Computers for Humanity: A Service Learning Approach to Computer Education

Dr. Wayne E. Pauli
wayne.pauli@dsu.edu

Ashley Podhradsky
ashley.podhradsky@dsu.edu
College of BIS, Dakota State University
Madison, SD 57042, USA

Dr. Crystal Pauli
crystal.pauli@dsu.edu
College of Education, Dakota State University
Madison, SD 57042, USA

Dr. Mark Moran
mark.moran@dsu.edu
College of BIS, Dakota State University
Madison, SD 57042, USA

Abstract

The project and resulting paper explores a creative solution to knowledge creation by replacing the "teachers teaching" model of instruction with one that utilizes the "learners learning" model. Rather than having a skilled instructor teach the nuances of computer hardware and software to undergraduate students via lecture, this solution of knowledge creation embraces concepts of transformative learning as the instructor serves as a resource for student learning. A service learning component is also present as students, through public/private collaboration, address the digital divide present in their community with acts of civic responsibility and strengthening of the community.The overall effectiveness of the Computers for Humanity Project will be evaluated by a self evaluation assessment survey on computer hardware, software, networking, security and service learning, which was initially administered in September 2009 and will be repeated in December 2009. The self evaluation questions will be answered at the beginning of the semester long course (pre-test) and at the end of the semester (post-test). They will be repeated the following semester starting January 2010, in which traditional computer instruction will be utilized. This will provide for a comparison to determine the overall effectiveness of the project.

Keywords: digital divide, service learning, public/private collaboration, transformative learning

1. INTRODUCTION

According to Samuel Johnson (1709 – 1784), "Knowledge is of two kinds. We know a subject ourselves, or we know where we can find information on it." (Frank, 2001, p.429)

Computer Information Systems (CIS) 350 is an introduction to computer hardware, data communications, and networking fundamen-

tals and theory. Computer design, components, voice and data communications and LAN design and operation issues are addressed in both lecture and hands-on formats. Emphasis is given to network design using the OSI model as well as network operations and setup issues. This is the course description from the 2009-2010 undergraduate catalog at Dakota State University of Madison, SD.

CIS 350 is a major requirement for all education majors as it plays an integral role in the technology endorsement that all education majors earn prior to graduation. In addition several majors in the College of Business and Information Systems (BIS) require CIS 350. On an annual basis this South Dakota University offers a minimum of ten (10) sections of this course and has enrollment nearing 200 students.

The concept of hands on learning by building computers in the classroom has many advantages for the students: 1) The student learns hardware in a new way with this hands-on approach. 2) The interaction between hardware and software is very realistic. 3) The student learns technology trouble shooting techniques. 4) The student is held accountable for the outcomes based approach of this learning module. 5) The student learns service-learning by way of a feeling of responsibility to the recipient families.

The goal of this pending research is to supply outcomes which would suggest that the creation of an innovative delivery mechanism (as outlined in this paper) for a legacy course such as CIS 350 will be of interest to IS educators. The student will participate in a project that allows them to have responsibility of their own learning and understand the changes in themselves as a result.

Technological advancements have made significant gains in assisting schools and other public agencies with their goal of providing computer and internet access to all, including the minorities and poor (Roach, 2003). Even with these advancements, according to Tefft (2002), "this Internet age has done little to narrow the gap between the rich and the poor, the haves and the have-nots; in fact these technologies could create new inequalities and reinforce the dominance of race and elitism" (p. 479).

This new approach to delivering the course subject matter will be coupled with a form of service learning, and providing a positive impact to the still present digital divide of the rural location of this university.

2. THE UNIVERSITY

In 1984 the South Dakota Legislature and the South Dakota Board of Regents changed the mission of Dakota State University (DSU) of Madison, SD. DSU was tabbed as the university in South Dakota that would educate leaders for the information age.

In recognition of its pioneering academic programs and outreach efforts relating to technology, DSU was selected as one of ten finalists for the 1987 G. Theodore Mitau Award. The "Mitau" is an annual award given by the American Association of State Colleges and Universities (AASCU). According to the 1984 mission statement (Staff, 2003),

Dakota State University is an institution specializing in programs in computer management, computer information systems, and other related undergraduate and graduate programs as out lined by SDCL 13-59-2.2. A special emphasis is the preparation of elementary and secondary teachers with expertise in the use of computer technology and information processing in the teaching and learning process. (p. 2)

3. THE STUDENTS

CIS 350 is included in the major field of study for the following undergraduate majors: Computer Information Systems, Computer and Network Security, Network and System Administration, K-12 Computer Education, and the Networking minor.

