Management for Students of Technology:
A Case Study in Information Technology Education

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Introduction

In her article on graduates of engineering and technology programs Kerry Hannon observes that ". . .corporations want the whole ball of wax—soft skills, science skills, and diversity."[1] Loria Yeadon, a patent attorney who holds a master's degree in electrical engineering, emphasizes the need for technology professionals to be "business-minded".[2] In *InternetWeek*, Nick Evans states that "Most will agree that management of IT has been an inefficient function that has been stuck in the Stone Age."[3] The Information Technology (IT) Program at the University of Cincinnati's College of Applied Science attempts to integrate key management concepts and practices into the education of its graduates through the course Management in Information Technology. This is a senior level three quarter hour course in the Bachelor's degree that meets for three contact hours a week over ten weeks. It is designed to fulfill one of the key goals of the Engineering Management Division articulated in Article II of the Division Bylaws: to encourage the inclusion of courses on engineering management in traditional curricula.[4] This paper discusses the course as a case study, including programmatic context, the standards that provide its foundation, and the content of the course, including key themes, supporting resources, and activities.

Programmatic Context[5]

The College of Applied Science's program focuses on IT in its broadest sense encompassing all aspects of computing technology. IT, as an academic discipline, focuses on meeting the needs of users within an organizational and societal context through the selection, creation, application, integration and administration of computing technologies. IT is an academic discipline distinct from computer engineering, computer science and management of information systems. IT encompasses software engineering and development, computer networking and communications, Web technologies, computer security, database management, and digital media technologies. The IT professional is hired by organizations of all sizes in all industries. Learners receive a broad education across the IT spectrum as well as technical specialization in the areas of their choice.[6]

The IT program offers a Bachelor (BS) and Associate (AS) degree option with both day and evening schedules. Learners choose a primary track specialization from one of three "tracks", including Software Development, Networking, or Web Technologies. BS learners also choose at least one secondary track specialization from one of five tracks, including Software Development, Networking, Web Technologies, Database or Digital Media. Co-operative (co-op) education experience is a vital part of the curriculum; all learners work in alternating quarters starting in their second year of study. BS learners co-op five quarters and AS learners two quarters. In addition to co-op, learners at the College of Applied Science learn by experience

through the integration of intensive, hands-on activities built into the courses and through the Senior Design project completed in the final year of study.[7]

The BS degree totals 181 quarter hours. Core requirements are built around ABET accreditation standards for engineering technology programs[8] and the emerging standards of the Special Interest Group for Information Technology (SIGITE) of the Association for Computing Machinery.[9] The degree integrates these requirements to include courses that focus on speaking, writing, project development, humanities and social sciences. Furthermore, several technical classes—for example, in the Digital Media sequence—have activities designed to expose learners to basic management practices, including teamwork, leadership, professional presentations, budgeting, and time management.

Standards

In its statement on specific program criteria for information engineering technology programs,[10] ABET states that ". . .baccalaureate degree graduates normally are well prepared for design, development, and management." Of three specific outcomes for such programs, the statement emphasizes that graduates "must demonstrate the ability to apply project management techniques. . . ."[11] Additional related criteria are articulated more broadly in three general program outcomes to achieve accredited status: an ability to function effectively on teams, an ability to communicate effectively, and a commitment to quality, timeliness, and continuous improvement.[12]

SIGITE has moved toward developing standards specifically for IT, apart from those for computer engineering, computer science and management information systems, in an effort to recognize the differences in the disciplines. In developing its standards, SIGITE emphasizes both technical skills and the skills that will help graduates "grow into leadership positions". Those most relevant to a graduate's understanding of management are to explain and apply appropriate information technologies and employ appropriate methodologies to help an individual or organization achieve its goals and objectives; to manage the information technology resources of an individual or organization; and to anticipate the changing direction of information technology and evaluate and communicate the likely utility of new technologies to an individual or organization. Specific program outcomes include to analyze, identify and define the requirements that must be satisfied to address problems or opportunities faced by organizations or individuals; to assist in the creation of an effective project plan; to analyze the impact of information technology on individuals, organizations and society, including ethical, legal and policy issues; to demonstrate independent critical thinking and problem solving skills; to collaborate in teams to accomplish a common goal by integrating personal initiative and group cooperation; and to communicate effectively and efficiently with clients, users and peers both verbally and in writing.[13]

Course Content

The goals for Management in Information Technology are largely derived from the standards articulated by ABET and SIGITE. These six central goals are the basis for the course's key themes.
   1. Learners should understand the theory behind the practice of management.
   2. Learners should understand the practice of management in a professional environment.

