TEACHING INFORMATION SYSTEMS
WITH A MULTI-COURSE CASE

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Abstract

This paper describes the experience of teaching a five-course sequence in information systems using a single case study as the subject of a group project in each course. The five-course sequence was taught under contract for a US Department of Defense agency. Lessons learned from the experience in contract teaching are included in the case. The background of the contract and continuous improvement methodology, which led to the inclusion of the multi-course case and lessons learned, are discussed.

KEY WORDS: Multi-course case, group project, continuous improvement

BACKGROUND

In December 2002, Auburn University Montgomery (AUM) was approached about the possibility of offering instruction to members of the U. S. Air Force (USAF) of then Standard Systems Group, Headquarters (SSG, now OSSG). OSSG is a US Department of Defense (DoD) agency, located in Montgomery, Alabama, USA at Maxwell AFB, Gunter Annex. The organization provides technical and customer service support as well as acquisition and program management oversight of over 160 Combat Support Information Technology (IT) systems. The OSSG also manages the Air Force standard desktop environment, and serves as the USAF lead for software program management under the auspices of the DoD Enterprise Software Initiative. With an annual Working Capital Fund operating budget of $303 million, OSSG is the source of a large infusion of commerce in the Montgomery area. OSSG has over 1,100 government employees, including 662 military authorizations and 436 Civil Service with the remainder of OSSG's support comprised of as many as 600 local and national IT and support contractors.

Additional OSSG activities include managing the Air Force single enterprise-wide license contract with Microsoft Corporation, executing the Chief Information Officer's Information Technology Commodity Council Strategic Sourcing program and administering the Network Centric Solutions (NETCENTS) contract valued at over $9B during 5 years. OSSG manages 51 Air Force Contracts and Basic Purchasing Agreements with a total value of $13.1B. Its 1700 local contract actions are worth $400M annually. OSSG is the largest single employer of information technology personnel in Montgomery.

The specific goal of SSG related to the present case was to become a Sun Java Center of Excellence (JCOE). The program of instruction described in this paper is known as the “Java Bootcamp.” The Java Bootcamp was viewed as extremely advantageous for AUM. OSSG is a very important economic and social contributor to the central Alabama economy. Participation in the Java Bootcamp allowed AUM to play an important role in support of the goals of OSSG. Also, students in the Java Bootcamp would be admitted to AUM and could complete an undergraduate degree at AUM. Finally, closer ties between OSSG and AUM could pay dividends far into the future.
PILOT PROGRAM

In January 2003 a pilot program for the Java Bootcamp was initiated. This program started with a lead-time of less than one month. Details of the pilot program follow.

Class Schedule
Meetings between AUM and OSSG lead to an agreement to provide instruction for two cohorts of students with each cohort containing a maximum of sixteen students. Each cohort would have a “class leader” who was both a student and a senior enlisted member of the Air Force. Each cohort would take five, consecutive, three-week classes. Classes would have a one-week break between classes and would observe federal holidays. The original plan had a morning cohort that attended classroom instruction by AUM faculty in the morning and afternoon lab staffed by SSG personnel. The afternoon cohort would have a morning lab and afternoon instruction. Students remained in the same room for both lab and instruction. Students would be in class or lab from 0800 to 1200 and 1300 to 1700 for 15 days.

Curriculum
The academic unit at AUM responsible for delivery of instruction was the Information Systems and Decision Science Department (IS&DS) in the School of Business. The department head was negotiated curriculum content with SSG. The course of instruction was the following sequence of classes:
1. Object-Oriented Analysis and Design
2. Introduction to Java Programming
3. Database Design and Implementation
4. Advanced Java Programming
5. Database Administration
Since Object-Oriented Analysis And Design and Database Administration were not currently in the AUM catalog, normal procedures for adding new courses were followed to add them to the catalog. Information Systems degree requirements were also changed in order to allow students in the SSG classes to apply all of their coursework in the Java Bootcamp to degrees in Information Systems.

Providing faculty for the program was also the responsibility of IS&DS. Faculty had to meet the requirements of the Southern Association of Colleges and Schools (SACS) and the Association to Advance Collegiate Schools of Business (AACSB).

Academic Enrollment
Student’s who were enrolled in the Java Bootcamp used their Air Force educational benefits to cover the cost of tuition. This meant that they were required to be officially enrolled at AUM. The Office of Enrollment Services at AUM attended meetings with Java Bootcamp students to assist them in the application process prior to the beginning of classes.

