

Information Technology Internships within Multidisciplinary Research Centers

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Abstract - Educating the information technology professionals of the future is not limited to the classroom setting; it takes place under many different circumstances and settings. One of these multiple settings is internship. However, internships are not always feasible educational experiences to all students due to many constraints such as: availability, location, time requirements, required expertise and activities to be performed among others. This paper describes an attempt made at the University of Southern Mississippi (Southern Miss) to eliminate the constraints that limit the students' ability to gain practical experience through internships. The method used to eliminate the constraints was based on the availability of a multidisciplinary research center house at Southern Miss that extended internship opportunities to information technology students. The results indicate that both the students as well as the research center benefit from this program. The hands-on experience obtained by solving real world challenges within the multidisciplinary research center increased students' ability to independently address future problems in the industry upon graduation. Additionally, the students completed projects that increase the efficiency of the multidisciplinary research center. Therefore, the pilot internship program described in this paper has the potential to directly benefit both the information technology profession and the research centers. Furthermore, the guidelines used in this pilot internship program could be used as a starting point to extend the benefits of this type of collaboration/internships to other engineering areas.

Keywords: Internship, Information Technology, Multidisciplinary Research Center

INFORMATION TECHNOLOGY AND CLASSROOM SETTINGS

Information technology (IT) as highlighted by the Information Technology Association of America (ITAA) is one of the fastest growing industries in the U.S. [ITAA 2004]. During 2001, information technology accounted for expenditures of over \$800 Billion. The expenditures and expertise in information technology encompasses a vast area including: computers, software, telecommunications products and services, Internet and online services, systems integration, and professional services companies [ITAA 2004]. Information technology is rapidly changing, which brings additional challenges to the educational environment.

The classroom has been the predominant setting for teaching at Universities. Classroom settings with activities such as: study groups, classroom discussions, project teams and cooperative teaching/learning methods have been successfully implemented [Schmuck 1988, Slavin 1995]. However, generally in classroom settings students are passive observers and recorders of the events [Penner 1996]. These classroom settings also have a series of constraints directly related to the number of students in the class, number of classes taught by a faculty, percentage of class time expended in non-teaching/learning activities, technology available in the classrooms, students' aptitude towards the classroom environment, time of the class and curriculum design among others. These

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classroom constraints and many other changes in education (such as: technology, accreditations and funding just to mention a few) have inspired faculty to explore other avenues to educate the information technology professional of the future. One of these avenues is internship. This paper describes an attempt made at the University of Southern Mississippi (Southern Miss) to eliminate the inherent constraints that also limit the possibility of information technology students to gain practical experience through internships.

THE INTERNSHIPS AS A LEARNING EXPERIENCE

Internships are not a new concept; in fact they have been used in academia as a learning experience for several years. As stated by Stalberte, internships are an exciting avenue for students to transition from school to work [Stalberte 1996]. Internships can be the bridge between an information technology student with zero experience and a professional career [Stock 2004]. The internship as a learning experience pros and cons have been extensively documented. Table 1 shows a compilation of some of the pros and cons of internships documented in the literature [MGECC 2004, QUCS 2004, Miconi 2004].

Table 1. Internship Pros and Cons

Pros	Cons
1- Gain career related experience 2- Test career choice before making a long term commitment 3- Improve employability for after graduation 4- Learn the current and latest practices and technology in industry 5- Improve interpersonal and communication skills 6- Make valuable business/industry contacts to build a professional network 7- Learn what employers want from new grads	1- Extent graduation date 2- Different classmates upon return 3- Relocate if the position is in another town 4- Need self-discipline to return to classes and study after an extended time away 5- Lack of structure in some internship programs

Cognizant of the internship’s benefits to the information technology students, the information technology faculty at Southern Miss established two options to fulfill the senior capstone experience. The two options are: (1) Internship, and (2) Project. Each option requires an initial statement of work, an interim report, and a final report. The internship option requires the students to complete 300 contact hours in a position directly related to the students’ concentration within the major. The project option requires the student to implement, document and demonstrate a project developed in a previous course. Although, the internship option is highly recommended, it is not feasible for all students to take advantage of this learning experience due to constraints such as: availability, location, time requirements, required expertise and activities to be performed among others. One of the methods currently used by Southern Miss to address these constraints is to make available internship opportunities for information technology students through a multidisciplinary research center housed at Southern Miss.

