Designing IS Curricula for Practical Relevance: Applying Baseball's "Moneyball" Theory

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ABSTRACT

Baseball's "Moneyball" theory states that the baseball market undervalues some attributes (and players with these attributes) that are key contributors to wins while overvaluing other attributes. Teams who correctly evaluate attributes that contribute to wins have higher winning percentages with relatively low payrolls. We applied the Moneyball theory for designing an Information Systems curriculum that could contribute to successful practice. First, we conducted a field study using six organizational case studies to identify skills, traits and attributes valued by IS practitioners as key contributors to successful practice. Next, we compared the skills, traits and attributes emphasized in traditional IS academic curricula (as specified in IS '97 and IS 2002 curricula) with those valued by practitioners. Our case study findings suggest a need for categorizing IS curricula into a framework consisting of three broad categories for practical relevance: (1) Foundational courses based on the traditional IS curricula such as IS '97 and IS 2002, (2) Localized and customized courses that meet the needs of local and regional employers of graduates of each IS program, and (3) Business assessment and systems thinking courses that enable IS graduates to (a) assess and understand organizational requirements and opportunities in ambiguous and messy organizational situations and (b) design systems that accomplish requirements and leverage opportunities. Our case study findings also suggest that the business assessment and systems thinking courses category is considered the most valuable for successful IS practice.

Keywords: Information Systems curriculum, Practical relevance, IS practitioner skills and attributes

1. INTRODUCTION

Baseball's "Moneyball" theory (Lewis, 2003) states that baseball teams, scouts, and managers overvalue some attributes (such as batting average and runs batted in) while undervaluing other attributes (such as walks and on-base percentage). Performance-based analysis of baseball data called Sabermetrics reveals that the under-valued attributes (walks and on-base percentage) have a much higher correlation with runs scored and games won by a team compared to the over-valued attributes (batting average and runs batted in). A few Major League Baseball teams, such as the Oakland Athletics, have used this imbalance in evaluation to their advantage by acquiring players with the under-valued attributes at much lower salaries than their actual value in terms of their contribution to the teams' wins. Lewis (2003) estimates that lower salaries range from 10% to 50% of the players' actual value.

We applied the Moneyball theory to information systems (IS) workers in business in order to determine if there are any under-valued skills and attributes that might be exploited or any over-valued skills and attributes that might be avoided in the hiring process. Further, we suggest the design of an IS curriculum that could help prepare IS graduates to become successful IS practitioners based on these skills and attributes.

Our first task was to conduct a field study to identify a set of skills and attributes that IS practitioners consider most important for successful IS practice. We compared these to skills and attributes that are prescribed in the widely used model curriculum guidelines, jointly published by the Association for Computing Machinery (ACM), the Association for Information Systems (AIS), and the Association for Information Technology Professionals (AITP) (Gorgone et al., 2003). Knowledge of these over-valued and under-valued skills and attributes could be useful in designing more relevance into future IS curricula, marketing state-of-the-art IS programs to potential students, and placing graduates with forward-thinking organizations.

The rest of this paper proceeds to first review research in the practical relevance of IS curricula and courses, followed by a presentation of our research method and each organizational case study. Then we discuss the case study data using the Moneyball theory lens and interpret the findings from these organizational cases. We end with some conclusions on how curricula may be constructed to provide

graduates with the most valuable skills and attributes from the Moneyball perspective.

2. LITERATURE REVIEW

A basic task for educators and administrators in MIS programs is to design a curriculum that provides value for their students. What courses are most appropriate to provide students with the necessary background, skills, and abilities required to become successful practitioners in their fields? Perhaps the most comprehensive effort to answer this question was undertaken by ACM, AIS, and AITP, who began to formulate a model MIS curriculum in the early 1970s. Their efforts have been periodically updated, with the latest model curriculum published in 2002 (Gorgone, et al., 2003).

The model curriculum derives its value by providing a basis for educational institutions to assure that their graduates have skills consistent with the needs of employers nation-wide, and possess the common body of knowledge in the Information Systems field. The curriculum is defined in detail, with specific learning goals assigned to each course. In addition to the obvious technical skills (programming, database, systems analysis, networking, etc.), IS graduates are expected to have analytical and critical thinking skills, proficiency in the functional areas of business, interpersonal skills, the ability to communicate effectively, and to be capable of working in teams.

