

**CONNECTING INFORMATION SYSTEMS ACROSS
DISCIPLINES: BUILDING THE MODERN KNOWLEDGE
WORKER**

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ABSTRACT

The last ten years has produced an information revolution that has transformed organizations and the habits of daily life. The proliferation of smart phones, as well as Web phenomena such as Facebook and Twitter has created a cultural expectation of 24/7 connectivity between individuals, technology, and their digital data. Within organizations, 24/7 connectivity, also called real time processing, has become the expected norm. These rapid advances in technology have resulted in changes in the structure and processes of most business functions, especially accounting, finance, marketing and information systems (IS). Therefore the curricula of most business disciplines will need to quickly evolve in order to prepare current students for today's fully connected workplace. This paper describes a collaborative effort between an information systems professor and an accounting professor to create curricula that approaches technology and accounting as fully integrated fields. This paper discusses the benefits and challenges of tightly connecting technology concepts to specific business domains.

INTRODUCTION – ENTERPRISE SYSTEMS AND HOW THEY ARE USED

Most medium to large size firms depend on software that fully integrates all activities and transactions related to the operation of the company. Known as Enterprise Information Systems, they deliver an information architecture that allows organizations to connect the activities and processes of all components of the firm. For example, when a salesperson places an order for a customer through an Enterprise Information System messages to accounting (to generate accounts receivable entries) as well as fulfillment (to complete the order) are generated. A complete record of events related to a transaction are generated and maintained by Enterprise Information Systems, providing real time 24/7 connectivity to transactional data and events of interest to an organization

For example, Supply Chain Management, which offers increased efficiency in procuring resources for manufacturing and optimized inventory control, is accomplished by Enterprise Information Systems. While large organizations have used Enterprise Information Systems for more than 15 years, the dramatic growth and prominence of digital social networks has brought new attention to the benefits these systems deliver. Just as people depend on Facebook for 24/7 connectivity to their social network, successful firms depend on Enterprise Information Systems for 24/7 connectivity to their company's information flow.

On a daily basis, both businesses and consumers use Enterprise Information Systems. If you have ever booked an airline ticket online, tracked a package being shipped by FedEx, or reserved a library book via the Web, you used an Enterprise Information System. These systems provide real time 24/7 access to business data for customers, managers, and executives. There is really no going back to paper based systems – real time digital access to information has become a standard requirement for any business that hopes to thrive in the future.

Professionals who use Enterprise Information Systems to carry out information intensive tasks are known as knowledge workers. Knowledge workers engage in largely self-directed work practices, both individually, and as members of a team. Knowledge workers can be found in any industry, within any business function. They make heavy use of Enterprise Information Systems to collect, process, and analyze information for work-related tasks, employing methods that create and exploit knowledge (Hasan and Pfaff, 2006). In order to prepare students for their future careers, they need to be fluent in their own discipline, and have a strong grasp on the methods and advantages offered by Enterprise Information Systems.

Within the next ten years Enterprise Information Systems will grow in scope to manage and control all functions of the firm, especially audit, compliance, and risk management. There will be significant career opportunities for students who can combine expertise in a business domain, such as accounting, with facility and fluency in the use of Enterprise Information Systems.

INTERDISCIPLINARY PROGRAMS AND THE DEMAND FOR KNOWLEDGE WORKERS

Many colleges and universities have increased their emphasis on interdisciplinary programs. The definition of an interdisciplinary program is one that uses a knowledge view and curriculum approach that consciously applies methodology and language from more than one discipline to examine a central theme, issue, problem, topic, or experience (Jacobs, 1989). Research in educational effectiveness has found that interdisciplinary methods improve student outcomes (Campbell, 2010). Interdisciplinary programs with a strong technology component are designed to produce employees that function as knowledge workers.

These knowledge workers use “information communication technologies (ICT) to create, acquire, process, synthesize, disseminate, analyze, and use information to be more productive” (Magal, 2009, p. 5). Positions for knowledge workers require candidates with excellent communication skills, problem solving experience, and team oriented work habits. With increasing globalization and expansion of ICT, companies need people who can work across departments, and even across time zones and continents.

WHY STUDENTS NEED ENTERPRISE SYSTEMS KNOWLEDGE TO PASS THE CPA EXAM

Pace University is a private institution with campuses in New York City and Westchester County. The structure of the school is divided into a number of specialized schools. It includes the Lubin School of Business, and a separate school of computing, The Seidenberg School of Computer Science & Information Systems. The Lubin School, accredited by AACSB, offers a number of degree options, including accounting and information systems. However, it is important to note that the faculty that teach information systems courses are members of the Seidenberg computing school, not the Lubin business school. This is a relatively rare configuration for business schools that offer information systems programs.