Because students were attending a class provided by their employer, the employer OSSG and USAF, had a vested interest in the learning achievements of students. In a sense, taking part in the Java Bootcamp was the “job” of the USAF members. One part of the role of the class leader was to assist students having difficulty with the course and to assist the instructor with performance or discipline problems from students. It was deemed necessary to by AUM to have each student sign a statement allowing the instructor to discuss a student’s performance with the class leader in order to remain in compliance with Family Educational Rights and Privacy Act (FERPA)^2.

Books
Books were purchased for use in the Java Bootcamp by OSSG. Books were checked out to students in the program and were checked in when a course ended.

Facilities
Classes would be taught in a computer-equipped classroom so that each student could have his/her own computer. Instruction took place in the AUM, Center for Advanced Technologies (CAT), which offers consulting and training to government agencies, commercial organizations and to the general public. The facility has a number of computer-equipped classrooms, an auditorium, instructor office space, technical support, administrative support and a kitchen.
PILOT PROGRAM REVISION

Lessons Learned Meeting
After the completion of each course a “lessons learned” meeting was held in order to continuously improve the program, individual courses and methods of instruction. The meeting included instructors, the program administrator from AUM, the CAT facility administrator from AUM, class leaders and program representatives from SSG. The meeting would begin with a report by the faculty member(s) of the just finished class. Class leaders would present their observations. Finally, a discussion of alternatives and decision on changes would be reached and circulated to all affected parties.

Scheduling Problems in the Java Bootcamp
As originally planned, the Java Bootcamp would deliver ten, 3-semester hour classes in approximately one semester. This would require the full-time equivalent of almost three faculty members. Full-time, terminally degreed faculty are the primary staff of the AUM IS&DS department. It was believed that the Java Bootcamp could be staffed with full-time faculty who would teach six overload courses in the Java Bootcamp and with adjunct faculty who would teach four courses on a contract basis. Since the normal load of most faculty members is during the evening and the Java Bootcamp is during the day, this seemed like a reasonable approach. The alternative of adding three fulltime positions with little or no notice for the purpose of staffing the Java Bootcamp would have been impossible. Also, too few adjuncts meeting the requirements of accreditation agencies were available to staff the Java Bootcamp entirely with adjuncts.

The schedule difficulty became apparent during the first class offered in the Java Bootcamp. When the impact was examined from the perspective of an individual faculty member, it became obvious that one Java Bootcamp class was the equivalent of a 20-contact hour per week teaching load. The normal load for faculty in the department is either 9- or 12-contact hours per week. The initial staffing of the Java Bootcamp was based on having one faculty member, teach both the morning and afternoon cohort for three weeks. This means that while they were teaching in the Java Bootcamp, they were teaching a 40-contact hour load in addition to a 3- or 6-hour load of their regular class schedule. This schedule was quickly determined to be unworkable.

A second schedule problem was related to the inability to adequately staff the lab portion of the course. The faculty member for the course was not available during the time the lab met since the faculty member would be teaching the other cohort. This meant there was no means to coordinate the lab portion of a course with the lecture portion of the course.

The Revised Schedule
A decision was made to immediately change the schedule so that each course was extended to four weeks. The revised schedule was implemented with at the beginning of the third course in the instructional sequence. Each week consisted of four days of lecture in the morning and lab in the afternoon. The AUM faculty member was responsible for both lecture and lab. The fifth day each week was reserved for test review, makeup of homework and work on group projects. One cohort would take a specific class, and after a one-week break, the other cohort would take the same class. By taking the course sequentially, the faculty member gets the benefit of reduced preparations, but spreads the load over two, four-week classes with a week off in between. The contribution of a Java Bootcamp course to the faculty member’s load would drop from 40-hours of lecture per week to 16-hours per week.

PILOT PROGRAM REVIEW
As the pilot program drew to a conclusion it was clear that OSSG wanted to continue the Java Bootcamp. Most students successfully completed the pilot program taught for SSG with a high degree of proficiency. This is due in part to the individual attention given each student, frequent testing, early diagnosis and early intervention. Very few students failed to complete the program and grades of “A” or “B” were the norm. The goal of the instructors in the AUM Information Systems Department is for every student to successfully master the required content of the course.
One of the issues not addressed in the pilot program was the need expressed by OSSG participants in the "lessons learned" meetings for more coherence in curriculum. The program started very quickly from the perspective of IS&DS and simply staffing the courses was a huge undertaking. During the pilot program, the courses were coordinated in content except that some were natural pre-requisites for others. The suggestion of using a team or group project that could be a part of every course in the sequence was suggested, but too late to be a part of the pilot program.

