Integrating Liberal Learning Principles into the Information Technology Classroom

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Abstract

While much has been published about integrating technology into liberal arts courses and the benefits of doing so, little has been written about integrating liberal learning principles into technology-based courses. The authors examine one introductory technology course at a New England business college and describe some of the assignments and subject matter that empower students to apply their knowledge of technology in contexts that transcend the technology domain. The authors share classroom practices, assignments, and student feedback to show how students develop an understanding of how to apply technology to new forms of creative expression. By encouraging students to lead technology-enabled lives, faculty can simultaneously encourage students to espouse the very essence of what it means to be life-long liberal learners.

Liberal Learning in a Professional Setting

Recent scholarship on integrating technology in the classroom has focused on creating environments where teaching liberal learning skills may be enhanced through the use of technology (Ehrmann, 2004; Scott, Chenette, & Swartz, 2002). Ehrmann (2004) looks at the ways in which technology in the classroom can support "the five key educational outcomes for liberal education" as outlined by the Association of American Colleges and Universities (AAC&U) in its 2004 report *Our Students Best Work*. According to Ehrmann (2004), those include the following:

1. strong analytical, communication, quantitative, and information skills
2. deep understanding of and hands-on experience with the inquiry practices of disciplines that explore the natural, social, and cultural realms
3. intercultural knowledge and collaborative problem-solving skills
4. a proactive sense of responsibility for individual, civic, and social choices
5. habits of mind that foster integrative thinking and the ability to transfer skills and knowledge from one setting to another (2004, 6)

A study of the effects of technology in the classroom at Grinnell College reveals numerous benefits to both students and faculty, including "increased impact of ideas," "increased efficiency and flexibility," and "increased opportunities for collaboration on and off campus" (Scott, Chenette, & Swartz, 2002, 32-33).

Exploration of the ways in which technology might foster the development of liberal learning skills is worthy of further investigation,   However, this article shifts the focus to show how an introductory technology course at a business college integrates liberal learning activities to develop a fundamental understanding of technology applications.   Through an examination of one introductory technology course offered at Bentley College, a business college in Waltham, MA, the authors argue that by creating opportunities for students to apply their technology learning to use new media as a tool for communication and creative expression, students will develop skills that will embrace both technology and liberal learning inside as well as outside the classroom. The authors share classroom practices, assignments, and student feedback to show how students develop an understanding of how to apply technology to new forms of creative expression. In addition, the authors describe some of the assignments and subject matter that empower students to apply their knowledge of technology in contexts that transcend the technology domain.

Frydenberg, Kamis and Topi (2005) examine the impact of handheld computers on students in Technology Intensive IT101, measuring attitudes toward information technology, skills, and performance by surveying students who have completed the course. This paper analyzes students' experiences and perceptions of their own learning.

Liberal Learning and Technology in a Business Context

Bentley prides itself on the integration of business and technology across the curriculum. Recent initiatives reflect the institution's commitment to integrating liberal arts throughout the curriculum, from e-commerce to economics and from physics to finance. In 2004, the school received a grant of approximately $200,000 from the Davis Foundation to fund faculty workshops aimed toward integrating liberal learning across the curriculum. Approximately 80 faculty members have participated in this program in its first two years. In addition, in December of 2004, the faculty approved the Liberal Studies Major (LSM). Taken in conjunction with a business major, the LSM helps students make connections among their General Education courses. It requires students to select General Education courses within a particular theme so that the students recognize the overlap among the disciplines and start to break down artificial distinctions in their own minds between the knowledge of one's major and the General Education requirements.

IT 101 and Handheld Computers

Efforts are under way at Bentley College to integrate liberal learning and professional training. IT 101 (Introduction to Technology) is a course required of all first year students at Bentley. The "standard" IT 101 course serves as a "leveling" course, introducing students to basic technology concepts, ensuring all students gain basic competency in using and maintaining their computers, and fluency in using the Internet. The course builds individual skills in creating web pages, developing spreadsheets, and navigating the Windows XP operating system, all crucial skills for future business leaders.