Many studies attempt to identify differences between academics in IS and practitioners in IS in their perception of what constitutes a valuable skill or ability. However, most studies dealing with the practical relevance of IS curricula have been conducted from the academic perspective rather than the practitioner perspective. Tang, Lee, and Koh (2000) surveyed 63 IS educators to determine their perception of gaps between required IS skills and the skills achieved by IS graduates. They found gaps in three areas: interpersonal skills, critical and creative thinking skills, and IS technology skills such as systems development methodologies, implementation issues and hardware. Fang, et al. (2004) surveyed IS seniors in three US universities to determine critical factors affecting job offers for new IS graduates. They report that GPA, internship experience, and double majors are key items that influence job offers.

Fewer studies have been done to determine the value of skills and attributes from the practitioner's point of view. Fang, Lee, and Koh (2005) surveyed 51 IS recruiters to determine the skill sets, knowledge areas, and personal attributes that they found to be most valuable. They found that recruiters rated interpersonal skills (ability to work and communicate as part of a team) most important; critical thinking, creative thinking, and personal motivation came second; core IS skills such as database design, programming languages, and system development life cycle (SDLC) methodologies came third; organizational knowledge (business environment and functions) came last. Van Vliet and Pietron (2006) surveyed 300 of their former undergraduate students to determine whether the traditional SDLC methodology was used in practice. They concluded that the SDLC methodology, as well as other traditional methods and techniques, remained popular in practice. In a survey of both academics and practitioners, Lee, et al. (2002) found that the knowledge of IS technology was valued more by academics than practitioners, while interpersonal skills and business knowledge showed the reverse, being more highly valued by practitioners.

Researchers have not only examined gaps in curricula, but also differences in how IS courses are taught. These differences can affect the ability of IS graduates to perform their jobs. Consider, for example, systems analysis and design (SA&D), which is perhaps the defining course in an IS curriculum. One survey of undergraduate programs showed it to be the most popular course in IS curricula, with 94% of programs offering it (Kung, et al., 2006). SA&D is so important because it requires such a wide range of skills: technical, business, and interpersonal. Despite its universal presence in the IS curriculum, there is not universal agreement concerning the content of the SA&D course (Harris, et al., 2006). Some teachers favor the traditional systems development life cycle (SDLC) approach, while others prefer the more modern object-oriented approach (Rob, 2006). Still others prefer to use "amethodical" approaches that do not restrict the analyst to follow a specific procedure (Introna and Whitley, 1997; Truex, et.al., 2000). Amethodical developers focus on getting the job done using the most appropriate tools available, regardless of whether their actions fit into a prescribed methodology.

A recent survey of essential entry-level skills for systems analysts (Banerjee and Lin, 2006) points out that while it is necessary to constantly review curriculum content, certain skills have remained constant. These include interpersonal and business skills important to managing people in organizations as well as the analytic skills required in the job. This confirms earlier findings (Leitheiser, 1992; Richards, et al., 1998) which showed that managers value business or people skills involving teamwork and communication as much as or more than technical skills.

In designing an IS curriculum, Ehie (2002) found that employers sought job candidates who possessed a strong systems orientation and who understood the concept of a business value chain. The ability to integrate skills and see the big picture from a business perspective was highly valued. Candidates with these capabilities were more effective in assessing and understanding the information needs of clients. Cappel et al. (2005) argue that one non-technical skill that is often overlooked is attention to detail, or doing the "little things" right. Other adjectives that describe attention to detail include: complete, thorough, meticulous, correct, accurate, exact, and conscientious. Their survey indicated that attention to detail is very important to IS professionals, but there is very little attention paid to it in educational programs or in job selection procedures.

Since the field of IS is very dependent on rapidly-changing technology, teaching the current state-of-the art in the field will always present a challenge. On the other hand, IS programs that place too much emphasis on technology may produce graduates that lack some of the other business, communications, and interpersonal skills that are so vital to IS practitioners. Trauth et al. (1993) found an "expectation gap" between industry needs and academic preparation. Universities were found to have placed too much emphasis on traditional and formal systems development, and failed to

produce graduates who valued a more holistic view of integrating technologies, applications, data, and business functions. Lee et al. (1995) also predicted that industry would demand graduates who combined technical capabilities with business operations skills, interpersonal skills, and the ability to manage and lead organizations as they integrate and reengineer their processes. In a survey of businesses in the Northeast US, project management and security issues were found to be inadequately covered in business schools (Kim, et al., 2006). Lippert and Anandarajan (2004) found a disconnect between the essential skill sets required by workers in organizations and the experience they gain through education and training. Potentially, this can result in application backlogs, development errors, missed deadlines, and excessive project costs. More programs emphasizing integration of systems (project management, business systems analysis, legal and ethical issues) are needed. With the growth of the Internet, it is now possible to track how technology is changing job requirements. For example, one recent survey detected a trend toward valuing contemporary programming and web development skills over traditional programming skills (Liu, et al., 2003).