3. Learners should understand the types of areas in which information technology plays a significant role.

4. Learners should demonstrate their grasp of the practice of management through presentation of findings from their research on a specific area in which information technology plays a role.

5. Learners should demonstrate professional attitudes and practices as participants in class.

6. Learners should demonstrate an ability to communicate on several levels: 1) rhetorically, as presenters within the atmosphere of a seminar in which there is an intensive exchange of information and ideas; 2) interpersonally, as colleagues who are analyzing and assessing information and ideas presented by others, 3) interpersonally, as learners interacting with professional practitioners of information technology, and 4) in writing, as learners communicating their research-based analysis and evaluation of information and ideas.

Management in Information Technology is built around the premise that most graduates will be working for organizations to provide IT support and service. Nick Evans says that "IT departments have traditionally served other business units across the enterprise and have helped to automate processes for enterprise resource planning, customer relationship management, and supply-chain management."[14] Based on such conclusions, the central theme for the course derives from the notion of "organizational culture". According to Carter McNamara ". . .organizational culture is the personality of the organization. Culture is comprised of the assumptions, values, norms and tangible signs (artifacts) of organization members and their behaviors."[15] The significance of organizational culture is articulated by Kathryn A. Baker, who says that a "review of the organizational culture literature makes it clear that (1) culture is essential for both successful organizational change and maximizing the value of human capital, (2) culture management should become a critical management competency, and (3) while the right culture may be a necessary condition for organizational success, it is by no means a sufficient condition. An important challenge for managers is to determine what the most effective culture is for their organization and, when necessary, how to change the organizational culture effectively."[16]

An advantage of this theme is that it is concrete and flexible: learners have been exposed to the concept of culture throughout their education. In addition, the manifestations of organizational culture are easy to grasp, ranging from personnel procedures to work processes. It also offers a firm basis for development of other themes since it provides a common reference point.[17]

Three additional key themes derive from the study of organizational culture: leadership, teamwork, and communication. Leadership is defined proactively as a process of influencing the activities of an individual or group in efforts toward accomplishing goals. It is at a pivotal point in management practices because it is through leadership that organizational culture evolves,[18] and its effectiveness is based in good communication and sound teamwork. Leadership's impact on the organization's environment shows itself in the essential interpersonal activities, including motivation, relationship management, and feedback. By understanding each of these elements, the manager-as-leader adapts his style of communication to build teams to achieve organizational

goals. These themes provide opportunities for both discussion and activities to help learners understand the role of the manager in most organizational contexts.

Driving the development of these themes is an integrated set of supporting resources and activities. These are designed to help learners draw conclusions about the relationship of the themes to the management of IT.

Supporting Resources[19]

The foundation for the study of the key themes is a set of readings selected for their relevance to topics that are central to the management of IT. Some of the topics and their related readings are fundamental and constant each quarter the course is offered, while some of the topics and their related readings change depending on contemporary focuses determined from the professional literature. For example, Project Management is a fundamental topic, while Entrepreneurship has replaced Financial Services as a contemporary focus. Readings and related supporting materials come from a variety of sources, although the great majority are from Web-based sources because of they are up-to-date and readily accessible. Recommended texts are placed on reserve in the College of Applied Science T.C. Day Library.

A set of generic Web-based sources is from ZDNet's Resource Centers, Transform Magazine's Topic Centers, a number of Useful Web Links I have compiled. It includes:

Collaboration
http://www.transformmag.com/collaboration/
Enterprise Solutions
 http://www.transformmag.com/enterprise/
E-Commerce Resource Center
http://cgi.zdnet.com/slink?34235:3587680
Mobile Computing Resource Center
http://cgi.zdnet.com/slink?34238:3587680
Security Resource Center
http://cgi.zdnet.com/slink?34239:3587680
Content Management
 http://www.transformmag.com/contentmgmt/
Web & E-Publishing
http://www.transformmag.com/web/
General Web Links:

Sam Geonetta's home page	Mike Ames' home page
http://homepages.uc.edu/~geonetsc	http://homepages.uc.edu/~amesmt

New Media:

http://www.cpm.com	http://internet.com
http://www.newmedia.com	
http://www.idg.net	

Business/Management:

http://www.optimizemag.com	http://www.sbcmag.net
http://www.theneteconomy.com	http://www.informationweek.com
http://www.internetweek.com	http://networkmagazine.com
http://www.transformmag.com	http://www.baselinemag.com
http://www.infoworld.com	