The Accounting program is one of the largest in the university, and draws students at both the undergraduate and graduate level. An important concern for students, the department, and the university is how to better prepare students for the CPA exam. The CPA exam is made up of a number of sections, including Financial Accounting Reporting, Regulation and Audit and a section called Business Environment and Concepts (BEC). The BEC covers a broad range of business topics, but especially includes material related to the structure of ICT and its relevance to the management of audit controls.. Many students find the BEC section to be one of the most challenging components of the CPA exam. The latest data available (2008) shows the pass rate nationwide for undergraduates is less than 50% for the BEC section. A notable concern is that only 27% of Pace undergraduates passed the BEC (see Table 1). Therefore it has become a priority of the department to take steps to improve the pass rate on this section of the exam.

Table 1: Pass Rate for BEC Section of CPA Exam (2008) (First time takers of the exam).

Population	BEC Pass Rate
National Average-All Jurisdictions-All Candidates	47.5%
Average-New York State-All Candidates	41.0%
Pace University Undergraduates	27.2%
Difference – New York State Average and Pace Average	13.8% Below

THE NEED FOR INCREASED ICT KNOWLEDGE

The specific problem addressed by this project was to identify the critical ICT knowledge needed by students entering the accounting profession. This investigation was informed by the following conditions of the current business climate.

In business, the required knowledge of ICT is continuing to expand and diversify, supported in part by the emphasis on continuous auditing processes put in place after Sarbanes-Oxley and the rapid change in technology. The very structure of information processing development and design has changed significantly, impacting the required “common body of knowledge” necessary for accountants, IT professionals, as well as business people.

The events of 2008 also bring home the multiple challenges brought on by a pervasive business culture that has downplayed attention to risk and decreased the reach of compliance and control systems. The collapse of Enron in 2001 was the first warning that this approach was flawed. This led to the Sarbanes Oxley Act, which specified the creation of technology driven, accounting based compliance and control processes. The recent financial crisis will most likely require additional compliance and control mechanisms that are implemented with ICT and administered by members of the accounting profession.

The benefits of rule based, automated compliance and control applications also apply to other thorny management problems. For example, firms face risks from their use of energy. Rapid price swings in energy costs can constrain cash flow and the overall profitability of an organization. Regular auditing of energy use can expose opportunities to reduce energy use and mitigate risks caused by rapid increase in energy costs. In addition, social expectations may

develop that require companies to improve their carbon footprint. However, just determining what the footprint really is can require advanced level engineering and data analysis. A logical solution to the problem might include developing a rule based system that automatically determines compliance with carbon emissions and provides an automated system that controls and helps manage the information around carbon emissions.

Finally, there is an expanding emphasis within all the professional exams, including the CPA, CIA, and CISA, on the role of ICT. ICT is an especially important part of the CPA exam, and students currently struggle to pass the BEC part due to limited ICT curriculum opportunities. We expect that students who take this course will have higher pass rates on the CPA exam. It will also provide a solid foundation for students interested in information systems auditing and taking the CISA exam.

These conditions provide strategic opportunities for accounting students. Even before the recent financial crisis, it was clear that ICT skills, especially with respect to data mining and forensic investigation, provided a leg up to accounting professionals in the employment marketplace. Those accounting professionals whose ICT skills are more clearly in line with the emerging opportunities in designing and managing automatic control and compliance systems will excel in their careers. Providing Pace University accounting students with a strong foundation in ICT skills, and practical experience with the use of data mining for control and compliance will give our students a competitive advantage in the job market, and give them the tools to be better equipped to take advantages of opportunities later in their careers.

HOW WE DEVELOPED THE CURRICULUM

We met weekly over the summer of 2010 with the intent of developing curricula around Data Mining and Auditing, a topic of interest to both computing and accounting students.

We carried out a survey of undergraduate and graduate courses around the country that covered many aspects of ICT and accounting. We identified technologies that could be potential components of the course, including computer assisted audit software such as ACL and IDEA, as well as material for SAP, a provider of Enterprise Information Systems. We also researched emerging technology standards for the accounting profession, such as XBRL (eXtensible Business Reporting Language.) All publicly traded US companies are required to submit financial statements to the Security and Exchange Commission (SEC) in XBRL format. This allows the automated collection and comparison of financial statements. We also considered the COSO and COBITS Control Frameworks and other fraud risk assessment techniques. Finally, we examined coverage on the CPA exam related to technology and computer assisted audit techniques.

At this point, we were able to develop course objectives and learning outcomes. We selected two textbooks, *Information Technology Auditing and Assurance*, by James Hall, and *Business Processes and Information Technology*, by Ulric Gelinas, Steve Sutton, and Jane Fedorowicz.