Hoffman (2003) found that CIOs claim that graduates are not prepared for corporate IS jobs. There is too much concentration on programming and system development skills and too little on business thinking, communication skills, and project management. Some schools are responding to this need by using business executives to teach some of their courses, integrating technical IS courses with business management courses, and using real-world projects, provided by local firms, in IS courses.

Defining and evaluating a successful Information System has been an ongoing and inconclusive IS research endeavor (Seddon, et al., 1999). DeLone and McLean (1992) were the first to systematically study measures of IS success. They stated that IS success should be measured by combining six categories: system quality, information quality, system use, user satisfaction, individual impact and organizational impact. Seddon et al. differed from DeLone and McLean in evaluating IS success by noting that different stakeholders are likely to evaluate a system in different, and potentially contradictory, ways. Hence, Seddon et al. suggested conceptualizing IS success as a value judgment made by a particular stakeholder and provided a 30-cell contextual table to evaluate IS success based on type of stakeholder and type of system. Alter (1999) disagreed with this conceptualization of IS success as a contextual table stating that it ignored the fact that information systems are integral parts of work systems. Alter instead stated that IS success evaluation should include evaluating the performance of the work system supported by the information system.

3. RESEARCH METHOD AND DATA COLLECTION

While the studies we reviewed above provide significant insight into the academic perspective on valuable IS skills and attributes, they provide much less insight into the practitioners' perspective. This limitation results from the survey questions typically used in these studies, which are designed from the academic researchers' perspective. This tends to constrain the respondents, who are IS practitioners, to a set of possible options that are determined by the academic researchers. In our study, we recognized the need to overcome this limitation by (a) using a qualitative case study research methodology instead of a quantitative survey methodology and (b) making our interviews and discussions practitioner-centric.

A qualitative case study research approach was appropriate for this research since we were investigating a contemporary phenomenon (what skills, traits and attributes contribute to successful IS practice) within its real-life organizational context (Lee, 1989; Yin, 2003). For our data collection, we used semi-structured interviews with a set of prepared questions (see Appendix). To make our interviews more practitioner-centric, we began all our interviews by asking the IS practitioners to take the lead in discussing skills, traits and attributes that contribute to successful IS practice. We used two open-ended starting questions that were grounded in the organizational context: (a) Who are the IS employees that are most valuable to your organization? (b) What are the attributes, skills, or traits that make them so valuable? These two questions made the process of eliciting responses "concrete" by having the respondents think of specific IS practitioners in their organization who are considered successful, and then describe their skills, traits and attributes rather than try to determine them in abstract. Most of our interviews evolved into unstructured, open-ended discussions. We encouraged this evolution as a means to get a more practitioner-centric understanding of the skills and attributes that contribute to successful IS practice.

Participants in the study were selected based on prior relationships with the authors. However, some care was taken to obtain multiple perspectives and reduce role-specific bias by including IS practitioners in different roles and positions: a Chief Information Officer, IS managers and project leaders, systems analysts, systems developers and IS consultants. To reduce bias specific to an IT sector, we interviewed IS practitioners working in different types of software development organizations, and using different types of software. The organizations included large IS consulting companies, small IS consulting companies, and IS departments doing in-house software development in both for-profit and not-for-profit environments. The software being used included customized software, commercial off-the-shelf software, and enterprise systems.

Despite these efforts to reduce bias, it was not possible in this small exploratory study to eliminate all potential sources of bias: for example, geographic bias. Since the study made an effort to conduct as many face-to-face interviews as practicable with practitioners in their day-to-day work settings, proximity to the researchers was an important factor. We selected five organizations (cases 1 to 5) within a 100 mile radius of our university campus in the Midwestern United States, and we conducted a telephone interview with one organization (case 6) that was more than 400 miles away, in the Eastern United States.