All education majors at Dakota State University complete a K-12 Educational Technology endorsement as part of their program. CIS 350 is one of the courses within the endorsement.

Searching for a learning environment for the range of educational interests is challenging to the university, the instructors, and the students.

4. TRANSFORMATIVE LEARNING

Based on the advances in information and communication technologies (Chatterji, 2000), the culture from which the workplace as well as education has existed throughout

the Industrial Age is being challenged. Professor of Management at the Sloan School of Management at Massachusetts Institute of Technology, Edgar Schein, addresses this issue as a transformative change within an organization. (Schein, 1999) Transformative change according to Schein is the "need to unlearn, and then relearn" (p. 124). This position would appear to be appropriate when attempting to understand the formal definition of culture as supplied by Schein (1992):

"A pattern of shared basic assumptions that the group learned as it solved its problems of external adoption and internal integration, which has worked well enough to be considered valid and therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems." (p. 12)

According to Egol (1999), utilizing transformative change techniques in education are necessary when one considers that the "theory of knowledge employed by most of today's schools, views knowledge as a thing to be transferred instead of created" (p. 488). Egol continues his thoughts by stating that, "the accelerating pace of change required that educators must continually learn and adapt to constant change" (p. 488).

Egol (1999), states that due to the accelerated pace that technology is changing how people learn, "the 'teacher-teaching' model must be replaced by a 'learners-learning' model" (P. 489). This change is evolutionary, given that teachers who once upon a time covered a prescribed body of knowledge are being replaced by self-directed learners in a how-to-learn model of education. Egol's theory (1999), conceptualizes that self-directed learning can be promoted by shifting from lecture based methods to project-based learning.

The vision of South Dakota as verbalized by recently retired Executive Vice-President Dr. Tad Perry (2003) and the Board of Regents is as follows:

1. South Dakota will have a population that reflects the synergy of an educated populace.
2. South Dakota will have a growing working-age population with the education needed to support a growing knowledge-based economy.
3. South Dakota will increasingly benefit from a significant increase in research and development.
4. South Dakota will be a national leader in the use of information technology. (p. 1)

5. SELF-DIRECTED LEARNING

Self-directed learning can be defined as the amount of responsibility the learner accepts for his or her own learning. The self-directed learner takes control and accepts the freedom to learn what they view as important for themselves. The degree of control the learner is willing to take over their own learning will depend on their attitude, abilities and personality characteristics Readiness for SDL is present in all individuals to some extent. Readiness for SDL is varies by the individual and can be measured with a Guglielmino's (1977) Self-directed Learning Readiness Scale (SDLRS). The assessment model used in this study uses a modified SDLRS to assess the level of student SDL for this study.

6. THE DIGITAL DIVIDE

Over four decades have passed since socialist and political author, Edward Michael Harrington suggested that if there was advancement in technology without social advancement for all of the populace, then an accompanying increase in misery and poverty would also be present. According to Dorrien (1997), Harrington delivered to the forefront of American politics the concept of the poor being invisible to middle-class America. The concept of haves and have-nots described by Harrington continues to permeate the economic and social landscape of the United States. Lindsey and Poindexter (2003), state that the gap between the haves and the have-nots has "created the digital divide" (p. 112).

Oddo (2002) posed the question, "How can the poor gain access to computer technology, and learn to use it to compute effectively in our high tech world? (p. 16) Oddo (2002) describes the digital divide as another wedge that has been driven between the wealthy and the poverty-stricken. Koss (2001) referred to the digital divide as "the gap between individuals, households, businesses, and geographic areas at different socioeconomic levels and their opportunities to access information and communication tech-

nologies" (p. 77). The term "digital divide" entered the American lexicon in the mid-1990's to refer to unequal access to information technology (Light, 2001).

Access to technology is a threat to the continuation and proliferation of the digital divide. Poor and minority families and their children have less access to a range of resources in society, and one such resource is access to the Internet (Natriello, 2001). The unequal access to technology comes from many facets. According to Vigna, Fairchild, Bearnes, and Sherry (2003), it comes from the aging of the rural population; it comes from the fact that the U.S. population has become more ethnically diverse; and it comes from the fact that web-based content on the Internet continues to target white America, not addressing the interests of minorities.