DESCRIPTION OF THE MULTIDISCIPLINARY RESEARCH CENTER PROVIDING THE INTERNSHIP OPPORTUNITIES

Multidisciplinary research centers are becoming more common at universities due to the increasing need of faculty engaging in research activities. Southern Miss is not an exception. One of the many research initiatives established at Southern Miss is the “Innovation for Construction and Engineering Enhancement (ICEE)” research center. ICEE is a multidisciplinary industrial, educational, and research hub that welcomes students, faculty, staff, industry professionals and other organizations. Table 2 provides the mission and vision statements of ICEE.

ICEE integrates both undergraduate and graduate students in the following research areas: (1) Virtual Reality, (2) Education and Training, (3) Safety, (4) Construction Management and (4) Transportation. Currently, there are four faculty with over a dozen research assistants from construction engineering technology, architecture engineering technology and information technology working in more than 1000 SF of research space located within

the university premises. ICEE information technology infrastructure includes 4 web-servers, 3 domain controllers, and 10 desktop computers. Three of the web-servers use Microsoft Server 2003 as the operating system and one of the web-servers uses Linux as the operating system. All three domain controllers use Microsoft Server 2003 as the operating system and all desktop computers use Microsoft XP the as operating system.

Table 2. Mission and Vision Statements of the ICEE Multidisciplinary Research Center

Mission
The mission of ICEE is twofold: 1-Develop, implement and assess the latest educational technology. 2- Enhance the economic development of industry through the use of the latest technologies and management tools.
Vision
ICEE will grow as a multidisciplinary synergistic organization uniting university and industry expertise and talent to support educational, research and economic development advancements.

All funded projects are monitored using Gantt Charts and weekly progress meetings for individual projects. Additionally, every Tuesday there is a weekly progress meeting including all projects. This weekly meeting requires the project leader to summarize the activities accomplished during the previous week and list the planned activities for the upcoming week. The ICEE multidisciplinary research center operates as a small start-up company, and therefore, provides a great internship environment for information technology students.

DESCRIPTION OF THE INTERNSHIP FRAMEWORK

The ICEE internship program was created in response to information technology students' needs for hands-on experience, as well as ICEE's needs for maintaining and upgrading the information technology infrastructure. The ICEE internship program is designed to develop an understanding of the information technology industry. It is used to gain experience in planning, developing, and implementing an IT project. The multidisciplinary environment, ease of access for the students, schedule flexibility, variety of projects and need of ICEE for maintaining and upgrading the research infrastructure create a very conducive environment for interns to enhance their professional capabilities.

This internship program allows students to become knowledgeable about the components and processes in industry. These experiences provide a way for students to understand the corporate environment, to make immediate contributions to the organization and to reduce training time in the initial year of employment [Stalberte 1996]. Students have the opportunity to apply their expertise and to develop new ones in preparation to enter the workforce. As indicated by Stalberte, internships are an excellent way to make transition from school to work [Stalberte 1996]. The ICEE internship program is organized around three components: (1) Internship interview, (2) Internship application, and (3) Internship.

Internship Interview

The internship interview must be scheduled in advance by the interested student; the approximate length of the interview is 30 minutes. The interview has two main goals: (1) to collect information from the students, and (2) to explain the students overall concept of the ICEE multidisciplinary research center and the internship program to the students.