In addition to these generic resources, readings related to specific topics are assigned.[20] For example, for one recent quarter, the following readings were assigned for the study of organizational culture and for one of the six topics (Project Management, IT and Media, IT in Education and Training, Security, Entrepreneurship and E-commerce, and Globalization):

Organizational Culture:
Optimize Magazine, January 2002
Digging Beneath Deep Dialog
To access the reading, go to www.optimizemag.com and enter the title in the search box. Be sure to place the title of the reading in quotation marks to delimit   the search.
(*N.B.*: The above directions to go to a specific Web site are the same for each reading.)
Optimize Magazine, January 2002
Moral Advantage: How to Succeed in Business by Doing the Right Thing.
Optimize Magazine, January 2002
Mars/Pluto Relationship
Optimize Magazine, January 2002
A New Kind of Business Case
*Informationweek.com,*September 22, 2003
Identity Crisis
Optimize Magazine, November 2001
Better Living Through Culture
Optimize Magazine, January 2003
Transforming IT
Baseline Magzine, May 15, 2003
Workplace Culture and Project Readiness

Project Management:
Baseline Magazine, December 3, 2002
How Much Risk Can You Tolerate?
Optimize Magazine, August 2003
The Incredible Shrinking Legacy Workforce
Optimize Magazine, February 2003
The Human-Capital Balancing Act
informIT, July 18, 2003
Principles of the Business Rule Approach: the "Flow" and the "Know"
Optimize Magazine, May 2002
Six Sigma Goes Corporate
Baseline Magazine, December 15, 2003
Soup's On?

Three texts placed on reserve include:
George M. Doss. *Management Skills for IT Professionals.* Paramus, NJ: Prentice Hall, 2001.

Jack R. Meredith and Samuel J. Mantel, Jr. *Project Management: A Managerial Approach*. Fourth Edition. New York, NY: John Wiley & Sons, 2000.

Kathy Schwalbe. *Information Technology Project Management*. Third Edition. Thomson Course Technology, 2004.

Additional support for the study of the themes of the class is from guest speakers who have a high degree of expertise from both their educational background and their professional practice in IT. Speakers are invited for a full fifty minute period and may lecture and/or create a learning activity related to their topic. Typical speakers have included a Six Sigma project manager from General Electric, the lead analyst for Educational Technology Systems at the University of Cincinnati, the head of IT for the local NBC television affiliate, the Director of IT for the Regional Internal Revenue Services office, and a trainer from a local IT training provider.

Activities

Activities are integrated with the readings and lectures. There are four major assignments. These include: 1. The Mission Statement, 2. The Article Analysis, 3. The Group Presentation, and 4. The Final Analysis. Each of these requires a demonstration of understanding of management concepts and practices. Each assignment sheet with its explicit rationale is reproduced below.

The Mission Statement is relevant to the development of thinking about all the key themes of the course. Most of the time, it is the first exposure of learners to such statements. It focuses on the learner's ability to articulate the basic *raison d'etre* of a given organization. By doing so, the learner develops a sense of fundamental organizational culture and how it impacts leadership, teamwork, and communication. In addition, the assignment requires the learner to write clearly and succinctly using professional style and technique.

The "Mission Statement" is an attempt to distill the operating philosophy of a corporation into a succinct written form. It should result from a clear perception of that philosophy. It is an important management function to articulate this statement and to focus on what it takes to make the organization meet it.

Requirements: Your assignment has three components: first, look at two industries or services related to information technology in the Cincinnati area. One of them should be the company for which you have co-oped or a company for which you work as an information technology employee. The other should be a second company of your choice.

Second, write a brief profile of each company. Include a description of the primary product or service of each, the target clientele and where these clientele are located for each company, and how many employees each company has.

Third, and most importantly, if you were asked to write their mission statement, how would you start? How would you identify the *grievers*? Write a mission statement for each organization based on your conclusions.

Be prepared to discuss your statement, including a justification for what you have written based on each profile you have prepared.

Evaluation:
Essays will be evaluated for quality of content. Each should have a clear focus and address each of the criteria stated above. In addition, each should be organized in a clear,

professional pattern that is direct and readable. Each should be free of grammar and spelling errors.

Essays will be evaluated for quality of form. Each should be completed using a word processor, with no hand-written corrections or additions.

Value: 150 points. 75 for each essay.

The Article Analysis requires learners to develop a fuller sense of the professional literature that should help form the basis of "lifelong learning" essential to their continuing development and awareness in their field. It helps extend the discussion of organizational culture by having them focus on areas that impact the practice of IT in various ways in various contexts. It also requires the learner to write clearly and succinctly using professional style and technique, while demonstrating the ability to condense details. The addition of commentary helps learners to form an understanding of the distinction between the "objective" material represented by the content of the article, and "interpretation" represented by their commentary.