During our interviews and discussions, we explicitly asked the interviewees and discussants to take an organizational, rather than an individual, perspective in their responses. In addition, to avoid an overly individual perspective, we interviewed at least two IS practitioners in

five of the six organizations represented. The interview questions focused on what the organization, rather than the individual, viewed as valuable skills, traits and attributes for a successful IS practitioner. Hence, the organization, rather than its individual representative, is the unit of analysis in our case studies.

Details of each organizational case are listed below. We conducted the interviews from February 2008 to April 2008. All except two interviews were conducted face-to-face, and most took place in the interviewees' workplace setting. We recorded interviews when the interviewees were comfortable with being recorded, and we took detailed notes otherwise. Table 1, at the end of the organizational case descriptions, provides a case-by-case data collection summary. The appendix provides the semi-structured interview questions that guided our interviews and discussions.

Case 1

Organization: An online company that is among the leaders in providing online discounts to public sector employees in the United States. The company offers public sector employees in three states discounts, special promotions, and services from local retail merchants and national brands.

Interviewees:

1. Vice President of Website Operations for the past year. He is the main designer of the company website and the company's online branding.
2. Director of Information Technology for the past two years. He has been the architect and lead developer for the company website. He manages a team of four web programmers.

Case 2

Organization: A large pharmaceutical company in the United States with approximately 2,000 employees.

Interviewees:

1. Software Analyst in the company's Enterprise Applications division for the past 18 months. He analyzes needs of users in business functional areas, customizes commercial off-the-shelf software, tests whether the software meets user needs, and deploys software that helps manage the company's inventory.
2. Program Manager in the company's Enterprise Applications division, who has worked in this company for the past seven years. He evaluates and recommends software that will meet the organization's maintenance and manufacturing requirements.

Case 3

Organization: A small IS consulting company that has 30 employees. They customize and deploy off-the-shelf software packages to meet the needs of companies.

Interviewees:

1. The company founder who currently functions as both the company's CEO and CIO. He founded the company in 1999.
2. Two application consultants who determine user requirements and write programs to customize and deploy off-the-shelf software to meet those requirements. They have worked for the company for the past two years.

Case 4

Organization: A large global IS consulting company with several thousand employees.

Interviewees:

1. A consultant who has worked for the organization analyzing client needs and deploying enterprise systems for the past four years.
2. A systems analyst who has worked for the organization analyzing client needs and implementing software solutions for one year.

Case 5

Organization: A large state university in the mid-western United States with about 30,000 students.

Interviewees:

1. Director of Information Technology for a college in the university who has been in this position for more than 10 years.
2. A software/database designer and developer in the university who has been developing applications for the university for one year. He has a total of more than ten years experience developing software applications.
3. A network administrator and applications programmer who has been maintaining and customizing software in the university for the past seven years.

Case 6

Organization: A business-to-business software development organization with about 30 employees.

Interviewee:

1. Director of new product development and project management. He is in charge of developing new versions of the organization's business-to-business software and deploying existing versions at large client sites, most of whom are Fortune 100 companies.

Case	Organization	Inter-views	Inter-viewees	Inter-view Hours
1	Online discounter	2	2	3
2	Pharmaceutical company	2	2	4
3	Small IS consulting firm	2	3	3
4	Large IS consulting firm	2	2	4
5	Large state university	3	3	5
6	B2B software vendor	1	1	2

Table 2. Data collection details

4. RESULTS AND DISCUSSION

We used questions and concepts derived from baseball's Moneyball theory to focus our discussion of, and findings from, our case studies. Some of these questions are: What skills and attributes make for a successful IS practitioner? Which of these skills are relatively difficult to teach? How

does one identify, evaluate, and validate such skills and attributes in a IS candidate? We have included supporting quotes from respondents for each of our case study findings as recommended by experts in qualitative research (Klein and Myers,1999; Myers, 2009).

4.1. Defining a "successful" IS practitioner

A starting point for our analysis was to understand and define a "successful" IS practitioner. Is a successful IS practitioner one who designs, develops, implements, and / or maintains "successful" information systems? If so, what constitutes a "successful" information system?

The respondents in our cases tend to agree with Alter's (1999) conceptualization of what constitutes IS success and, in turn, what defines a successful IS practitioner, using statements such as the following:

- "A successful IS practitioner should understand a company's particular requirements to be able to develop and deliver system functionalities of value to that company."
- "A successful IS practitioner should be able to assess a business situation and understand where the technology fits in the big picture."