We developed a course syllabus (see Appendix), then approached the curriculum committees of both the Seidenberg School and the Lubin School of Business and obtained permission to run the course as an undergraduate elective for both computer and business majors.

DESCRIPTION OF THE COURSE

The end result was an undergraduate course, “CIT396B – Advanced Information Technology for Accounting Applications,” offered for the first time in Fall 2010. It was offered as a three credit Seidenberg computing elective that could also count as a general business elective for Lubin business students.

All class meetings took place in a computer lab. Classwork consisted as much as possible of hands on exercises with enterprise level accounting applications. For example, students carried out accounting exercises using ACL, a data analysis and continuous monitoring audit tool.

The course also included instruction in creating diagrams using UML (Unified Modeling Language.) Most accounting textbooks teach students how to create flowcharts that follow the logic of a business process and identify steps that require the implementation of controls. However, the computer industry has moved away from the use of flowcharts and embraced UML. UML has some significant advantages compared to the use of flowcharts. Tools have been created that can take a UML diagram and auto-generate the corresponding computer source code. Tools also can take computer source code and create UML diagrams. The power of UML is that the diagram is therefore bound to, and is an accurate representation of the executing program. Flowcharts, on the other hand, are representations with unknown and unknowable authenticity with respect to the system code. Our students used Microsoft Visio to create UML system diagrams. Exercises including documenting the deposit and withdrawal of funds from a cash machine, as well as describing the process a student follows when registering for a class.

RESULTS AND ASSESSMENT

As part of the final assessment in this class, we gave a final exam that included direct questions from the “Business Environment & Concepts” section of the CPA Exam. These questions reflected topics such as business continuity, databases, general computing concepts, IT controls, and security (see Table 2). The students in this class were from various business and IT majors and, as the chart below indicates, they did very well on this content exam with an overall average of 73%.

Table 2: Assessment of CIT396B Students' Mastery of BEC Topics.

Topic	% correct
Business Continuity	75%
Database	45%
General Computing Concepts	88%
IT controls	65%
Security	83%
Total	73%

We then compared the average achievements of our Pace students in CIT396B (73%) to the actual BEC CPA exam results for Pace accounting students in 2008 (27%.) Table 1 shows the national average of all undergraduate students in the U.S. taking BEC in 2008 as 47.5%. We then examined the New York State results for all undergraduate candidates on BEC in 2008. This percentage was 41.0%. For Pace University undergraduate students the pass rate was only 27.2%. Although our class statistics result from a small number of students (seven in the first class), we believe our new course could be instrumental in increasing our university's pass rate on the BEC section of the CPA exam.

ANALYSIS AND CONCLUSION

There were a number of serious obstacles we encountered in this project. First of all, while professionals and academics agree that ICT is an important component of the accounting profession, there is little definition as to what knowledge is critical and required for future success in the profession, and how and where that content can be integrated into the curriculum. The major contribution of this work is to identify what accounting students need to know about technology in order to pass the BEC section of the CPA exam, and prosper in their career. It continues to be a challenge to figure out how to make this knowledge part of an accounting degree program, either on the undergraduate or graduate level.

One unintended outcome has been the opportunity to connect with accounting and IT auditing professionals. A number of accounting professionals have been very enthusiastic about this project, and have offered advice and support. This course has created an opportunity to strengthen the ties between the Seidenberg School and the Lubin School, with professionals in the accounting and IT auditing field.

One objective of the class was to more clearly define the appropriate body of ICT knowledge for accounting professionals. By developing and delivering a course with these topics, we hoped to improve the pass rate for our students on the BEC section of the CPA exam. We have evidence that this class would improve the pass rate, although it is a very small sample. However, the

students had done no other preparation for the questions other than the class material and access in the library to a copy of a CPA review book on reserve. Since many students prepare for the CPA exam by taking an intensive review course, these findings provide evidence that including this material in the accounting curriculum can help students master fundamental ICT concepts.

Finally, this project supported our University's mandates to pursue interdisciplinary curriculum development, to address a need in the Accounting Department for elective courses that reflect the emphasis of the CPA exam on the reliance on IT, and a desire of the Seidenberg School to develop courses that present technology embedded within a specific domain.

GOING FORWARD

Originally, we planned that this course would be offered at the graduate level as an accounting elective. However, due to requirements to take the CPA exam by the New York State Department of Education, there was little room in the graduate curriculum for electives. However, recently our university's admission of students with undergraduate degrees in accounting has created a significant need for accounting electives at the graduate level. We are currently meeting with the deans of both schools to create a) a permanent business elective course at the undergraduate level for all business and computing majors, and b) a similar course for graduate accounting and computing students. We believe these interdisciplinary courses will result in needed increased IT skills and a higher passage rate on the CPA exam.