Each of you selected two of the areas listed on the course syllabus that were of interest to you. Reading is a key method that one uses to understand and keep up with one's professional field. Find two articles from appropriate, <u>high</u> <u>quality</u> professional sources (journals, magazines, Web sites, books, chapters in books) related to the area to which you have been assigned. Read the articles analytically. Write an essay of two or three pages. In the essay you should report the key ideas articulated in each article (see the item on the Blackboard site about "Writing Abstracts". Note especially the guidelines on content and length.). In addition, after you write about the content of each article, you should *write a commentary* on the professional relevance of the article to a professional manager in information engineering technology; that is, why is it relevant, what about the information is significant for the manager of IT, etc. Comparisons with and references to articles from the readings for this class *should be incorporated* to provide more depth to your commentary.

Evaluation:

Content

Your choice of articles will be a consideration. **Please include copies of them.** The essay will be evaluated for quality of content. It should have a clear focus, with a clear summary of the content of the articles. Use appropriate specific supporting citations from the articles.

Your commentary should show your ability to think analytically and critically; it should show insight. In addition, it should be organized in a clear, professional pattern that is direct and readable.

It should follow the conventions of the English language, with a style appropriate for a professional, including sound grammar and correct spelling.

Form

Essays will be evaluated for quality of form. Each should be completed using a word processor, with no hand-written corrections or additions.

Format: Standard Word for Windows formatting. Borders: 1-inch top and bottom, 1.25 inches right and left. Type: 12 point Times New Roman. Spacing: Double spacing.

Value: 150 points, including:

75 points for quality of analysis.

75 points for quality of articles.

The Group Presentation is based on "case studies". Each topic represents an area in which IT is practiced. The assignment develops a sense of leadership, teamwork, written communication, and interpersonal and rhetorical communication. The need to work as a team and to provide guidance is essential to completion of the assignment, especially given the tight deadlines imposed by the short time frame of the quarter system. Another form of written work is also required for this activity: the concise summary of professional articles used to develop the group's presentation. Interpersonal communication comes into play as the group members meet to develop their presentation and rhetorical communication is practiced when each member presents his or her contribution.

There are six key areas that form the professional emphases for the class. Last week you chose two as areas in which you would be interested. Learners will work in groups to help provide depth in these areas.

Requirements:
- Each group will be responsible for developing materials relevant to the subject area to which its members have been assigned. The group will prepare a presentation that provides an overview of at least three professional issues relative to its subject area. For example, the Education and Training group members might concern themselves with the issue of the poor preparation of teachers to use technology in the classroom, as well as two other issues.
- Each group has 40 minutes in which to present its materials, with 10 minutes for questions.
- Presentations will take place during the 50-minute period immediately preceding or after the guest speaker on the relevant subject area.
- Each group will distribute to the class members a resource list of at least 5 current, relevant resources, with a brief paragraph describing/summarizing each resource.
- Each group member will provide an individual resource list of materials used to prepare his/her presentation, with a brief paragraph describing/summarizing each resource.
- After each presentation each group will lead a discussion of relevant issues.

Evaluation:
Presentations will be evaluated for quality of content. *An essential consideration for evaluation is how the topic under discussion relates to the IT professional as a manager.* Each should be organized in a clear, professional pattern appropriate for oral presentation, with an equitable distribution of effort. Resource lists should be from strong professional sources.

Presentations will be evaluated for quality of form. Each group member should speak in a professional manner with appropriate supporting materials. Resource lists should be prepared professionally, with clear source citations and good formatting.

Value: 300 points, including:
150 for the group presentation.
50 for the discussion.
50 for the group resource list.
50 for the individual resource list

The Final Analysis requires learners to demonstrate the ability to write a comprehensive report integrating relevant materials from the course's resource pool. It helps provide a final

summary that should show their grasp of management concepts and practices through clearly structured, well-stated writing.

We have dealt with a variety of key areas in information engineering technology management throughout the quarter. In our initial discussions we focused on "organizational culture" and "new paradigms" in management. Take the broad ideas we discussed, re-visit the readings for the class, and think about how what you read and what we discussed seem to fit together. Write an essay of four to six pages. In the essay you should show an understanding of how the ideas we discussed regarding organizational culture and the information and ideas in other, appropriate readings "fit". Your goal is to integrate elements of our discussion and the material in the readings to show an understanding of organizational culture, new paradigms of management, and practices for management in information technology.