All six organizations stated that there is value in technical skills such as database design, programming, and networking which have constituted the basis of the traditional IS curriculum. However, all of them also stated that the greatest value that IS candidates add to the organization is in their abilities to (a) assess business requirements and opportunities in messy and ambiguous organizational situations and (b) design solutions in a situated, customized manner, using heuristics, improvisation, and opportunistic combinations rather than prescribed systems development methodologies (Ciborra, 2004). For this, the IS practitioner needs to comprehend the relationship between the reality or territory (the organizational setting, users, and their work practices) and the representation or map (the information system used within the organizational setting to accomplish work practices). A successful IS practitioner asks and finds answers to several questions that relate the reality to the representation (Introna, 1997, pp. 9): "How does the map relate to the territory? What assumptions does *this* mapping of the territory imply (what is included, what is excluded, and who decides this)? What can we know, and what can we not, 'know' from the map? Is there more than one way to read the map? Whose interpretation does a particular mapping and interpretation serve and at whose expense?"

4.2. Differentiating software: Commodity versus customization

Respondents from four of the six organizations we interviewed stated that they do not program and develop applications from scratch. Instead, they customize and configure infrastructure software such as Enterprise Resource Planning (ERP) software, Customer Relationship Management (CRM) software and web portal server software to meet specific organizational and user requirements. In two organizations, the ERP software used was SAP; in one organization, the CRM software used was Microsoft Dynamics CRM; and in two organizations, the web portal server software used was Microsoft's SharePoint.

The respondents from these four organizations stated that an organization does not derive advantage from the underlying infrastructure software since any competitor can buy and duplicate the same infrastructure. A respondent from a pharmaceutical company that uses SAP stated the following key criterion for recruiting IT personnel: "Our company is not looking for experts in SAP functionalities, but people who can apply SAP functionalities to leverage our expertise in pharmaceutical products." In effect, the infrastructure software has become commoditized (Carr, 2003). An organization's advantage is derived from identifying opportunities and unique, intangible characteristics in the messy and ambiguous organizational situations and, then, customizing and configuring the software to leverage those opportunities and the organization's unique and core functionalities (Ciborra, 2004).

4.3. Breadth over depth

Surprisingly, two organizations mentioned that breadth of knowledge across several IS technical and conceptual areas (programming, networking, database design, systems analysis) was more important than depth of knowledge in one particular IS technology or conceptual area, especially for an entry level IS position. Respondents from these two organizations provided two reasons for preferring breadth of IS knowledge over depth when hiring a new IS graduate:

- "Our organization's needs are not always specific to one IS area such as networking or programming but varied over multiple areas. An IS graduate who has a wide range of general IS skills would be able to fit into any of these needs in multiple areas compared to a graduate who has a specific specialization and interest."
- "New IS graduates might not be aware of all the different opportunities in the IS field, and might not know the area in which they are most proficient without exploring several different options."

4.4. Analytical and problem solving skills

More than knowledge of any particular systems design and development methodology, all six organizations want IS graduates to be able to analyze requirements and develop solutions for less structured, complex problems. It is not important that the IS graduates know a specific methodology (such as Structured systems development methodology, UML-based object-oriented methodology, or agile systems development methodology). This finding is exemplified by a respondent's statement, "We don't care whether an IS practitioner knows a particular methodology or technology. He should be able to communicate well with users, figure out their key requirements, and build systems that meet those requirements."

Technical skills evaluation is focused more on problem solving ability than on knowledge of specific technologies or programming languages. Abstract thinking and critical thinking skills are highly valued. Some conceptually oriented technical skills, such as object-oriented design and programming, are considered more difficult to teach

compared to more specific technical skills such as a particular programming language (for example, C# or Java).

While knowledge of development environments such as Microsoft .NET is useful, it is more important that IS students learn to use these development tools in the context of actual systems development. Our case study respondents emphasized that IS students need to understand and use the development tools to deliver a business functionality.

4.5. Communication and team skills

Three organizations stated that they valued communication and team skills, and the ability to get along with other team members, more than IS technical skills. One respondent stated how important he considered team skills as follows: "I consider a candidate's poor social skills or inability to function as a team player as major disqualifying attributes, since these problems are difficult to correct. I am more willing to hire candidates with lesser IS technical skills if they possess better communication and team skills." Another respondent made the following statement to emphasize the importance of communication skills: "An IS candidate's ability of what, when, and how to say something is a major consideration in my hiring decision, in some cases more important than the candidate's technical knowledge."