As the use of computers increases at home and in high schools, so does the number of students who arrive on college campuses with some previous computer experience (Meirtschin and Willis; 2003, Baugh, 2004).   This trend results in the need for colleges to adapt their introductory courses to meet the needs of these technologically advanced students. The instructor's response was to create a "technology intensive" version of IT 101 which would encourage students to incorporate the use of technology not only into classroom exercises but also into their day-to-day activities. The course concepts are similar in both the standard and technology intensive sections

of the course; however, the methodology is different. In the Technology Intensive sections, students purchase Internet-capable PDAs (personal digital assistants) instead of printed textbooks to learn about technology. Students use their PDAs, along with their laptops, and online resources to complete carefully crafted experiential learning exercises that demonstrate the need to apply technology concepts to real world situations. As a result, students develop not only a greater understanding of and appreciation for technology, but also develop skills in critical thinking, writing, and problem solving, as they see how they might integrate course concepts into their own lives.

Assignments for Learning and Discovery

The types of assignments students are asked to complete in the technology intensive course are rather straightforward. Students in the class find themselves creating surveys, analyzing spreadsheets, developing websites, publishing podcasts, and evaluating software applications. On the one hand, the assignments are designed to introduce a new way to apply a specific technology to solve a specific problem. On the other, they are also intended to encourage critical thinking and the use of technology to present a student's findings using a variety of media. These are the same goals as assignments given in an expository writing or a research methodology course, where students are introduced to concepts such as primary and secondary resources and are required to engage in advanced types of research. Such primary research activities give students an opportunity to develop their critical thinking skills as they formulate the questions and determine the goal of their projects.

Survey Assignment

When creating surveys, students often determine that their questions are too biased in nature once they test the survey on a small sample. Such an exercise helps them think through the ultimate focus of their research and the ways in which their questionnaires may or may not support that research. In addition, after receiving a sample of responses, students are also able to determine if they failed to ask for specific data. For example, students who fail to ask if the respondent is a male or female find themselves unable to make claims about their research and the effects of gender.   Students in the Technology Intensive IT 101 course have these learning experiences as "side effects" of applying technology to solve practical problems.

In one assignment from the course, students use Perseus™, a software package, to create surveys on topics of interest to them. After working with a group to develop a survey instrument on their laptops, each student transfers the survey onto his or her Pocket PC. Students quickly come to appreciate the benefits of a mobile device, as they interview subjects and use their Pocket PCs to record their subjects' responses. After gathering several responses, the students must then transfer the responses to their laptops and merge their data with that collected by other students in their group. Next the students must export the combined results to Microsoft Excel™. They create a spreadsheet to analyze their responses and produce graphs and charts to illustrate their findings. Finally, they must determine how to present and publish their results to a web site. From a technical point of view, this assignment helps students become familiar with the process of managing data shared between several software applications and hardware platforms. From a critical thinking perspective, like any survey assignment, this assignment gives students the opportunity to develop questions, analyze data, and critique the usefulness or uselessness of their own research tools.

Advantages of the Approach

In the survey assignment, students find themselves developing a number of skill sets. They must gather data on the Pocket PC, transfer, merge, and analyze the data using their laptops, and create a web page to present their results. Thus students face new challenges that require both creative and critical thinking and understanding about domain-specific knowledge as well as how to apply technology. The assignment asks students to think about the very process of information

seeking, requires them to develop criteria for analysis, and encourages them to best determine how to visually present their findings to others and draw conclusions from their results.

Students must also understand under what conditions it is advantageous to administer a survey using a Pocket PC. They also come to realize that when giving surveys via web sites, email, or paper, the surveyor does not interact directly with the respondents. This may be desirable when the sample size is large, geographically dispersed, or needs to be anonymous. However, for short surveys which are administered on site (such as exit polls at voting sites or marketing research surveys at retail establishments) using a mobile device to administer a survey and record the results allows for a face-to-face conversation with one's subjects while facilitating the process of data collection.

Students quickly find they have an emotional investment in the assignment because they were involved in every part of it, from determining the questions to displaying the results. While the process that each group must follow is the same, each group's end product is always very different. This encourages creativity and collaboration within each group.

More importantly, the traditional teaching/learning dynamic here is disrupted. This process of trial and error requires the student to discover best practices on his/her own. Students must develop their own questionnaires and assess their findings independently. Only after engaging in the entire process can the student learn best practices retrospectively. Thus, the liberal learning comes from active involvement in the process of using technology to perform a task. The technical learning is found in assessing one's own understanding of the underlying technology used in performing that task. The assignment encourages active learning as students critique their own processes. No lecture or explanation could prepare the student for such moments of discovery.

