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Communications of the Association for Information Systems

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The Information Systems-Accounting Nexus: Lessons from an Australian Institution

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Abstract:

The bursting of the dot com bubble in March 2000 caused firms to be wary about investment in, and the use of, information technologies. Consequently, demand in technology-related jobs dropped significantly. This drop in demand has had a profound negative impact on the demand for information systems (IS) courses in the tertiary education sector. Some IS departments suffered badly, and some were forced to downsize their faculty through attrition, giving back faculty lines, freezing hiring, or releasing faculty. At the same time, there has been significant and sustained growth in demand for accounting programs. Professional accounting bodies have introduced technologies to accountants and auditors, and technologies have gained its significance in the accounting discipline. With such an observation, this paper explores whether accounting students see IS courses as a complement to their program and the chance to offer IS-related courses to accounting students. We administrated a survey to explore accounting students' preferences for accounting-related disciplines. We then conducted a number of focus groups to gain an understanding of their expectations and interest in technology-related courses. We found that although accounting students preferred finance courses to IS courses, they were interested in IS and considered IS to be useful to their long-term career. We then proposed several IS courses customized for accounting students. This will open up more teaching opportunities for IS academics, and strengthens the IS programs by providing stability in an otherwise unstable environment. After the rationale for a list of proposed IS-related courses for accounting students, we discussed some issues that IS academics should pay attention to before launching these courses.

Keywords: information systems, enrolment, curriculum design, accounting, auditing

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I. INTRODUCTION

With the significant rise of the dot com in the late 1990s, firms invested heavily to incorporate information communication technologies (ICT) into their business processes. However, these investments did not necessarily complement the firms' business models and consequently were not value-adding. Because of this, capital markets repriced ICT firms and firms with major ICT investment. Consequently there was a considerable fall in information technology share values in early 2000s. Following this, firms questioned the long-term benefits of technologies and were hesitant to invest further, resulting in a substantial decline in the job market. The situation was worsened by outsourcing of technology projects to low-cost centers in developing countries. This was followed by a dramatic drop of students' demand for information systems (IS) courses in tertiary education. Reports show that in 2001, IS enrolments decreased as much as 80 percent throughout the world [Granger et al. 2007].

With the considerable drop in the IS enrollment, some academics questioned the independence of IS, and doubted whether the IS departments should be merged with other disciplines, such as accounting, computer science, and management. The identity crisis of IS became controversial [Ayanso et al. 2007; Neufeld et al. 2007], and there were a myriad of recommendations for overcoming it [Agarwal and Lucas 2005; Teo and Srivastava 2007]. To survive and thrive, a hiring freeze came into effect in many IS departments. In some cases, IS departments were even forced to scale back their faculty through releasing faculty.

In the last few years, many IS departments reevaluated their curriculum in the hope that a strong curriculum design would make students more marketable in a hyper competitive job market and add value to the program [Kung et al. 2006]. Some even restructured their curriculum [Chand 2004; Duggan 2004] and assigned effective teachers to introductory IS courses to bolster students' confidence and attract students to IS majors [Looney and Akbulut 2007]. New IS courses have been introduced to enrich the curriculum [e.g. Lim 2006; Strong et al. 2006; Wixom 2004]. Instead of designing new courses, this work explores the opportunities to offer customized IS courses to accounting students. We chose accounting to be the area of interest, because accounting generally has the largest number of students in the schools of business and their enrollment figures are relatively stable. The aim of this paper is not to challenge the identity and independence of the IS discipline. Instead, our objective is to assess the feasibility of offering IS-related courses to accounting students and discern how to tailor these courses to suit students' needs. This benefits both the IS academics and accounting students. First, if IS courses can be customized for accounting students, it is likely that there will be greater teaching opportunities for IS academics. Although enrolments in IS programs are on the rise, we believe that the technology-related job market is cyclical rather than secular and IS enrolment tends to be particularly responsive to cyclical conditions in the job market. Thus, opening up the opportunities to offer customized IS courses to students in other disciplines can strengthen the IS programs by providing stability in an otherwise unstable environment. Second, technological advancement is rapidly changing the work nature of most accountants and auditors. As a consequence, accountants and auditors are expected to have basic technology-related knowledge and skills. Some of them are even involved in the development of software to meet unique data management and analytical needs. Our study, in particular, addresses three questions: (1) Do accounting students see IS courses as relevant? (2) What are accounting students' perceptions of IS courses? And (3) how should we tailor the IS courses to suit the needs of accounting students?

The paper is organized as follows: In the next section, we present the relatedness of the two disciplines, accounting and information systems. Sections III and IV present the findings of a survey and focus groups with accounting students. The survey and the focus groups help us gain an understanding of accounting students' perceptions to and expectations of IS-related courses. Section V discusses the findings and proposes three customized IS courses. The last section concludes the paper.