However, one organization cautioned over-emphasizing the ability to get along with team members. A potential problem with hiring IS candidates based, to a large extent, on their attitude towards working without conflicts in a team environment is that it could result in "group think" (Janis, 1982). In such an environment, there is less chance of group members raising questions about potential problems, leading to delays in identifying system problems or system failure.

5. CONCLUSIONS

The main principle of baseball's Moneyball theory is to identify, and develop, what is truly valuable over the long term. Drawing upon this principle, we suggest a framework for designing IS curricula to provide IS graduates with valuable skills that will enable them to become successful IS practitioners. Some of these skills may currently be undervalued by both IS academia and IS industry. However, as the recognition of their long-term value grows, these skills will provide greater financial and performance-based rewards to the IS graduates and the organizations that hire them. We, in the IS world, can draw an analogy from what is occurring in professional baseball since the publication of the Moneyball theory in 2003. Players, such as Kevin Youkilis of the Boston Red Sox, who possess these newly recognized high-value attributes, are indeed receiving higher salaries, and teams, such as the Red Sox (World Series Champions in 2004 and 2007), have improved their performance by obtaining the services of such players.

Our case study findings suggest a need for categorizing IS curricula into a framework consisting of three broad categories (as shown in Figure 1) in terms of relevance for helping develop successful IS practitioners. Based on data from our case studies, these categories advance in importance for successful IS practice as we move up the pyramid (the business assessment and systems thinking courses category is considered the most valuable for successful IS practice). We discuss the three categories that constitute this framework below.

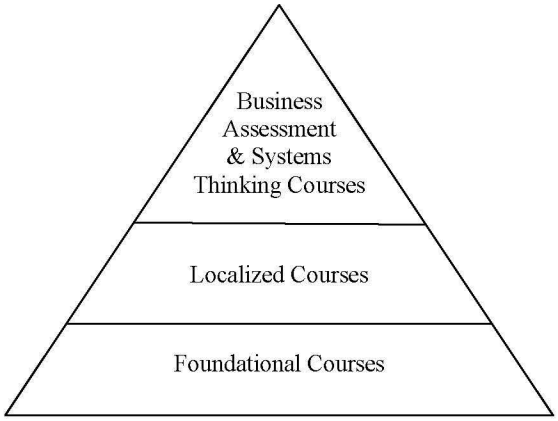

Figure 1. IS Curricula Framework

Foundational Courses Category: The foundation consists of courses traditionally included in IS curricula, as per the IS '97 and IS 2002 model curricula recommendations (Gorgone et al., 2003). These courses include Database design, Programming, Networks, Systems Analysis and Design, and Project Management. They have value in terms of providing the technical foundation for IS practitioners. However, most organizations in our case studies indicated that while IS practitioners needed to satisfy a minimum threshold in terms of the skills gained through the foundational courses, they were not the determining factors for successful IS practice.

Localized / Customized Courses Category: These courses are optional and designed entirely at the discretion of each IS program. They introduce concepts or technologies that are not handled in the foundational courses. Based on our case studies, we found that each organization has specific conceptual or technological needs. For example, the three dominant employers of graduates from the IS program in our university need IS practitioners with knowledge of ERP systems (specifically, SAP), CRM systems (specifically, Microsoft Dynamics CRM), and web portal server systems (specifically, Microsoft SharePoint). So, we plan on offering customized courses on enterprise systems (encompassing ERP and CRM) and web portal development using SharePoint. Of course, we need to be careful that we do not create localized and customized courses for each new "fad of the week." These courses need to be developed in close collaboration with the organizations most invested in the IS program, especially in terms of hiring. One of the key findings from our study is that an IS program that wants its curriculum to have practical relevance will have to offer customized courses that meet local and regional employment needs and opportunities.

