning is still too passive. Getting large numbers of people to accept and embrace change is difficult at best.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?
I will contribute to the LIKES initiative in any way I can. I believe my humanist perspective, my emphasis on active learning, and my enthusiasm for the architecture of knowledge will be my most valuable contributions.

Participant: Steven D. Sheetz

Title, affiliation: Associate Professor of Information Systems and Director of the Center for Global e-Commerce, Pamplin College of Business, Virginia Tech
E-mail: sheetz@vt.edu

1. What do you believe is necessary for the LIKES initiative to succeed?

The most important thing is for faculty across the disciplines of the core curricula to embrace the concept of enhancing the learning of core content by integrating relevant computing concepts. Similarly, the willingness of computing faculty to contribute to the development of students beyond their majors is required for the development of modules and materials to teach the computing concepts.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?

Yes. I have studied the ability of students to learn computing concepts in the form of OO programming techniques and have taught for a decade in the Interactive Marketing Institute to bring knowledge of database concepts to marketing professionals. In addition, I teach in the MIT India program that teaches people with professional experience in related fields, e.g., engineering and finance, IS concepts.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?

I will contribute by developing modules through student projects in undergraduate and graduate classes, participating in the LIKES workshops, and defining a LIKES core curriculum relevant for students nationwide.

Participant: Wingyan Chung
Title and Affiliation: Assistant Professor, Department of OMIS, Leavey School of Business, Santa Clara University
Email: wchung@scu.edu

1. What do you believe is necessary for the LIKES initiative to succeed?

I believe the following conditions are necessary for the LIKES initiative to succeed: (1) A broad participation from different disciplines and institutions, (2) A deep discussion among participants on various issues related to LIKES mission, and (3) Concrete demonstrations, deliverables, or testimonies showing the impacts of new ideas, pedagogies, and/or new curriculum that result from the initiative.

2. Do you have specific teaching/learning experiences in your background that relate to what LIKES is trying to accomplish? Or experiences from a business setting?

My relevant teaching/learning experiences are as follows: (1) I have more than 10 years of teaching experience at graduate, undergraduate, and high-school levels that provide me a broad perspectives related the LIKES project; (2) I have been a certified teacher and obtained a post-graduate certificate in business and accounting education (PC Ed). The training I obtained from the PC Ed program help me to understand the education needs of my field. (3) I have curriculum development experiences in the Hong Kong Education Department for about three years (on a part-time basis) and in The University of Texas at El Paso.

3. How do you feel that you can best contribute to moving the LIKES initiative forward?

I believe by organizing the LIKES workshops, participating in the project activities, and contributing ideas and actions to integrating IT and computing into business education will help to move the LIKES initiative forward.

Living in the KnowlEdge Society (LIKES) Workshop Reimbursement Request Form				
Name				
Organization				
Social Security #		Phone number		
Home Address:	Street #			
	City			
	State		Zip	
Date of Workshop	11/30-12/1	Location of Event	Santa Clara University	
Travel (flight and local transportation)				
Lodging				
Cost for Auto Mileage (_____ miles × $0.485 per mile, attach a map showing mileage between your organization and the workshop location)				
Honorarium (if any)				
Total Amount Requested				

Note: To be reimbursed for expenses, original receipts must be attached. A 1099 for payment of services provided will be issued to IRS for tax reporting purposes.

_____ _____

Date Signature

Mail the completed form and all the original receipts by December 15, 2007 to:

Ms. Patricia Kyu
Accountant, Sponsored Projects Office
Santa Clara University
500 El Camino Real
Santa Clara, CA 95053

(For Official Use: Accounting String – 6200-13001-OMIS-RSCH-NSF056)