The unique aspect of this course is demonstrated in the very combination of technology and liberal learning that is evident in assignments that students complete. Teachable moments arise in any course during the production of the survey and the assessment of the data. Here, though, interesting dilemmas arise out of the administration of this survey via the Pocket PC. For example, immediately after the 2004 World Series, many students surveyed their friends on the following question: What's your favorite baseball team? Students who created their surveys with a single text field to enter a response ended up collecting a variety of responses that may or may not have indicated the same answer. One respondent might enter the words *Red Sox*, with both words in capital letters. Another might enter *Redsox* with the two words merged together. And a third response might be *Sox*. As a result, students are left with variations in responses that all convey the same intended response, but the raw data are not in a format conducive to quantitative analysis. Thus, students found themselves analyzing the setup of their surveys and the ways in which respondents would enter information into the fields. In this case, students discovered that including *Red Sox* as one of several probable responses for multiple choice would eliminate this situation. Recognizing this need for uniformity in survey responses would not be evident if the students administered the surveys and compiled their results manually. The use of technology generates new opportunities for analytical thinking.

Podcasts and Multimedia Assignments

Learning opportunities come from a variety of assignments, as liberal learning is evidenced in a number of ways. New media make possible new ways for students to demonstrate their understanding beyond the printed word.   Robinson and Dodd (2006) and others have suggested that millennial students are more likely to be engaged by using "music devices as part of the teaching and learning process." Podcasting is one such example. A podcast is an audio or video file distributed to an appropriate media player over the Internet. Users may subscribe to a series of podcast episodes known as a "feed." Portable music players, such as Apple's iPod, have popularized the use of this technology. While many college faculty have created podcasts of their

lectures for students to download and listen (Read, 2006), students in this class work in pairs to create audio or video podcasts demonstrating a key concept they learned about during an assigned class session. Their classmates download them to listen or watch on their laptops or Pocket PCs. Students learn the technology behind podcasting and how to use it effectively as a tool to communicate their ideas or findings. Students demonstrate their understanding of a subject by speaking coherently about it as they record their own voices and create videos that will be distributed as podcasts. They must understand the processes involved in creating their audio or video recordings, compressing them and posting them to a web server, and updating the associated index file that lists the available podcast episodes. Students find themselves having an "out-of-classroom experience" as their podcasts become a vehicle for teaching and learning outside the classroom.

Students also collaborate on a multimedia assignment, where they combine voice, images, and sound to create a sixty-second commercial for a real or fictitious product or organization. This task requires students to create or find digital images, and appropriate accompanying audio. Students must consider how to share their message using multimedia, enabling the opportunity to develop both technical and liberal-learning skills. Just as they must cite references in a term paper, they must also credit the sources of any copyrighted images or music that are included in their commercials. This also leads to a discussion of fair use of copyrighted materials, and sources of images and multimedia in the public domain.

Software Evaluation Assignment

Early in the semester, students work in groups to identify, install, and evaluate a shareware or freeware software application that takes advantage of the wireless or on-the-go capabilities of their new mobile devices. As consumers, they must make key decisions as to whether or not a given program is easy to use and meets their requirements. They must also recommend additional enhancements not found in the current version, that they would like to see included in a future release. During two class sessions, each group presents its evaluation to the class along with a live demonstration of how to use the program. The following week, each student, individually, must install and review one of the programs that another group presented. Students who presented a particular program provide "help desk" support for their classmates who chose to review the same application. In this way, students learn from each other formally through classroom presentations as well as informally when providing one-on-one assistance to other students.

Student Self-Assessments

At the end of the course, students wrote a web log ("blog") entry that described their learning throughout the semester. The question posed was "What did you learn this semester that I can't test you on?" In each of two consecutive semesters, common themes emerged from the students' responses as they described their learning accomplishments. Many commented about the extent to which the technologies they learned are relevant in their lives and that they can use technology to manage their own lives.

In most cases, however, students did not focus on the specific tasks or technologies (i.e., how to create spreadsheets, post web pages, or maintain one's computer) that they learned, but rather on the learning and critical thinking skills that they developed as a result of doing so. Their responses acknowledged a sense of surprise at "how much" they learned compared to how much they thought they already knew, and conveyed that they learned how to think and develop the confidence that they could make accessible things that they originally thought were beyond their reach. Because the course creates opportunities to use technology to express themselves and in ways they have not thought possible, they develop some self-esteem and take pride in their accomplishments.

Evidence of Liberal Learning

Consider these student responses that evidence the AAC&U five key educational outcomes for liberal education as presented above:

On strong analytical, communication, quantitative, and information skills: Students become quite aware of both their skill based knowledge and their abilities to learn new skills.