During the collection of information from the student, the student is requested to:

- 1- Synthesize information regarding their academic background
- 2- Describe their technical interested and expertise
- 3- Summarize their information technology strengths

- 4- Summarize their information technology areas of improvements

During the explanation of the overall concept of ICEE and the internship program, the ICEE representatives are requested to:

- 1- State explicitly that the internship is non-paid
- 2- Provide the goals, mission and vision of ICEE as presented in Table 2.
- 3- Describe the internship program focus and objectives.
- 4- Summarize the information technology needs of ICEE as shown in Table 3.
- 5- Describe work hours, timesheets, weekly meetings
- 6- Show the information technology infrastructure

Table 3. Common areas of Information Technology Application in ICEE

Networking
Desktop Support
Routing and Switching
Web Animations
Network Design
Network Administration
Server Administration
Programming
Java
C & C++
Visual Basic
HTML
ASP/SQL
PHP/MySQL

Internship Application

Should the student decide to continue with the application process, the student is requested to submit, by e-mail, the following information:

- 1- Detailed technical strengths
- 2- Detailed technical areas of improvement
- 3- Description of their possible contribution to ICEE
- 4- Schedule of available hours

Based on the information provided by the student, the faculty of ICEE discuss the potential contribution of the student to ICEE and decide whether or not the student will be invited to continue with the application process. The application process continues with a meeting with the student. During this meeting, a detailed explanation is provided regarding the tasks required to complete the internship application. An outline of the explanation is provided in Table 4.

Table 4. Pre-Internship Documentation

Task Number	Task Title	Task Description
Task #0	Internship Agreement	Standard document that outlines the relationship between the organization and the student
Task #1	Job Opportunities and skills matrix	Identify job opportunities and develop a matrix indicate the skill required to obtain each of the job opportunities
Task #2	Resume, personal strengths and Weakness and application to jobs	Prepare resume and request career services to comment. Prepare a detailed description of technical strengths and weaknesses bases on the skill required by companies.
Task #3	Analyze ICEE structure, resources strengths and areas for improvement	Prepare a short report describing the resources and organization of ICEE providing special focus to the strengths and areas of improvement

Internship

The internship begins with the: (1) establishment of a work schedule for the semester, (2) explanation of the regulations and expectations of ICEE, (3) issue of an ICEE key, (4) provide computer access, and (5) introduction to the members of the ICEE multidisciplinary research center.

Intern students are expected to be at the ICEE research facilities for a minimum of 300 hours to complete the internship. The work schedule is mainly based on the student availability and utilization levels of the ICEE research area. The student is responsible for filling a timesheet (figure 1) every week and submitting it. This timesheet not only tracks the work hours, but more importantly allows tracing the activities that the students performed during the work hours. The students are allowed to work extra-hours (without previous approval) based on the deadlines and progress of their projects. This is facilitated by issuing a key to each student to enter the ICEE research space, given the students the flexibility to access the facilities at their convenience. Additionally, the students are required to attend a weekly meeting to report their accomplishments of the previous week and present their planned activities for the upcoming week. During this meeting, other students and faculty provide feedback and highlight the importance of defining measurable and achievable activities for the week

The students are responsible for accomplishing all the tasks of the internship on or before the target dates as shown in Table 5. Although the students are given specific tasks and target dates, the students have great flexibility to explore the best method to accomplish their specific project within each task. All the students' projects within ICEE shall meet two main goals: (1) Enrich the technical expertise of the students and (2) Improve the information technology infrastructure of ICEE. As indicated by Rompelman, it is envisioned that this type of hands-on experience will allow the students to gain some insight into the information technology profession [Rompelman 2002]. Upon completion, the projects are integrated to the ICEE information technology infrastructure and used as the backbone to perform research projects.



Internal Time Reporting Form
Student Weekly Timesheet
ICEE - Time



Student Last Name: _____
 Supervisor Name: _____

Student First Name: _____

Student ID: _____

Weekly Period Beginning Sunday, _____ Ending Saturday, _____

Remarks:
 Number of Hours should be rounded to the nearest 15 minutes.
 15 min = .25hr, 30 min = .50hr 45 min = .75 hrs)
 Description of Work should be filled out for each day that work hours are recorded.