A 2005 study found that family income continued to be the most prevalent economic factor identified by the participants regarding the lack of access to home computers and Internet access. Research has illustrated, (Howland, 1998), (Koss, 2001), (Natriello, 2001), (Dickard, 2002), (DeBell & Chapman, 2003), and (Pauli & Moran, 2009), that the larger the family income, the more likely the family is to have access to technology in the home. In the 2005 study in excess of 71% of the respondents who did not have a computer at home cited the computer being too expensive as the reason for not having a computer in the home. The percentage of respondents who cited Internet service in the home as being too expensive as the reason for not having Internet access increased to 75%. The findings of the entire population of the study demonstrated that slightly more than 21% did not have a computer at home, and this percentage grew to almost 39% of the families with an annual income of under twenty thousand dollars.

7. SERVICE LEARNING

Service-Learning is a teaching and learning strategy that integrates meaningful community service with instruction and reflection to enrich the learning experience, teach civic responsibility, and strengthen communities. An exciting, hands-on approach to education, service-learning is taking place in a wide variety of settings: schools, universities, and community-based and faith-based organizations throughout the country. The core concept driving this educational strategy is that by combining service objectives and learning objectives, along with the intent to show measurable change in both the recipient and the provider of the service, the result is a radically-effective transformative method of teaching students. (What is Service Learning, 2009)

8. THE PERFECT STORM

A plan has been developed to teach the CIS 350 curriculum in a mission sensitive approach that embraces transformative learning and addresses the local digital divide through a form of service learning for the students and faculty involved. The perfect storm is designed to create knowledge by way of incorporating the learners learning model as described by Egol (1999).

It is the hope of the facilitators that by using the theories of self-directed learning and transformative learning, learners will experience change in attitudes, behaviors and skills which will be useful when working with school-aged children in the future. This project will allow future educators the opportunity to see first-hand how self-directed learning can be transformative. They will participate in a project that allows them to have responsibility of their own learning and understand the changes in themselves as a result. It is the belief of the facilitators that this will be an invaluable experience.

9. PUBLIC – PRIVATE PARTNERS

The updated delivery mechanism for the curriculum of CIS 350 creates partnerships between the public university and several private enterprises. This curriculum delivery also acts as a catalyst for change with regard to building a collaborative approach to providing educational opportunities while instilling the value and virtues of service learning to this undergraduate population. The U.S. Government has steadily increased funding to bridge the digital divide; the increased investments by industry and government working together have created jobs and expanded educational opportunities; and the Information Age has replaced the Industrial Age as the driving force to the U.S. economy. Those people who do not have access to the Internet are at a disad-

vantage regarding jobs as well as educational opportunities (Dickard, 2002)

10. COMPUTERS FOR HUMANITY

Computers for Humanity, comprised of the Dakota State University's CIS 350 class, Center of Excellence in Computer Information System, College of Education and College of Business and Information Systems, is partnering with the Madison Habitat for Humanity Chapter to build three custom desktop computers for Habitat for Humanity families. The barrier of cost is central to the discussion of the digital divide due in large part to the concept of the haves against the have-nots. The Computers for Humanity Group is also working with private industry to provide a complete home computer system and address the barrier of cost. The private companies are:

- RadioShack of Madison is donating printers and providing all computer components at a discounted price
- Knology is providing 6 months of internet access for each family
- Secure Banking Solutions of Madison is providing each family security software to protect their computers
- Montgomery's Furniture of Madison is providing each family with a desk

CIS 350 teaches students about all of the internal components that make a computer work. Students learn how to build, repair and upgrade computers. The Computers for Humanity Project will allow students to apply the knowledge derived from the course into building three computers for Habitat for Humanity Families. Traditionally CIS 350 students have worked on legacy computers and computer components, so this project also gives the students the opportunity to learn the current components that make up home computers. This course is taught in a semester long period of time from September 1, 2009 to December 17, 2009. Figure 1 demonstrates the course timeline.