II. IMPACTS OF INFORMATION TECHNOLOGIES ON ACCOUNTING

The Internet gained a public face in the early 1990s. With the abundant opportunities presented by the Internet, many firms regarded an online presence as a route to instant riches. A plethora of e-business models were proposed. Firms started to perform most transactions online, and ICT were integrated with their business processes [Dehning et al. 2006]. Undoubtedly, accounting, being a discipline concerning disclosure of, or provision of assurance about, accurate financial information, was influenced by firms' growing dependence on technologies in business transactions [Gelinas and Gogan 2006].

Continuing developments in ICT are likely to affect various aspects of accounting [Lord 2004]. For example, firms lever off the impacts of ICT by modifying their business models. They can further automate their business processes and incorporate technologies, such as web services architecture and Internet-based supply chain management systems, into their infrastructure. The nature of these technology-oriented “assets” is different from physical assets, such as factory and equipment. Accountants are usually able to value physical assets reliably and their values do not change significantly within an accounting period. The evidence of the rapid change in the capital market of the values for firms in an information-driven market (e.g. Dell) indicates that their underlying technology-oriented assets change significantly [Li and Alam 2007]. Under AASB 136 Impairment of Assets, accountants and auditors have a legal obligation to reliably record a non-current asset to its recoverable amount when its carrying amount is greater than its recoverable amount. Hence, accountants and auditors must have knowledge of technology infrastructures and their impacts on business processes [Davern et al. 2005].

In addition, with the adoption of enterprise systems, firms transfer and store data in electronic form, and most transactions are performed online [Rikhardsson and Kræmmegaard 2006]. Accountants are expected to know not only how to use basic accounting software to manage data, but also have a solid understanding of critical technological components that drive information systems. Technology-related risks and security issues are drawing auditors’ attention. Identity management is now the primary transaction security focus for banks and financial institutions. Internal controls and audits have to be implemented properly for diagnosing vulnerabilities and threats to firms [Weidenmier and Ramamoorti 2006]. What’s more, accountants and auditors play a significant role in information technology governance, which is to ensure that business systems deliver the values that the organization board expects [Lynch and Gomaa 2003]. Thus, accountants and auditors are expected to have a very high level of technology-related knowledge and grounding. It is generally believed that they would continue to be responsible for the development of in-company e-business initiatives.

The recent launch of eXtensible Business Reporting Language (XBRL) is likely to radically change the financial reporting process [Bovee et al. 2002; Farewell 2006]. By tagging individual pieces of business information with common data definitions and providing a means of transporting the information over the Internet, XBRL increases the speed and the consistency of financial data and the data capturing process. Traditionally, accountants have been in the vanguard of turning a largely untested financial reporting framework into a basis for financial reporting in more than 90 countries. Nowadays, many countries in Europe and Asia are adopting and using International Accounting Standards (IAS). The way in which XBRL describes financial and business reporting data helps firms to enhance the transition to a full alignment for those countries currently using their local standards to transition to IAS. With the changing regulatory requirements affected by, for example, the Sarbanes-Oxley Act, legislation in the US International Financial Reporting Standards (IFRS), the role and tasks of accountants and auditors are changing significantly. In other words, XBRL is not only a technology advancement, but also a change of regulations and practices in accounting and auditing. As remarked by Sutton [2000], “while accounting standards setters have continued to focus on purification of the reporting process through information reliability, the relevance of financial accounting information has continued to diminish, due primarily to a lack of timeliness.”

XBRL enables the disclosure of insider trading information, which is currently available in electronic form on Electronic Data Gathering and Retrieval (EDGAR) through the Securities and Exchange Commission (SEC) Web site [Debreceeny et al. 2005]. Historically insider trading transactions were publicly disclosed by an SEC Form 4 filing 10 days after the end of the month of the trade. As required by Section 403 of the Sarbanes Oxley Act of 2002, insider trading information is now disclosed within 48 hours of the insider trade in the XBRL format. New reporting analysis frameworks for general users to retrieve and analyze XBRL files from the SEC should be proposed by accountants with reasonably good technology-related knowledge. Since software tools that they use to prepare statements are able to import and publish XBRL-tagged documents much in the same way as HTML, accountants are not expected to master the technical infrastructure of XBRL standard. However, they do need to understand the XBRL filing process in order to learn its impact on accounting and audit procedures.

In sum, an information-driven market and the advent of enterprise systems and reporting technologies have occupied the key areas of accounting specialization. In financial accounting, the traditional approach of recording business events in journal entries has been replaced by computer information systems and XBRL designed with programmed rules and instructions to record these entries. There is a reduction in information asymmetry between information producers and information consumers as markets become more information-driven [Davern et al. 2005; Li and Alam 2007]. In managerial accounting, accounting professionals have to learn how to examine and interpret the embedded rules in enterprise systems that influence cost allocations. Given the new requirements of the Sarbanes-Oxley Act of 2002, internal audit functions must use appropriate technology to increase their efficiency and effectiveness. Internal controls are enacted within enterprise systems to execute the calculations and record transaction entries to ensure data validity, accuracy and completeness. Technical skills and knowledge become a must for auditors to understand and implement the system control process. As a result, professional accounting

bodies, such as the International Federation of Accountants (IFAC), strongly support the integration of the study of ICT-related courses with accounting programs. Given the high relatedness of accounting and IS, the current work explores the opportunities to provide accounting students with accounting-relevant IS courses, and enhances our understanding of how accounting students perceive these courses.