	Sun / /04	Mon / /04	Tue / /04	Wed / /04	Thur / /04	Fri / /04	Sat / /04
Date							
Time of the Day Start							
Time of the Day End							
Activity Code							
Hours Worked on Activity							
Time of the Day Start							
Time of the Day End							
Activity Code							
Hours Worked on Activity							
Total Hours Worked							

Total Week Hours:

Activity Code	Activity Description

I certify that the above recorded hours and description are true and accurate
 Students' Signature: _____ Date: _____

Supervisor's Signature: _____ Date: _____

Form prepared by: Dr. Tula S. Gannon in March 2004

Figure 1. Internship Timesheet

Table 5. Internship Progress and Documentation

Task Number	Task Title	Task Description	Target time
Task #4	Project plan	Prepare a project plan (2-4pgs) describing the main highlights of the project. The project should be divided in three phases of approx. 70hr each phase.	Before completing 20 hrs of work
Task #5	Technical mentor feedback	Interact with Technical Mentor regarding project plan and modify accordingly	Before completing 40 hrs of work
Task #6	Progress presentation and report 1	Prepare and deliver a presentation and a report demonstrating the accomplishments of the phase 1 of the project	Before completing 100 hrs of work
Task #7	Progress presentation and report 2	Prepare and deliver a presentation and a report demonstrating the accomplishments of the phase 2 of the project	Before completing 160 hrs of work
Task #8	Progress presentation and report 3	Prepare and deliver a presentation and a report demonstrating the accomplishments of the phase 3 of the project	Before completing 220 hrs of work
Task #9	Future improvements	Prepare a short report of future improvements and modifications of the completed project	Before completing 270 hrs of work
Task #10	Final internship report and presentation	Prepare final internship report and presentation	Before completing 295 hrs of work
Task #11	Evaluation forms and closure of internship	Discuss with ICEE director and associate director internship experience and evaluation form	Before completing 300 hrs of work

INTERNSHIP OUTCOME

Since its creation in May 2004, the ICEE intern program has hosted eight interns who have completed all of their requirements, and it is currently hosting four interns that are expected to complete their requirements by May 2005. The projects include both networking and programming areas as shown in table 3. Following is a brief description of some of the projects.

1- Active Directory Integration: establish two servers to control ICEE member access and privilege of all desktop computers.

2- Gantt Project implementation with WebDAV: install and set-up the open source project management system called Gantt Project and install WebDav to allow access to Gantt Project through Internet.

3- Dynamic Generation of Project & People Web Pages based on User Input: design a website that allows members to fill out forms and upon submission save the information to a SQL database to dynamically generate web pages.

4- Creating a Website using Open Source Code: prepare a Unix based server and install the open source management system Bazaar.

5- A Web-based Internship Application using Java: design a dynamic web site to receive applications of interns and record the information in a database.

6- Network Management/Security: implement a monitoring system for the ICEE network.

7- Using Virtual Reality Environments to Recreate Scenes: create Virtual Reality models of forests and fires to be used in the development of a predictive model of wildfire spread.

8- Relationship between VR and Database: create an interface that allows users to dynamically interact with Virtual Reality models to determine construction cost.

Though these projects are very different in nature, all of them benefited both the students and the multidisciplinary research center. The hands-on experience obtained by solving the real need of the center increased students' ability to independently address future problems in the industry upon graduation. Additionally, the students completed projects that increase the efficiency of the multidisciplinary research center.

SUMMARY

Information technology education will continue to be challenged due to its rapid growth and change. As faculty and universities continue to explore alternatives to enhance the educational experience of information technology students of the future, the pilot internship program presented in this paper could help shape similar initiatives. It is particularly important to emphasize the use a multidisciplinary research center as an avenue to provide internship opportunities to the information technology students. This paper presented the three components of the internship program: (1) Interview, (2) Application, and (3) Internship. For each of these components a description was provided of the specific goals and tasks encompassed within the component. Thus, the guidelines used in this pilot internship program could be used as a starting point to extend the benefit of this type of internship to other engineering areas.

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