**CONTRACT INSTRUCTION PHASE**

OSSG decided to continue funding the Java Bootcamp concept past the end of the pilot program. OSSG issued a request for proposals (RFP) to cover training of two cohorts with the opportunity to extend the contract for up to four more cohorts of students using the compressed four-week schedule for each class. It was determined that neither Advanced Java nor Database Administration would be required for all students. The RFP allowed for students to take either four or five courses by taking either or both Advanced Java or Database Administration. The successful bidder would furnish books, tuition, facilities and faculty. The program would serve both credit seeking and non-credit seeking students.

AUM prepared a proposal and was successful in winning a contract with a total value of over $575,000 including extensions. The contract was awarded shortly after the completion of the pilot program and provided only a few weeks of lead-time before the first class met.

Enrollment at AUM became optional since students were not relying on tuition reimbursement to participate in the program. Some Java Bootcamp students already had degrees and were not interested in taking courses for credit. This change also allowed civilian employees easier access to the program.

The change to contract instruction allowed students to keep the books issued to them by AUM. They were free to highlight, write and keep their books. The books were no longer government property issued to students for use during the course.

**INCORPORATING THE MANAGER EVALUATION SYSTEM CASE**

After the contract was awarded and prior to the beginning of class, personnel from OSSG arranged for a meeting between technical staff at OSSG, the AUM contract manager and one of the Java Bootcamp faculty members. The purpose of the meeting was to evaluate using the Manager Evaluation System (MES) in the Java Bootcamp. The MES was a case study used for training purposes by OSSG and solutions to the case were examples of OSSG best practices for Java development.

**Overview of the MES**

The MES was a proposed system for evaluation of managers by subordinates in a hypothetical organization. The system would involve an administrator, managers who were to be evaluated and subordinates of the managers who would participate in the evaluation. The administrator would set up an evaluation by designing a measurement instrument. The instrument is a template that could be used for one or more managers. The administrator would notify subordinates that they were invited to participate in an evaluation of their own manager by a secure method. The subordinate would have the ability to securely start, resume and revise an evaluation before submitting it. The subordinate would have a deadline for submitting the evaluation and could elect not to participate. Administrators could remind subordinates who have not participated in a current evaluation that they may do so. Subordinate participation in an evaluation is such that a subordinate can only participate once and the subordinate’s responses are not traceable back to the subordinate. A manager who has been evaluated can compare current and past evaluations. A manager can compare evaluations to those of similarly situated managers. A manager of a manager can view the current and past evaluations given to the subordinate manager. The complete MES case is given in Appendices A and B.

**Allocation of MES Development Tasks**

In order to use the MES to achieve a more coherent curriculum for the Java Bootcamp, it must be possible to allocate specific objectives for the MES case to courses in a manner that is

- Directly related to the key learning goals for the individual courses, and
- Logical given the sequence in which courses will be taken.
Analysis of the MES case by the Java Bootcamp faculty and contract manager resulted in an allocation of tasks to courses that they were satisfied would be a logical sequence, emphasize key learning goals for individual courses and show how different techniques from different classes could be integrated in a single project. The allocation of tasks to courses follows:

1. Object-Oriented Analysis and Design students will construct use cases for the MES system and UML diagrams of objects
2. Introduction to Java Programming students will design classes with methods and properties for the MES system.
3. Database Design and Implementation students will construct Entity-Relationship diagrams for persistent storage in the MES system. In addition, they will construct the tables and relationships for the system.
4. Advanced Java Programming students will enhance the design of classes used in the system.
5. Database Administration students construct database security architecture through the use of roles and privileges, construct stored procedures for the system, construct the database and populate it with sample data.

At the end of each course, students made presentations of their work on the MES case. The AUM contract manager and various faculty members in the program attended the presentations. Often members of the local IT community were invited to observe and comment on the presentations.

Implementation of the MES Case

The MES case was formally introduced as part of the curriculum of the Java Bootcamp with the beginning of the contract instruction phase of the program. Evaluating the impact of the MES case is subjective since no baseline exists for which to compare.