In the following, we will present the findings of two studies. In the first study, we surveyed accounting students. They reported their perceptions of various disciplines, including economics, management, finance, and IS, and evaluated how courses from these disciplines are relevant to their accounting studies. In the second study, we conducted a number of focus groups with accounting students to explore their expectations of accounting-relevant IS courses.

III. WILL ACCOUNTING STUDENTS CHOOSE IS COURSES TO COMPLEMENT THEIR STUDIES?

Participants and Questionnaire Design

To address Question 1 mentioned in Section I, a self-administered paper survey was conducted at the University of Melbourne in Australia. The questionnaire consisted of 40 questions. Except for the questions on demographics, all questions were measured on a nine-point Likert scale. The time taken to complete the whole questionnaire was 15 minutes. We disseminated the survey to undergraduates with an accounting major. The data were collected in October 2006.

The accounting students were asked to report their preferences on four disciplines, including economics, finance, management, and IS. With the consent of the lecturers-in-charge in accounting core courses, we distributed the survey in a number of large classes which had more than 120 students per stream. The lecturers-in-charge explained the purpose of the survey and told students that their participation was voluntary.

We disseminated nearly 900 questionnaires. 588 students returned the questionnaires. Out of 588 responses, 414 were complete. There were 242 (58.45 percent) females and 172 (41.55 percent) males. Their average age was 20.75 (S.D.1.69). These 414 students consisted of 83 (20.05 percent) first-year students; 154 (37.20 percent) second-year students; and the rest were third-year students. All respondents had taken at least one course on accounting information systems, and they self-evaluated themselves to have reasonably good computer knowledge. Hence, their opinions on accounting-related information systems issues were deemed to be valid.

Comparison of Information Systems with Other Disciplines

We first asked the participants to weigh a list of factors which might be important in course selection. According to Table 1, the participants considered a course's usefulness to their long-term career to be the most important factor (7.74). Other important factors included a course's usefulness to students' job seeking (7.72), relevance to accounting courses (6.83) and interesting (6.79).

Table 1: The Degree of Importance When Students Select a Course

Selecting a Course	Mean	S.D.
Usefulness to my long-term career	7.74	1.57
Usefulness to my job seeking	7.72	1.57
Relevance to accounting courses	6.83	1.94
Interesting	6.79	1.97
Word-of-mouth from other students	5.47	2.26
Fitting my timetable	4.33	2.63

Note 1: Questions were measured on a 9-point Likert scale (1 = Strongly Disagree; 9 = Strongly Agree)
 Note 2: The number of complete responses was 414.

They were then asked to compare the four disciplines of interest, including economics, finance, management, and IS. These disciplines offered courses to accounting students in the University of Melbourne. Hence, it was valid to ask the students to compare these four disciplines in the survey. Specifically, we asked them to evaluate each discipline on four dimensions, including (1) relevance to accounting courses; (2) interesting; (3) usefulness to accounting students' job seeking; and (4) usefulness to accounting students' long term career. We performed a number of t-tests to compare IS courses with courses in other disciplines. Results are shown in Table 2.

Table 2: Results from One-Sample T-Tests

Score(IS) – Score(X)		Paired Differences					t	df	Sig. (2-tailed)
		Mean	S.D	Standard Error Mean	95% Confidence Interval of the Difference				
Item	X							Lower	Upper
Long-Term Career	Econ	0.145	2.727	0.134	-0.119	0.408	1.081	413	0.280
	Finance	-0.130	2.484	0.122	-0.370	0.110	-1.068	413	0.286
	Mgmt	-1.444	2.431	0.119	-1.679	-1.210	-12.091	413	0.000
Job Seeking	Econ	0.027	2.429	0.119	-0.208	0.261	0.223	413	0.824
	Finance	-1.500	2.441	0.120	-1.736	-1.264	-12.502	413	0.000
	Mgmt	0.304	2.586	0.127	0.055	0.554	2.395	413	0.017
Relevance	Econ	0.080	2.383	0.117	-0.150	0.310	0.681	413	0.496
	Finance	-1.411	2.297	0.113	-1.632	-1.189	-12.498	413	0.000
	Mgmt	0.925	2.661	0.131	0.668	1.182	7.074	413	0.000
Interesting	Econ	-1.256	2.917	0.143	-1.538	-0.974	-8.760	413	0.000
	Finance	-1.920	2.706	0.133	-2.182	-1.659	-14.439	413	0.000
	Mgmt	-0.667	2.851	0.140	-0.942	-0.391	-4.757	413	0.000

Note 1: Questions were measured on a 9-point Likert scale (1 = Strongly Disagree; 9 = Strongly Agree)
 Note 2: The number of complete responses was 414.
 Note 3: IS = Information Systems; Econ = Economics; Mgmt = Management
 Note 4: MEAN = score of IS – score of course X (X = Economics, or Finance, or Management)

Figure 1a shows that the participants perceived IS courses (4.51) to be significantly less interesting than economics (5.76) ($t = -8.76, p < 0.01$), finance (6.43) ($t = -14.44, p < 0.01$), and management (5.17) ($t = -4.76, p < 0.01$).