Evaluation:

The essay will be evaluated for quality of content. It should have a clear focus, with a clear thesis and a clear, professional pattern that is direct and readable. Use appropriate specific supporting citations from the readings; your choices will be considered in the final evaluation. Your essay should show your ability to think analytically and critically; it should show insight. It should follow the conventions of the English language, with a style appropriate for a professional, including sound grammar and correct spelling. Edit it closely so that it shows economy of expression, with sound phrasing and appropriate wording.

Cite sources using standard bibliographic format in the handout available on the Blackboard site for the class.

Essays will be evaluated for quality of form. Each should be completed using a word processor, with no hand-written corrections or additions.

Format: Standard Word for Windows formatting. Borders: 1-inch top and bottom, 1.25 inches right and left. Type: 12 point Times New Roman. Spacing: Double spacing.

Value: 250 points

Conclusion and Outcomes

The course Management in Information Technology is designed to achieve outcomes that help the College of Applied Science's Information Technology BS degree graduates understand key areas of management practice. By developing an awareness of essential competencies, the course enhances learners' ability to grasp the role of IT within various organizational contexts. It does so by developing opportunities to explore and practice leadership, teamwork, and communication through a series of integrated activities. By adapting the methods in this course to other engineering and engineering technology disciplines through the use of relevant resources, such as discipline specific readings and expert speakers, the course can result in positive outcomes for learners in other disciplines.

Bibliographic Information
(*N.B.*: Some of these links may be dead. You will need to go to the root Web site and enter the title in the search window to find specific items.)
1. Kerry Hannon. "What Employers Want." *Prism*, Volume 12, No. 9, May-June 2003, p. 20.

2. Kerry Hannon. "The Graduate." *Prism*, Volume 12, No. 9, May-June 2003, p. 19.

3. Nick Evans. "IT Needs Business Management Discipline." Http://www.inernetwk.com/story/INW20030103S0001. January 3, 2003.

4. American Society for Engineering Education. "Bylaws of the Engineering Management Division." http://www.asee.org/members/organizations/divisions/bylawsMgmt.cfm. May 25, 1977.

5. For complete program information see University of Cincinnati, College of Applied Science. Http://it.cas.uc.edu.

6. University of Cincinnati, College of Applied Science. "Information Technology at the College of Applied Science." Http://it.cas.uc.edu. Cf. ACM Special Interest Group for Information Technology Education. "IT Definitions." Http://sigite.acm.org/activities/curriculum/downloads/IT%20Definitions.pdf.

7. University of Cincinnati, College of Applied Science. "Program Description." Http://it.cas.uc.edu.

8. ABET. "Accreditation." Http://www.abet.org/accreditation.html.

9. ACM Special Interest Group for Information Technology Education. Http://sigite.acm.org/activities/curriculum/. September 21, 2004.

10. These criteria helped form current standards since the current program emerged from a two + two program offering the BS in Information Engineering Technology.

11. ABET. "Program Criteria for Information Engineering Technology and Similarly Named Programs." Http://www.abet.org/images/Criteria/T001%2004-05%20TAC%20Criteria%201-19-04.pdf. November 1, 2003.

12. ABET. "Criteria for Accrediting Engineering Technology Programs." Http://www.abet.org/images/Criteria/T001%2004-05%20TAC%20Criteria%201-19-04.pdf. November 1, 2003.

13. ACM Special Interest Group for Information Technology Education. "IT Definitions." Http://sigite.acm.org/activities/curriculum/downloads/IT%20Definitions.pdf.

14. Nick Evans. "IT Needs Business Management Discipline." Http://www.inernetwk.com/story/INW20030103S0001. January 3, 2003

15. Carter McNamara. "Organizational Culture." Http://www.mapnp.org/library/org_thry/culture.culture.htm. 1999. McNamara's definition is typical of what one finds in the literature. See Kathryn A. Baker's discussion and reference list (item 16. that follows). McNamara's page contains a collection of links to various materials about organizations that I have found to be very useful.

16. Kathryn A. Baker. "Organizational Culture." Http://www.sc.doe.gov/sc-5/benchmark/Ch%2011%20Organizational%20Culture%2006.08.02.pdf

17. Request detailed materials including PowerPoint presentations from Dr. Geonetta at sam.geonetta@uc.edu .

18. Edgar Schein. *Organizational Culture and Leadership.* Third Edition. New York, NY: Jossey-Bass, 2004.

19. The course materials are all posted on a Blackboard site so learners have ready access to them.

20. Request a current reading list from Dr. Geonetta at sam.geonetta@uc.edu.

Biographical Information
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