1. Instructors in the Java Bootcamp unanimously agreed that students reacted positively to working on the case. The case seemed real to the students and the techniques used in the solution could be used in any number of real systems.
2. Working on one case for the entire sequence resulted in more efficient use of time for students. Students didn’t have to study a different case in each course in order to comprehend what the case involved, so students didn’t waste time. In all but the first course, students already knew the case thoroughly and could quickly apply new techniques to it.
3. Working on one case for the entire sequence resulted in more efficient use of time for instructors. Instructors in all but the first course could use the MES case as an example of concepts they were teaching even if they hadn’t mentioned the case in class before. Instructors knew all of their students were intimately familiar with the case.
4. Since each class had specific assignments that contributed to the final solution, coordination of some essential course content was achieved.
5. The MES case became a vehicle of communication between faculty teaching different courses. It must be mentioned that since we were “teaching under contract” there was no option for faculty to opt out of using the MES case.
6. Presentations given by students of work done on the MES case were of very high quality. It was obvious that students had expended considerable effort to do very thorough work on the case. In each successive class they could go so much further with work on the same case than they could have working on a new case. The impact of community IT professionals attending the presentations was very positive.
7. The customer, OSSG, was pleased with the results of the Java Bootcamp and extended the contract for an additional pair of cohorts.

The incorporation of the MES case into the curriculum of the Java Bootcamp was definitely a success. The alternative would have been to have cases that did not facilitate the goal of cohesion for the program.

SUMMARY

AUM provided OSSG to provide classroom instruction in the Java programming language and relational database technology. Six cohorts of students were each taught four or five regular academic classes on a compressed schedule. Important lessons were learned concerning the scheduling of fulltime
academic faculty to teach on- and off-load courses on a compressed schedule when the faculty also have concurrent semester-long classes.

All faculty members involved in the program enjoyed the experience of teaching USAF members. In general the students performed at a very high level and entered the program with a high level of skill and technical knowledge. They applied themselves to the course of instruction and achieved a high level of expertise.

The use of a multi-course case was demonstrated. The use of the case was carefully planned and was implemented consistently across courses. The MES case was a very good case for the individual courses—it was not forced to fit any of the courses. Many advantages and efficiencies accrued from having the same case as the subject of a variety of courses.

In planning the schedule of instruction for an accelerated program of instruction, it is essential to consider the effective loads generated for individual faculty members while they are in the program, not just the total load for the semester.

The use of "lessons learned" meetings after every course resulted in a continuous improvement toward meeting stakeholder objectives. Without this practice, it is unlikely we would have ever gotten to the stage of using the MES case, and it is certainly possible that the entire pilot project could have been cancelled before the first cohort completed the entire course sequence.

APPENDIX A
Manager Evaluation System (MES)
Vision Document

Version 1.0

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Introduction

Purpose
This document defines the project vision for MES. It establishes the business need for MES, and outlines its high level requirements as needed to satisfy the specified business need. This document is not an exhaustive requirements description, but will instead provide overall direction for a separate more detailed set of system requirements. This document's primary purpose is to establish priority among the most important issues, considerations, features, and overall goals.

Scope
The scope of this document is the instantiation of MES as a J2EE application with an architecture aligned to run within the GCSS-AF framework. The system is being implemented using J2EE and will be installed and tested in the Common Development Environment (CDE).

Business Opportunity

Background
MES originated as a class exercise in the SEP Requirements class. The purpose of the system is to demonstrate new technologies and methodologies, provide a working J2EE reference application and help developers understand how to create robust, scalable, and portable applications.

MES allows employees to anonymously evaluate their manager. The objective is to assess the employees' view of their manager's performance in 5 critical areas of management (planning, organizing, staffing, directing/leading and controlling).

The MES Administrator can create evaluation templates that contain sections pertaining to the different areas of management. For each section the administrator can add different type questions such as single choice, multiple choice or comment type. Once the template is saved the administrator can associate it with an evaluation.

A manager provides the administrator with a list of employees that are to evaluate him. The administrator emails the evaluation to the employees, otherwise known as evaluators. The evaluators can anonymously evaluate the manager or decline the evaluation. If it is not declined, the evaluator can complete the evaluation up until the evaluation period expires. Once the evaluation period is over, a manager can generate reports to summarize the results. MES will only summarize the evaluations that have been completed. Any evaluations that were in process or declined will not be included in the reports.

System Context
MES will interface with Tivoli Access Manager via GCSS-AF.
Primary Stakeholders

This section describes the 'stakeholders' in the MES project. These are the individuals whose needs directly impact the MES design and architecture. A primary user is defined as those users who require access to MES for a J2EE reference. There is one primary stakeholder, and one primary user of the MES application.

**Stakeholders:**

**JAVA Center of Excellence (JCOE)** - Responsible for the software development of MES, insuring that the overall System Architecture meets with JCOE standards.

**Users:**

**Air Force Software Developers** – A user who is responsible for developing GCSS-AF framework compliant software. The user can reference the MES application source code and documentation.