Regarding the relevance to accounting courses, finance (6.81) was found to be the most relevant. There was a significant difference between the scores of finance and IS (5.40) ($t = -12.50, p < 0.01$). No significant difference was found between IS and economics (5.32) ($t = 0.68, p > 0.1$). IS courses were perceived to be more relevant to accounting than management courses were (4.47) ($t = 7.07, p < 0.01$). Figure 1b summarizes the results.

Figure 1c shows how the participants perceived the usefulness of various disciplines to their job seeking. Again, finance (6.86) was found to be the most useful to one's job seeking and there was a significant difference between the scores of finance and IS ($t = -12.50, p < 0.01$). IS (5.36) and economics (5.33) had similar scores ($t = 0.23, p > 0.1$). Accounting students perceived IS courses to be more useful than management courses (5.06) ($t = 2.40, p < 0.05$).

Regarding the usefulness to one's long-term career, IS (5.47) was not perceived to be any different from finance (5.61) ($t = -1.07, p > 0.1$) and economics (5.60) ($t = 1.08, p > 0.1$). However, courses in management were evaluated to be the least useful in one's long-term career (5.32) ($t = 12.09, p < 0.01$).

Overall, accounting students considered finance courses to be the most useful in their job seeking and the most relevant to their studies. Accounting students considered IS courses to be useful, and IS courses and economics courses were equally important to their studies. But students tended to evaluate management courses poorly.

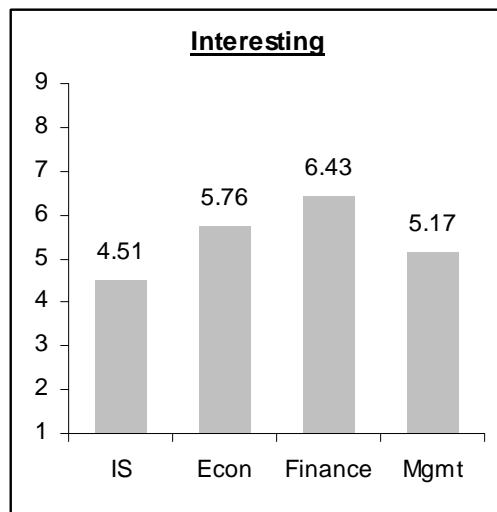


Figure 1a

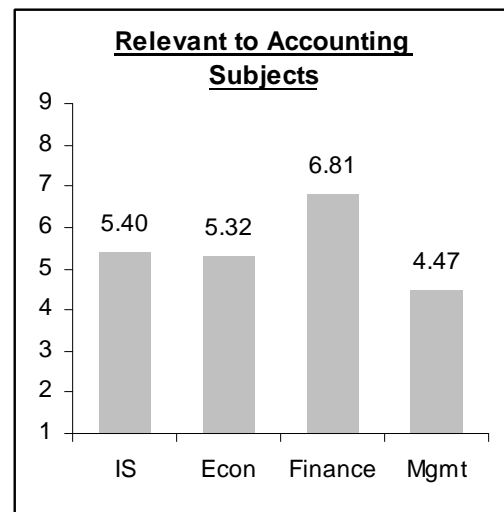


Figure 1b

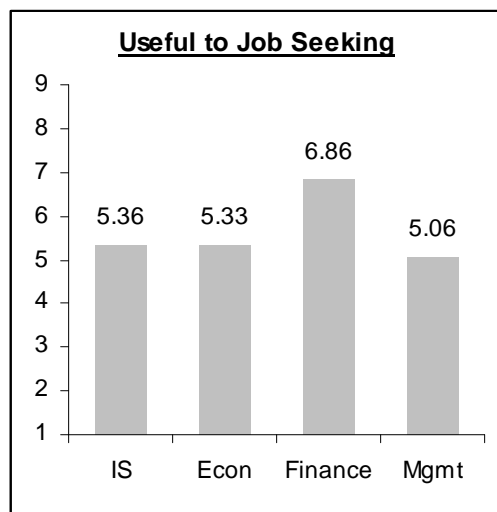


Figure 1c

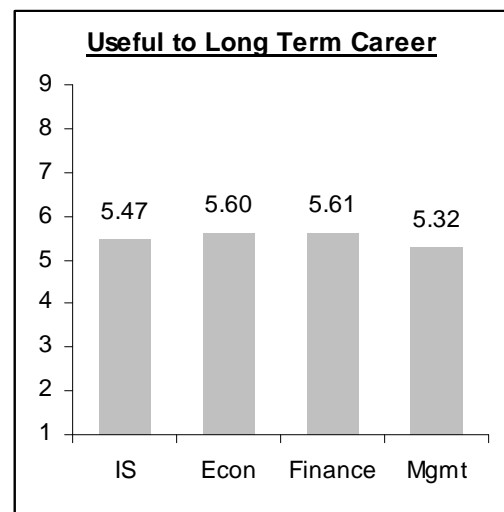


Figure 1d

Note 1: Questions were measured on a 9-point Likert scale (1 = Strongly Disagree; 9 = Strongly Agree)
 Note 2: The number of complete responses was 414.
 Note 3: IS = Information Systems; Econ = Economics; Mgmt = Management

Figure 1. Students' Evaluation of IS Courses and Courses from Other Disciplines.