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APPENDIX

Syllabus for CIT396B – Advanced Information Technology for Accounting Applications

Course developed by Catherine Dwyer and Susanne O’Callaghan

Funded by Verizon Thinkfinity Grant

Course Description

Advanced IT skills aid the advancement of professionals in any business environment. This course will expand students’ IT skills by giving them hands on experience with computer based business workflow analysis and audit tools. The goal of this course is to give students a mastery of professional accounting applications such as SAP, ACL, and Business Process Modeling applications. Course exercises will provide an organizational context so that students will be exposed to the role of data management in support of broader business goals and objectives.

Business students can expect to use different software run on firm wide information systems throughout their careers. Business professionals utilize information gathered across a wide variety of technology sources and storage technologies. These tools can be used more effectively if students understand the various ways data are collected, processed, and digitized within organizations.

Therefore, this course emphasizes technology concepts that enhance the ability of business students to find, validate and use relevant information. These topics include information storage hardware concepts, internal data representation, principles of data mining, system diagramming and modeling languages (UML), business process modeling (BPM), and database functionality and constraints.

There is an expanding emphasis within all the professional exams, including the CPA, CIA, and CISA, on the importance of Information Technology. IT is an especially important part of the CPA exam, and students currently struggle to pass the BEC part due to limited IT curriculum opportunities.

Course Objectives

- 1) Students will understand the diverse nature of digitized information in modern firms, and the challenges business professionals face in combining and reconciling these diverse data sources
- 2) Students will be able to analyze business problems and case studies give using real world business tools such as SAP, ACL and Business Process Modeling (BPM)
- 3) Students will gain knowledge of standardized data formatting mechanisms such as XML and XBRL, which provide a solution to the problem of combining diverse organizational data sources
- 4) Students will be able to document and describe information systems using object oriented design methods and UML
- 5) Using object oriented design tools, students will be able to analyze the structure of information systems directly, and drill down into the detail of the actual system architecture to gather evidence for accounting tasks

Textbooks and Online Reading

Hall, James A., Information Technology Auditing and Assurance, South-Western Cengage Learning, 3rd edition (to be pub. September 2010), ISBN 1-4390-7911-0.

Ulric Gelinis, Steve Sutton, Jane Fedorowicz , *Business Processes and Information Technology*, From the Global Text Project (<http://globaltext.terry.uga.edu/>).

SAP, “A Look into the Future: The Next Evolution of Internal Audit Continuous Risk and Control Assurance,” Available at http://www.complianceweek.com/_cache/articlefiles/CRCA.pdf.

Software Applications

Automated Control Language (ACL) – data analytics and continuous monitoring software

SAP – provider of enterprise resource planning systems, including data mining, general ledger, and other audit/accounting processes

Visio – Microsoft diagramming software, available to students free of charge through Seidenberg’s MSDNAA subscription.

Business Process Modeling – technique for diagramming and analyzing business processes so they can be improved upon and automated

ePortfolio

All students will have an account on Pace’s ePortfolio website, <http://eportfolio.pace.edu>. We will use the ePortfolio site to create a public online site where students can display their class work, and share their assignments with potential employers.

Course Outcomes

At the end of the course students will be able to:

- Comprehend the computing concepts involved in business processes
- Understand digital data representation and its impact on the various processes
- Understand and apply object oriented systems concepts in order to identify controls within a specific system architecture
- Read UML and other systems diagrams and use them to gather evidence for audit tasks
- Use Visio to create UML diagrams for controls
- Use computer tools (ACL and SAP) to carry out various business tasks and routines
- Analyze business cases, design appropriate controls and utilize information for business decision making
- Analyze business cases and recommend the best possible solution to various business problems.

Prerequisites

CIS 101(Computer Information Systems)

ACC 203 (Financial Accounting)

ACC 204 (Managerial Accounting)

Major Topics Covered in the Course

- The modern enterprise and the information systems that support each of its accounting and other business functions
- The nature of computer operations (hardware/software/networking) and data management systems
- Overview of ERP systems, with a specific examples using SAP
- Overview of data mining principles
- Data representation topics, including binary code, standard data types
- Hands on experience with business analysis tools, such as SAP, ACL, and other hands on exercises
- Overview of standardized data formats for inter-system exchange, e.g. XML and XBRL
- E-commerce applications and electronic data interchange standards (EDI)

Grading

Activity	Value
Attendance and class participation Since in class discussion will be the basis for many assignments, attendance is required for all classes. If you cannot attend a class for a serious reason, please inform Prof. Dwyer before the start of that class.	10 points
Homework and class assignments (assigned throughout the semester)	20 points
ePortfolio	10 points
Midterm	20 points
Final	20 points
Team Computer Audit Project Students will complete a Team project using computer based audit tools. The exact requirements of the project will be distributed later in the semester.	20 points
Total	100 points

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