One student wrote of his technology skills:

"I plan on using the technologies I have learned to use this semester for at least the next few years. As technologies and software becomes outdated, I will have to learn new things, but the vast array of different things I have learned will have prepared me for many current technologies as well as many upcoming ones."

Another placed individual learning within a larger context:

"Over the past semester I have learned a great deal from taking the intensive section of IT. My Excel skills improved, my understanding of computer terms expanded, and I was introduced to writing blogs. After experiencing all of these different topics and more, there is one ultimate lesson that I have learned. That lesson is no matter how much you know about certain technologies, there is always something that you have not learned yet."

On deep understanding of and hands-on experience with the inquiry practices of disciplines that explore the natural, social, and cultural realms: The term "war driving" originally referred to a journey by vehicles equipped with specialized antennas to detect and infiltrate wireless computer networks. One popular IT 101 active learning discovery sends students on a small scale war driving expedition, in which students use their Pocket PCs in search of free wireless Internet access anywhere off campus. They visit coffee shops, hotel lobbies, airports, downtown apartment buildings, and residential neighborhoods. Once they find it, students must analyze and report about their experiences. The questions they must consider range from the technical (how secure is the network if I can get in?) to the business (who is paying for it, and why is it free?) to the ethical (if they don't know that I'm using their internet access, is that stealing?) This exercise places students in a situation that requires them to reflect on the many implications of their discoveries.

After completing this exercise, one student wrote of his war driving experience at a local internet café, and analyzed why such a free service was provided, and told of how he made use of it:

"I believe that their wireless is free to add to the appeal of going to their cafe rather than others as it is becoming a trend that internet service be available in coffee shops and cafes across the country. The free wireless gives them an edge. My roommate was sleeping when I left and my cell phone had died, so I did not bother taking it with me, but once I arrived at [the café] I contacted him through AIM to let him know where I was."

Another student recognized the interrelationship between course concepts, and one's ability to apply them:

"This class was about technology in a lot of ways but it was also about learning what we can do. It goes beyond just being able to enter some lines of HTML or DOS. We know how to use it effectively and how to build upon it all. It isn't some simple setup of 'do A then B happens.' It began an organic, free flowing process of 'here is A, how do we get to B?'"

<u>On intercultural knowledge and collaborative problem-solving skills:</u> Many course assignments required students to learn together in pairs. Such a learning partnership contributes to making the material more engaging because students are engaging in a process of dialogue and interaction about it with their peers.

> "Something I that learned in IT class that cannot be tested is the importance and fun of teamwork. Several projects were completed in groups, and teamwork cannot be stressed enough. These projects would have been much harder to complete solo if it were not for the group work. Each person doing his or her part to fulfill the task was one of the best things about the work for this class. Learning things like HTML and Excel is much more fun when you get to learn and have fun with a teammate. This is especially true with [the multimedia assignment], which I think was the best assignment for teamwork."

<u>On a proactive sense of responsibility for individual, civic, and social choices:</u>

Students acknowledged that they were challenged and celebrated in recognizing their successes. This student commented:

> "We can be told to bust out a website in HTML or to write a program in three days. And almost always, we did it. So much of this class was about realizing what we were capable of as individuals. Daunting tasks would seem to appear out of nowhere. The website went from something in the back of my mind to an 'Oh my God, I need to get this done.' I procrastinated on the whole thing. Then the night before, I had to bust out a whole webpage. It was amazing. After each assignment I felt a level of accomplishment, not because the work was done but because I knew I was the one who did it."

On social choices, many students have admitted to illegally downloading music, software, or other electronic media. A discussion of the technology, business, and ethical issues allow students to make informed decisions.   One student remarked, after a unit on learning to write simple computer programs, "I always just downloaded programs, and I guess I took it for granted because I never saw how much work it took to make a program. It is a lot of hard work."

<u>On habits of mind that foster integrative thinking and the ability to transfer skills and knowledge from one setting to another:</u>

Many introductory technology courses are based on covering chapters from a technology concept textbook. Chapter 1 may be on parts of a computer; chapter 2 may cover fundamentals of operating systems; chapter 3 teaches how to connect to the Internet (Beekman, 2006). The course continues as a series of sequential topics, some of which build on each other, and others of which may not be revisited later in the semester. Thus, students do not often see the integration of their previous learning, or how earlier concepts may be applied in new situations. In the technology intensive sections, many course activities require students to combine their earlier knowledge and build upon it to understand more complex topics or use now-familiar technologies in a new way to accomplish a particular task. For example, after creating a web page, students constantly update it to create an "e-portfolio" of their work during the semester. This task reinforces the importance of developing and creating web pages, and reinforces the notion that web pages should not be static entities, but should be kept fresh and current.