IV. PERCEPTIONS OF IS COURSES BY ACCOUNTING STUDENTS

Though accounting students like IS-related accounting courses, they tend to choose finance courses. This motivated us to conduct a number of focus groups to explore the underlying reasons. The reason for adopting this approach is that focus groups are likely to bring to light the collective views of accounting students on whether they are receptive towards taking IS courses [Bryman 2001]. The focus groups were to address Questions 2 and 3 mentioned in Section I. In this section, we will present the findings of the focus groups.

Participants and Research Design

We conducted four focus group sessions comprised of 32 accounting students from the University of Melbourne. The sessions were held in the Faculty of Economics and Commerce within the university during the second week of November 2006. Sessions were recorded and transcribed to produce qualitative data for subsequent analysis. In this study, we followed closely the general guidelines of focus group research [Fern 2001].



The participants we selected had all completed an IS-related accounting course in their first year. Hence, they had some basic IS knowledge. A moderator who had performed a similar role in previous research ran the focus groups. The main role of the moderator was to facilitate useful and relevant discussions among group members. We encouraged participants to freely express their views since their identities would remain anonymous throughout the data collection and analysis processes. The questions were open-ended. Excerpts of the interview questions are shown in Appendix 1. For example, we asked students their perceptions of IS courses and whether they would select them as electives. Each focus group lasted approximately an hour.

After the data were recorded, they were transcribed immediately to allow for coding and analysis. The data analysis involved rigorous examination of extensive interview transcripts. We compared, conceptualized and categorized our data. Coding categories reflected the interpretations that interviewees formed about the IS courses. We eventually arrived at six fundamental attributes. The data suggested most accounting students we interviewed expressed a weaker preference for selecting IS courses than finance courses. The findings were consistent with the survey findings. The concepts and patterns observed were linked to the IS literature. We endeavored to provide a data-theory link [Klein and Myers 1999] and attempted to understand accounting students' perceptions of IS that is associated with the theory. In order to reduce researchers' bias and also to validate that no important attributes had been missed in the result summaries, a colleague was asked to comment on the analysis of the data. This allowed the incorporation of two different perspectives for our results and minimized the potential that we might have overlooked something important. The role of this colleague was to "bring a different and possibly more objective eye to the evidence" [Eisenhardt 1989 pp. 538]. The information this colleague received did not include the field researcher's list of attributes. We went through the interview transcripts several times and moved back and forth between the data, IS literature and the concepts emerged. In the following, we will present the conceptualization and categorization of the data in our final round.

Findings of Focus Groups

Analysis of the interview data elicited a variety of attributes that might contribute to accounting students' low preference for IS courses (compared with courses from economics, finance, and management). The attributes were (1) relevance of IS knowledge; (2) nature of IS knowledge; (3) competitions from other disciplines; (4) poor course image; (5) lack of awareness; and (6) job opportunities. These attributes are discussed in great detail in the subsequent sections.

Relevance of IS Knowledge

Accounting students first rationalized the importance of IS courses in terms of their relevance to the accounting discipline. Exploring the perspectives of the individual students by discussing the importance of IS was paramount to beginning to understand the relevance issue in our study. Most accounting students agreed that IS played an important role in accounting professions.

"I don't think anyone here can deny the growing importance of IS, especially now with globalization and increasing automated processes. Almost all corporate transactions are processed by computerized systems. For accounting, we need to obtain the data from the computer and store the data too. Accountants use information systems because it is more efficient and effective."

"Obviously information systems are important. It is more efficient and effective. Efficiency is about time, money and effort, and effectiveness is about getting things done. Computers over the years have shown us they can do things by taking less time, effort and potentially costs less, and still get jobs done. For bookkeeping, I am sure with information systems, there will be fewer errors. Besides, it is easier to control processes using systems."

"I reckon it is ridiculously important. Everything now is done through e-mail and the Internet. I think it is important to learn to use information systems because everyone communicates via the Internet. I could not imagine any accounting firm would not use information systems."

While most, if not all, accounting students agreed that it was important to obtain IS knowledge, many of them refuted the idea of selecting IS courses as their choice of electives. While the students failed to see the need to learn system development knowledge and the programming languages, they were confident about learning it after they started their career.

“I won’t consider IS as an elective because many seniors told me we can learn it at the workplace. Like computer transactions and stuff like that I can easily learn them on the job. Now we should focus more on accounting issues and when you get to work, we can then learn how to use information systems.”