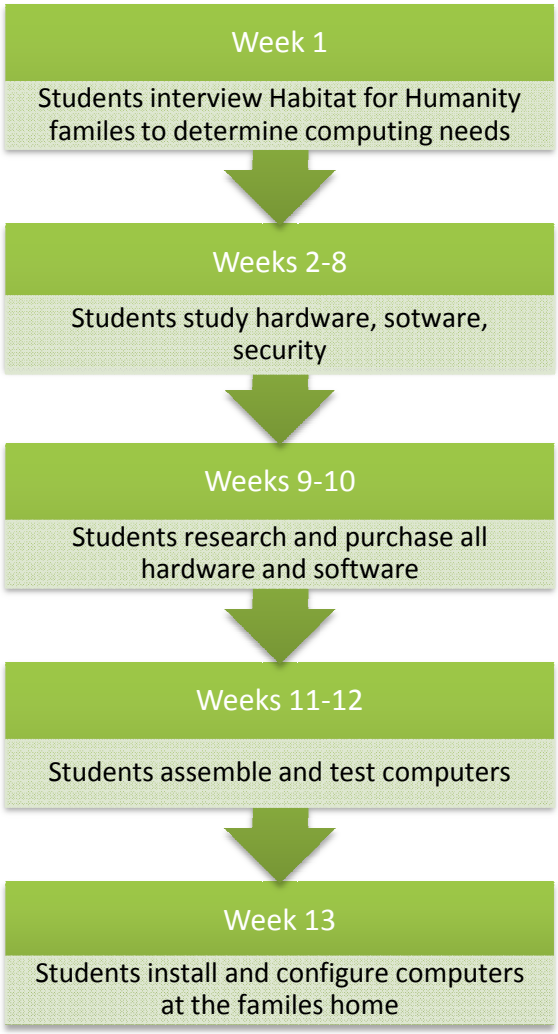

Figure 1- Computers for Humanity Timeline

11. TIMELINE

The CIS 350 students will spend the first week of the course meeting, interviewing, and developing a computer scheme for each of the families. Each family has different needs for their computer; as a result each CIS 350 class will build a customized computer for their selected family.

The students will spend the next seven weeks of the course learning about computer cases, motherboards, chip sets, processors, hard drives, data cables, power supplies, along with other aspects of computer hardware. The students will also learn about different computer software such as the operating system, drivers and applications.

After the initial eight weeks, the students will spend two weeks researching and purchasing compatible hardware and software for the computers. Every component of the computer will be purchases locally through RadioShack. When all the components arrive, the class will assembling the computers, installing all software, and testing the computers.

During the 13th week, the CIS 350 class will visit the Habitat for Humanity families and set up the systems. The families will also receive technology support from the class on how to use the computers.

This project will allow the CIS 350 students to create knowledge and apply the learners learning model regarding computer hardware and software in an innovative fashion. The students will learn how to research the components and determine compatibility of all of the components that make up a computer, along with physically building the computer. The students will also integrate service learning into the course with the partnership between Computer for Humanity and Habitat for Humanity.

12. DATA COLLECTION

To validate the effectiveness of the Computers for Humanity project a self-evaluation assessment will be given at the beginning of the CIS 350 course (pre-test), and again at the end of the semester (post-test). The students will be asked to rate themselves on a scale of 1 to 5 on the following questions:

1. How comfortable are you installing an operating system?
2. What is your knowledge of computer hardware components?
3. What is your internet troubleshooting knowledge?
4. How comfortable are you installing peripherals on a computer?
5. How comfortable are you upgrading memory on a computer or laptop?
6. How comfortable are you securing a wireless network?
7. How knowledgeable are you about service learning?
8. How comfortable are you with service learning?

This study will evaluate the impact of the computers for Habitat project on the self-directed learning aptitude (SDLA) and its factor aspects for the student participants. These factors: (a) effective learning (EL), (b) fondness for learning (FFL), learning motivation (LM), and active learning (AL), among others, will be evaluated using competency base learning (CBL) model proposed by Guglielmino (1977). CBL is a self-directed, individual, and mastery method, allowing students to achieve predetermined competency standards with the knowledge and skills that they have learned.

The Guglielmino questionnaire has been used by many researchers (L. Guglielmino & P. Guglielmino, 1991) and future modified by Teng (1995). For this study the SDLA questionnaire has been modified based on findings by Cheng (2007). The survey utilized asks the eight initial questions with the addition of selected questions addressing the four factor aspects. See table 1.

Table 1

SDLA Factors and questions	
Effective Learning (EL),	11 questions
Fondness for Learning (FFL)	9 questions
Learning Motivation (LM)	7 questions
Active Learning (AL)	10 questions

In terms of statistical analysis the researchers plan to evaluate SDLAs before and after the project is complete. Perhaps one-way ANOVA or SEM will be used to interpret the results.

This assessment will provide an initial measurable baseline to test the perceived computer hardware, software and networking knowledge of the CIS 350 students. Repeating the assessment at the end of the semester will allow the students to reevaluate their perceived level of knowledge.