> "I applied the HTML skills learned in class to my web page. Rather than posting a long, ugly link I renamed the link and incorporated the word into a smooth paragraph. I used the image coding to insert embedded movies into the web browser, as well as spruce up the background to my blog by editing and tiling the background image. Moreover, learning more HTML has done wonders for the aesthetics of my personal webpage and blog. This class definitely expanded my foundation of computers and challenged me to try new forms of media technology. I am glad that this course pushed me beyond my comfort zone."

Finally, using a Pocket PC was a major factor in encouraging such experiential living and learning with technology. One student wrote:

> "The Pocket PC has greatly improved my overall lifestyle. I remember things because of the scheduling thing that I wouldn't have had a chance of remembering before. I have had some problems with my wi-fi, but when it is up and working it is great. I can use my Pocket PC as a mini MP3 player and even though my storage card hasn't come in the mail yet, I can hold a couple of songs on it. It will be even better when the card comes. Using AOL Instant Messenger on my Pocket PC is by far my favorite thing do to even though it's tougher to type with it than on my laptop. I can be away from my laptop and use it anywhere. Sweet."

Liberal Arts Learning In and Beyond the Technology Classroom

In an interview in *The Harvard Business Review*, Chris Anderson, chairman and host of the Technology, Entertainment, and Design Conference, addresses the differences between acquiring broad knowledge versus deep knowledge (2003). Anderson asserts, "true innovation and strategic value are going to be found more and more in the synthesizers—the people who draw together stuff from multiple fields and use that to create an understanding of what the company should do" (19). As evidence, he describes technology companies that narrowly focused on "cool technologies" (19) with no attention paid to whether or not those technologies were needed by consumers. He states, "Technology for technology's sake is not interesting. How do you make it meaningful to people?" By combining divergent areas of inquiry" (19).

While the technology intensive IT 101 course described here centers around the use of incorporating handheld computers into almost every assignment and topic, we can envision a similar course taught without these devices. Students would use only a personal computer without a supplementary mobile device to complete their assignments, many of which would be adapted to so that a Pocket PC was not required. In fact, with the exception of the survey and war driving assignments, where the mobility factor of the Pocket PC simplified the process of actually completing a specialized task, most all of the other assignments required the use of personal computers in order to create a result (a web page, a multimedia presentation, or a podcast) that could be viewed on a laptop in addition to a Pocket PC.

The Pocket PC adds to the student engagement factor to make their learning even more personally relevant. As the trend continues for mobile devices to converge, the use of Pocket PCs in this class may shift in the coming years to iPods, SmartPhones, or ultra mobile PCs. Each presents different learning opportunities. What remains constant is the focus on active learning by doing, and demonstrating understanding by combining skills across the knowledge domains. The technology intensive course creates a context for learning which integrates technologies, requires critical thinking, enables students to experience core concepts, and encourages them to apply their knowledge in their daily lives. Students must acquire both technology skills and liberal learning skills, as the ability to easily adapt to the rapid change in current and emerging technologies requires both.

Conclusion

Scott, Chenette and Swartz (2002) write, "As liberal arts educators, we want to empower our students to become lifelong learners and creative and critical citizens of a media-intensive world. Well-educated citizens need to understand technology and how to communicate within new media effectively in the same way that they need to be able to write. Our students will be creators of, participants in, and observers of various means of digital communications" (30). The goals are much the same in this technology-based course: by integrating liberal arts learning into a

traditionally technology centered forum, these students' combined mastery of the underlying technologies along with their demonstrated abilities to use them effectively will enable them to confidently take their places in a media-intensive world.

This analysis of the Technology Intensive IT 101 course, its assignments, and student projects demonstrates ways that liberal learning principles may be integrated into the information technology classroom. Such an approach helps students to develop both a richer awareness of technology concepts and an ability to use technology to communicate that newly acquired understanding effectively. At the same time, anecdotal evidence suggests that students are better able to integrate knowledge across subject domains and take initiative for their own learning.

The process of integrating these liberal learning principles into technology-based courses requires careful creation of activities that provide a context for learning technology concepts through discovery and experience while also using the very same technologies as new media for collaboration and communication. The use of technology to accomplish such real-world tasks helps to make the course "real" and gives students opportunities for living technology-enabled lives.

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