“Generally people at our age are familiar with technologies, computers and things like that. Most of us perceive we’re pretty familiar with what is going on with systems. For such things, it only takes a little effort to master the knowledge and get used to a new system at the work place.”

“My opinion is that if employers are looking for candidates with in-depth IS knowledge, they will hire IS graduates. For accounting students, we only need to learn general IS knowledge which we can easily pick up next time. Employers would conduct such trainings for us. So what’s the point of learning IS knowledge twice.”

“Most companies have an internal IS department. These IS experts would help employees to resolve any technical problems they face. Therefore, it is alright if you don’t know much about IS as you would always get help.”

Nature of IS Knowledge

In today’s rapidly evolving business environment, computer systems have enhanced our ability to process data, but at the same time, companies face the great challenge of handling the sheer volume of business data. In order for business to keep pace, IS must continue to innovate to respond to these changes to assure the critical success of organizations. This need for continuous change and improvement has also infiltrated into the IS curriculum. According to a survey conducted by Kung et al. [2006], IS curriculum in the US has changed significantly in the last 10 years and has placed large demands on IS educators and students to continuously acquire new knowledge in the IS area. Most accounting students had echoed a similar sentiment of rapidly evolving IS knowledge and as such, there was no urgency to master the knowledge since it might be obsolete in the near future.

“Information systems are always changing anyway. What we learn now may change by the time we join the workforce.”

“Without IS knowledge, we still can get our jobs and learn on our jobs. Besides, what we learn now may be irrelevant later. You never know about technology, it is constantly changing.”

“I think IS knowledge is important in our future careers, the problem is technology changes too fast. Whatever IS knowledge we learn may only be useful now and become useless a few years later. For example instead of using EDI to send data, we may have brand new information systems.”

Competition from Other Disciplines

Students should select a course area that is of interest and for which they have an aptitude. The criteria when choosing a major were individual goals, career aspirations, interest and abilities. Research shows that students working in a discipline for which they had an aptitude, affinity, or special interest did well academically [Kung et al. 2006]. Academic disciplines are constantly changing as the maps of knowledge are redrawn. As such, competitions between course disciplines are not uncommon. Our data suggests that most accounting students had a similar degree of preferences in IS, management and economics; however, they preferred finance to IS courses due to several reasons related to their career aspirations, interest, and abilities.

“Firms prefer accounting students with economics, management, or marketing knowledge because it is harder to teach economics, management, and marketing to them, but easier to impart IS knowledge. Overall, students should either learn the technical IS knowledge in which case they should enroll in IS schools or general business courses such as finance and management.”

“Sometimes when you select courses, you think a lot about the opportunity cost. If you choose this course, what can’t you choose? It is always choosing the one that gives you the most leverage and this case, it has to be finance.”

“Compared with other commerce courses, IS courses are too difficult for me, especially courses like database, information architecture etc. I have never liked IS.”



Poor Course Image

It is important to dispel any negative impression of a curriculum as it may affect students' course selection. By allowing the wrong impression to proliferate amongst the student population, students' decisions might be biased and distorted. Our study reported that accounting students had a poor impression of IS courses, branding them less exciting, less rewarding, and with minimum appeal.

"Other courses like finance and economics are far more glamorous. Imagine, you can become an investment banker or something, whereas in IS it has a bit of a stigma."

"It (i.e. marketing) is dynamic and fun. On the other hand, my impression of information systems is having nerds with thick glasses sitting in front of computers all day. Why would someone wish to become like them?"

"Based on what I heard about IS, it is not very attractive. Many seniors advised us of the usefulness of having accounting and finance knowledge in the Big 4 firms and banking environments as compared to IS knowledge. Furthermore, I presume you will be paid much more having an accounting and finance background. Besides several newspapers also reported IS jobs being moved to other countries. So why study IS?"

Lack of Awareness

Even though many accounting students spoke less favorably about IS courses, many of them admitted that part of the reason was due to their lack of understanding in what IS courses could offer. Several of them associated IS with computers and the Internet, and had little idea of what they could learn by enrolling in these courses.

"I had to admit most of us do not know what they are. No one came to explain to us what these courses could add value to our accounting knowledge. For example, how a course such as 'electronic commerce' could relate to accounting? If we do not know about the course, it is obvious we would not sign up for it."

"There is simply no marketing of IS courses. During the beginning of the semester when we selected the courses, we had many speakers promoting the finance curriculum. They even invited senior people from the bank to come and speak to us about how interesting and important finance knowledge proves to be. I don't recall anyone coming to promote IS. The visibility for information systems is too low."

"Many of us do not know many IS courses plus few of our seniors had taken these courses before. The message we received seems to be 'don't know much', 'don't hear much' and so 'don't go near it'."

Job Opportunities

Our data analysis suggests that though accounting students considered ICT to be important in the accounting and auditing field, there were more job opportunities for accounting students who have been equipped with finance knowledge. In fact, most of them recognized the availability of a large pool of IS graduates coupled with a dip in the demand for them from the major IS corporations.

"I checked several career Web sites, and they all ask for accountants with accounting and finance knowledge rather than IS. I reckon accounting and finance knowledge seem rather similar."