Impact of Missed Opportunity

MES will serve as a guide on how to build a J2EE application for the GCSS-AF framework. The full source code and documentation will be available. By referencing MES, Air Force developers will understand how to create robust, scalable, and portable applications. By not providing MES, all of these benefits will not be realized.

Proposed Solution

Primary Features

**Essential Features**

- **HTML Interface** – Provide a web-based user interface to the MES application.
- **IBM Policy Director / Tivoli Access Manager** – Interface with Tivoli Access Manager for user authentication.

The following features will be established with MES 1.0 release.

- **Logon** – Provide the ability to logon to the web-based system through the GCSS-AF Portal.
- **Create Evaluation Template** – Provide the ability to create a template for an evaluation.
- **Create Evaluation Token** – The system generates an evaluation token for each evaluation response.
- **Create Evaluation** – Provide the ability to create an instance of an Evaluation from an Evaluation Template.
- **Load Evaluation** – Provide the ability to select an existing evaluation to view or modify.
- **Update Evaluation** – Provide the ability to modify an existing evaluation.
- **Evaluate Manager** – Provide the ability for an employee to complete the evaluation response form provided by the System.
- **View Reports** – Provide the ability for a manager to generate and view the results of an evaluation.
- **Enter Reviewed Employee** – Provide the ability to associate an evaluation with a manager and to send the evaluations (otherwise called evaluation responses) to the employees.
- **Delete Evaluation** – Provide the ability to delete an evaluation.
High-Value Features

Follow-on Features

- **Create Canned Choices** – Provide the ability to create pre-populated choices for questions. This will assist the user when he is creating evaluation templates.
- **Delete Canned Choices** – Provide the ability to remove pre-populated choices from the database.
- **Modify Canned Choices** – Provide the ability to modify existing canned choices.

Priority Systemic Qualities

In this section, we identify the primary service-level requirements for MES. This list is not exhaustive, but is intended to capture the most important requirements from a business perspective. They are based on issues with envisioned direction of GCSS-AF.

Maintainability

Software maintainability will be ensured through the use of modern software engineering practices. These practices will include Object Oriented Analysis and Design (OOAD) of the software, maximum use of validated reusable software components and COTS software components, through testing of the software, design reviews, and code walk-throughs prior to testing.

Flexibility and Extensibility

MES will be designed to allow future enhancements and modification. The system shall be developed using software engineering methods that promote easy modification and maintenance.

Constraints

Development Process and Team Constraints

The system is being developed on a part-time basis. The developers on the project have other duties that are of higher priority, and this project is being developed as time permits.

APPENDIX B

Manager Evaluation System (MES)

This system will allow employees to evaluate their manager. Your manager is defined as the person who writes your performance appraisal. The objective is to assess the employees’ view of their manager’s performance in 5 critical areas of management (planning, organizing, staffing, directing/leading and controlling). This should be viewed as feedback that will show the manager his employees’ perception of his performance and encourage him to improve as a manager.

This is a delicate matter and employees must be assured of anonymity. Employees may or may not participate at their option; however, they must inform the system that they decline if they choose that option. The evaluation process should be performed from any Windows desktop computer at Gunter. Each employee is allowed only 1 evaluation per evaluation period.

Evaluations will be stored in a central database and reports will be generated for the manager and for his manager upon request. Historical data will be available in report form to evaluate trends.

The form has not been finalized, but it will consist of 3-5 questions in each of the 5 areas, which will be answered, with values of 1 to 5 indicating excellent to inferior performance respectively. There will be one question that allows the employee to enter general comments not to exceed 1 page in length.

The employee will be allowed to put his/her answers into a holding area for 48 hours (Holidays & Weekends not counted) before they are submitted to the system to allow time to consider his/her responses and change them. The manager that the employee is evaluating will be selected by the
system based on which manager evaluated the employee and subsequent criteria TBD if the employee has had more than one manager since the last evaluation.

**Concept of Operations**

A manager will evaluate his employees and give the MES administrator the list of employees that were evaluated. The administrator will make sure that these employees are in the database and associate them with the manager. The administrator will then create unique passwords for those employees and give each employee their unique password securely and let the employee know that the MES system is available for their critiques for a fixed time period. At the end of that time period, the manager is allowed to request management reports.

**ENDNOTES**


2 The Family Educational Rights and Privacy Act (FERPA) (20 U.S.C. § 1232g; 34 CFR Part 99) is a Federal law that protects the privacy of student education records.

**REFERENCES**