The assessments will again be administered in a subsequent CIS 350 course in which the Computer for Humanity project is not taking place. This will allow the researchers to test the effectiveness of the applied, service learning approach to CIS 350.

13. FUTURE RESEARCH

Future research based on this project will examine the collected data and will provide for additional examination of this learners learning approach to teach a technology based class. Depending on the results of the SDLA model this approach can be applied to other courses at this university. The goal of this pending research is to supply outcomes which would suggest that the creation of an innovative delivery mechanism (as outlined in this paper) for a legacy course such as CIS 350 will be of interest to IS educators.

14. CONCLUSION

Student retention is an important issue for universities worldwide. The authors believe that active, self directed learning will improve student engagement in their coursework. Project based learning should enhance learning performance of college students in this course. This project enhanced course will be compared to traditional classroom teaching in the Spring semester of 2010. The authors will compare the results of start and end of course surveys for the students in both course setups.

15. REFERENCES

Chatterji, D. (2000). "Strategic impact of the information age." Research Technology Management, 43(1), 35–37.

Dakota State University 2009-2010 undergraduate catalog (Vol. CVIII).(2009). Madison, SD: Dakota State University.

DeBell, M. & Chapman, C. (2003, Nov. 7). "Computer and internet use by children and adolescents in 2001: Statistical analysis report." NCES Electronic Catalog, i – 56. [Electronic Version] Retrieved May 17, 2004, from http://nces.ed.gov/pubsearch

Dorrien, G. (1997). "Michael Harrington: Socialist to the end." [Electronic Version] Retrieved January 17, 2004, from http://www.religion-online.org

Dickard, N. (2002). "Benton foundation policy brief series to explore consequences of digital divide funding cutbacks." [Electronic Version] Retrieved May 17, 2004, from http://digitaldividenetwork.org/content/stories/index.cfm?key=217

Egol, M. (1999). "Don't reengineer the existing system." Vital Speeches of the Day, 65(16), 487–490.

Frank, L. (2001). Quotationary. New York: Random House

Guglielmino, L (1977) Development of self-directed leaning readiness scale. Dissertation.

Guglielmino, L, & Guglielmino, P. (1991) Learning preference assessment facilitator guide. King of Prussia, PA Organizational Design and Development, Inc.

Guglielmino, L & Long, H. McCune, S. (1989), Reactions to Fields investigation into the SDLRS, Adult Education Quarterly, 39: 235 -245.

Howland, J. (1998). "The 'digital divide': Are we becoming a world of technical 'haves' and 'have-nots'? "The Electronic Library, 16(5), 287–289.

Koss, F. (2001). "Children falling into the digital divide." Journal of International Affairs, 55 (1), 75-90.

Light, J. (2001). "Rethinking the digital divide." Harvard Educational Review, 71 (4), 709–734.

Lindsey, B., & Poindexter, M. (2003). "The Internet: Creating equity through continuous education or perpetuating a digital divide?" Comparative Education Review, 47(1), 112–124.

Natriello, G. (2001). "Bridging the second digital divide: What can sociologists of education contribute?" Sociology of Education, 74(3), 260–265.

Oddo, A. (2002). "Bridging the digital divide: Financial and ethical challenges." Teaching Business Ethics, 6(1), 15–25.

Pauli, W., & Mark Moran (2009). "The Digital Divide: an Investigation of Native American Undergraduate Population in South Dakota." Proceeding from MWAIS 2009

Roach, R.,(2003). "Report: Digital divide rooted in home computer ownership." Black Issues in Higher Education, 20 (20), 50.

Schein, E. (1992). Organizational culture and leadership. San Francisco: Jossey-Bass.

Schein, E. (1999). The corporate culture survival guide. San Francisco: Jossey-Bass.

South Dakota Board of Regents policy manual. (n.d.) [Electronic Version] Retrieved January 11, 2004, from http://www.ris.sdbor.edu/policy/policy.htm

Tefft, S. (2002). "Digital Divide: Civic engagement, information poverty, and the Internet worldwide." Journalism and Mass Communication Quarterly, 79(2), 479–481.

Teng, T. (1996) Adult instruction and self-directed learning. Taipei, Taiwan: Wu-Nam publication

Vigna, D., Fairchild, P., Bearnes, K., & Sherry, L. (2003). "4-H cyber fair: Bridging the digital divide." Journal of Family and Consumer Sciences, 95 (4), 34-36.

What is Service Learning? (2009). [Electronic Version] Retrieved August 10, 2009, http://www.servicelearning.org/what-service-learning