"In terms of the job prospects and marketability for accounting students, they should complement their accounting knowledge with financial knowledge. According to my dad, who is a financial controller of a major bank, a finance person will always be the last one to be fired followed by an accountant. Unfortunately, the technical person will always be one of the first to be asked to leave. In this regard, having accounting and finance knowledge has better job security."

"In terms of getting a job, finance would be easier than IS. This is because there is a large supply of IS graduates and as such competition is stiff. Finance is in great demand and it would pay better than IS."

V. DISCUSSION

To attract accounting students to select IS-related courses, academics have to address two fundamental questions: (1) What IS-related courses should be offered to accounting students? And (2) how to make them feasible? In the following, we first propose three IS-related accounting courses, and then discuss a number of issues to be considered before launching these courses.

Proposed IS-Related Accounting Courses

Today's accounting students are expected to learn some technology-related concepts [Fordham 2005]. Disappointingly, some accounting students misunderstand that technologies refer to the basic use of accounting information systems, electronic commerce, or even spreadsheet and word processing software. They think that they can learn fundamental and in-depth ICT knowledge after graduation. Obviously, a clearly presented curriculum structure and relatedness between accounting and IS is the first step to influence accounting students' aspirations to pursue IS-related accounting courses. IS courses should be customized to the accounting background [Bain et al. 2002]. To tailor to the needs of accounting students, the courses should be business and non-technically oriented. This can not only be a better fit with students' accounting background, but also strengthen students' confidence in their ability to acquire relevant knowledge and perform well in these courses. In the ISWorld discussion on 11 October 2006, Professor Saeed Roohani at the Bryant University gave an important remark that "we are focusing too much on the system, where the most important part is the information."

We sampled 75 university Web sites from the ISWorld list. Amongst these universities, about 15 of them merged accounting and IS into one department and offered an accounting program which consisted of at least one IS-related course. Their IS courses covered skills such as accounting information systems, business modeling and technological risks. To a certain extent, some programs provided accounting students with an elective course, project management, probably the rationale behind was that the new role of accountants would be "information managers". A plausible approach to impart relevant technical skills to accounting students is to embed IS knowledge within an accounting context. By demonstrating how ICT plays a significant role within an accounting setting, one may solicit greater buy-in from accounting students.

We propose to provide accounting students with a fully-fledged accounting information systems curriculum at the elementary, intermediate and advanced levels. At the elementary level, a course may focus on providing an integrated view on information systems and related accounting processes in organizations. It can provide students with a broad knowledge of the fundamentals of accounting data management, information integration, and modeling of business processes. At the intermediate level, a course may be offered to examine how organizations implement enterprise systems to link various business functional systems into a tightly integrated single system with shared data and how accountants may utilize the enterprise systems to organize and present updated financial information. After the students gain a general idea of auditing in their second year or third year, at the advanced level, a course may be designed for accounting students to better understand computer frauds and fraud detection methods. Given the statement on Auditing Standards (SAS) No. 99 (Consideration of Fraud in a Financial Statement Audit), auditors are required to become more vigilant in assessing fraud risk. Thus, this course is closely related to auditing.

In the following sections, we specify three courses: *Business Process Analysis*, *Enterprise Resource Planning*, and *Information Technology Forensics* for elementary, intermediate, and advanced levels respectively. We also provide a short synopsis of what these courses entail.

Business Process Analysis and Accounting

This course equips accounting students with basic database and documentation skills, and helps them gain an understanding of accounting processes, including ordering, purchasing, production and human resources, and data stores. Basic database skills include relational database, referential integrity and form design to eliminate user input errors. Structured query languages can further enhance their knowledge on extracting and querying the data. Regarding basic documentation skills, accounting students should learn how to document a narrative of accounting processes with techniques, such as data flow diagrams and system flowcharts. Analytical skills of assessment and evaluation of the risks associated with accounting information systems are highly relevant to auditing. Students should learn how to design and evaluate control practices to manage those risks, to improve the internal control and to achieve information validity, accuracy and completeness. Greater weight should be placed on internal control and transactions processing, whereas moderate importance should be placed on software and hardware issues [Bain et al. 2002].

Enterprise Resource Planning and Accounting

Enterprise resource planning (ERP) systems are considered to be one of the most important technologies in accounting or auditing field [Strong et al. 2006; Sutton 2004]. Relative to the proposed course in Section 6.1, this

course is more technology-oriented. Students should gain an understanding of the impact of various e-business technologies. For instance, Greenstein and McKee [2004] carried out a literature search and came up with 36 important information technologies, with the confirmation from more than 300 accounting IS professors and 200 auditing practitioners. Apart from basic computer skills (e.g. database searching, word processing and spreadsheets), sophisticated areas are also expected. Sophisticated areas include expert systems, encryption software, groupware, computer security and intrusion detection and enterprise resource planning systems. Standard practices to establish control over development, implementation and maintenance of accounting information systems should be covered. This course also enhances students' knowledge in advanced technologies, including XBRL, data mining and data warehousing. Data mining and data warehousing are relevant to accounting disciplines, because auditors use technologies to deal with large amounts of financial data for fraud detection.