Business Assessment and Systems Thinking Courses Category: In all our organizational cases, respondents stated the need for "communication skills." However, on further probing of what the respondents meant by communication skills, we realized that they did not refer just to the IS candidate's verbal and written skills. While the abilities to speak and write clearly were considered important, the

greater focus was on the IS candidate's ability to assess organizational requirements and communicate his assessment to the systems designers or perform the system development himself. For assessing organizational requirements, the IS candidate needs to go beyond just verbal and written skills. He or she needs to be able to observe and understand what users do in their everyday work practices. In addition, he or she needs to be able to differentiate between what users say they do in their work practices and what they actually do, i.e., distinguish between their espoused theory and theory-in-use (Argyris, 1976). To help IS graduates attain these skills, which are difficult to teach using traditional lecture or demonstration methods, case studies could be used for systems analysis, design, and development courses (Cullen, Richardson, and O'Brien, 2004; Tetard and Patokorpi, 2005). In addition, some ethnographic techniques such as in-work-setting observation and participant-observation (Harvey and Myers, 1995) could be introduced and discussed in these courses. Further, as we discussed in section 4.1, successful IS practitioners need to comprehend the relationship between the reality or territory (the organizational setting, users, and their work practices) and the representation or map (the information system used within the organizational setting to accomplish work practices) (Introna, 1997). Our respondents were less concerned with IS practitioners' knowledge of the exact steps of systems development methodologies (such as Structured Systems Development Methodology or Rational Unified Process) than their ability to apply systems thinking and understand requirements and opportunities in less structured and confusing organizational situations. Therefore, Systems Analysis and Design courses could use more flexible methodologies such as Soft Systems Methodology (Checkland and Holwell, 1998; Checkland, 1999), Multiview (Avison et al., 1998) and ETHICS (Mumford, 1996). However, these methodologies should not be used in an unreflective and mechanical manner, becoming crutches to avoid engaging in thoughtful systems development (Wastell, 1996). Systems development is inherently complex and challenging, and applying mindful systems thinking approaches greatly aids good systems development (Checkland, 1999).

Following Moneyball theory's objective of focusing on what is truly valuable, we conclude with a summary of four major findings from our organizational case studies that we believe should be considered by IS academia:

1. The greatest value that IS graduates add to an organization is in their abilities to (a) assess business requirements and opportunities in messy and ambiguous organizational situations and (b) design solutions in a situated, customized manner, using heuristics, improvisation, and opportunistic combinations rather than prescribed systems development methodologies.
2. More than knowledge of any particular systems design and development methodology, IS graduates should be able to analyze requirements and develop solutions for less structured, complex problems.
3. Breadth of knowledge across several IS technical and conceptual areas (programming, networking, database design, systems analysis) is more important than depth of knowledge in one particular IS technology or conceptual area, especially for an entry level IS position.
4. Communication and team skills are as important as IS technical skills for becoming a successful IS practitioner.

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APPENDIX: SEMI-STRUCTURED INTERVIEW QUESTIONS

Note that "Attributes" in the interview questions refer to technical skills, personality traits, business functional knowledge, and interpersonal skills. Examples of attributes include: "programmer" (technical skill), "well-organized" (personality trait), "marketing expertise" (business function knowledge), and "effective communicator" (interpersonal skill).

1. What is your position or role in the organization? How many years have you been in this position or role?

2. What type(s) of software do you manage, administer, evaluate, develop, test, or deploy (custom, packaged, enterprise systems such as ERP/CRM, operating systems, other)?

3. Who are the IS employees that are most valuable to your organization? What are their attributes that make them so valuable (in order of most value)?
    a. Why are these attributes important and how do they add value?
    b. How do you identify, evaluate, and validate (how do you verify that your evaluation is correct) these attributes?

4. What attributes would you seek in an "ideal candidate" for an IS position?

5. Lack of what attributes will make you disqualify a candidate for an IS position?

6. What attributes of IS positions are over-valued? Why?

7. What attributes can and cannot be taught to a candidate for an IS position?

8. What attributes are more efficient to train after hiring an employee than to pay more for hiring an employee who already has those skills? How do you conduct this training?

9. "Education should provide analysis and conceptual skills that last a lifetime." Can you evaluate analytical and conceptual skills of IS candidates? If yes, how?

10. Are there any "core" IS areas (areas that do not change over a period of several years) that you evaluate?

11. How do you evaluate a candidate's aptitude for a specific attribute in which he does not have previous academic or work experience (examples, technical skills such as C# / Programming or a particular industry sector such as Banking / Government)?

12. How much emphasis do you place on a candidate's past performance versus his future potential?

13. Are you looking for current needs or future possibilities when hiring? How far ahead do you project when hiring?

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