Information Technology Forensic and Accounting

Apart from corporate fraud and disputes, organizations face the risks of their information systems being compromised. Risks include computer frauds, virus attacks and server hackings. As such, organizations ought to take every precaution to protect their systems through tighter internal control and audits. Accounting students who aspire to be future auditors or forensic accountants may need to understand how computer frauds may be conducted, how to increase the difficulty of committing a fraud, and ways to improve fraud detection methods. Accounting students should be equipped with basic technology-related knowledge, such as network technologies and the Internet infrastructure, to know the IT-related risks, their perpetration, investigation, and prosecution. The course puts an emphasis on the legal framework and the investigation of fraud, principles of handling computer evidence, analysis of computer evidence, and presentation of evidence in a court as an expert witness.

Issues to be Considered

The importance of technological advancements is universally recognized. Though accounting students acknowledge the importance of ICT and they consider IS courses to be useful, it seems that they prefer finance courses to IS courses. We believe that the success of the IS-related accounting courses is driven by not only content delivery, but also pedagogical arrangements. IS departments should consider a number of issues before offering these courses.

First, a clear positioning of IS courses is important. According to our findings in the survey and focus groups, accounting students prefer finance courses the most. With the high job demand in investment banks, finance courses are highly attractive to accounting undergraduates. Hence, it is unlikely that students can be convinced to forgo finance courses and to select IS courses. However, IS courses are competitive with courses offered by departments of economics and management. Flexibility in students' course selection is important and curriculum designers should ensure that there is sufficient flexibility for accounting students to choose some elective courses after students select their core finance courses.

Second, IS-related accounting courses are on the boundary across two disciplines, accounting and IS. A critical issue is whether these courses should be taught by accounting professionals or IS professionals. Should this content be taught in a standalone course or embedded in some existing accounting courses? To teach effectively, instructors should have reasonable accounting knowledge to contextualize the ICT content in accounting and audit domains. A tight integration of IS courses into the accounting curriculum is required. Our suggestion is different from a typical approach adopted by some commerce or business programs, in which an introductory IS course is offered to all first year commerce students. Undoubtedly, customizing courses for accounting students incurs more teaching preparation effort. However, we believe that, in the long term, the IS departments can strengthen their curriculum by opening more teaching opportunities.

Third, the support by professional bodies and accountancy organizations is crucial to leverage our efforts. Accounting programs in tertiary education recognize the importance of ICT, and some have tried to enrich the accounting curriculum by exposing students to developments in ICT. For instance, in 2001, the education committee of IFAC asserted that "information technology is pervasive in the world of business. Competence with this technology is an imperative for the professional accountant." In January 2003, IFAC published an article to highlight the importance of information technology for professional accountants¹. To strongly promote technology-related courses to accounting students, we need support from the accounting and auditing communities. For instance, professionally accredited programs, such as Certified Practicing Accountant (CPA) Program, currently include modules that assume candidates have a mastery of not only accounting, auditing and taxation law, but also finance. These modules primarily focus on advanced 'accounting and finance' issues, leaving little room in the program for modules that advance ICT knowledge. Accounting students need to complete these courses in order to gain their

¹ See: <http://www.ifac.org/Members/DownLoads/IEG-11-Revised.pdf>

CPA qualification. To recognize the significance of technology, these professionally certified programs should introduce more ICT-related materials, and include them as part of certification completion criteria.

Finally, greater effort must be made by industry to highlight the importance of ICT in accounting-related jobs. For example, with the emergence and rapid expansion of forensic accounting, there is a great need for data mining skills, as well as forensic ICT investigative skills. Also, public accounting firms try to fill positions with students having some exposure to SAP R/3. Consequently, the market needs to clearly signal the need for these skills in any job advertisement and position description.

VI. CONCLUSION

ICT are heavily used in firms. Technologies, such as forensic tools, XBRL and data mining, are commonly used in accounting and audit sectors. Therefore, it is important for accounting students, the future accountants and auditors, to receive proper technologies training in their tertiary education. This paper examines whether and how IS disciplines can provide and customize IS courses for accounting students. Our survey findings show that accounting students consider IS courses to be useful and interesting. However, they tend to choose finance courses to complement their study. Our focus group findings demonstrate that accounting students have some perceptions (or misconceptions) about IS courses. Academics, practitioners and professional societies should help accounting students fully understand the importance and usefulness of IS courses in their long term career. This paper also proposes three IS-related accounting courses at the undergraduate level, and points out several important issues for educators before offering these courses.

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APPENDIX 1. EXCERPTS OF THE INTERVIEW QUESTIONS

1. Would you consider IS as your area of elective courses? Why? Or why not?
2. Please suggest ways to make IS courses more appealing to accounting students.
3. How do you perceive the importance of IS knowledge in future career?
4. Do you agree that IS will play an increasingly important role in accounting or auditing? Why? Or why not?
5. Why do most accounting students choose finance courses as an elective?

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