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Desperately Seeking IS Curriculum Relevance: Teaching Information Systems in a Cross-Functional Context

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ABSTRACT

The information systems academic community has been searching for an effective response to the steep decline in enrollment in IS programs. Researchers have identified the design of the introductory IS course as a critical opportunity for increasing student interest in the IS field. In this paper we describe our experience redesigning an introductory IS course in the context of a semester long cross-functional product development project for college juniors. By including practitioners in the design process, we identified four areas to be addressed to increase the career relevance of the course and used this agenda to develop new content which tied the IS course more closely to the semester project, especially in the area of online marketing.

Keywords

Management Pedagogy, Curriculum Development, Cross-Functional Coursework, Internet Marketing.

INTRODUCTION

The past decade has seen an extended discussion in the information systems (IS) academic community about the identity and direction of our discipline (Benbasat and Zmud, 2003). This discussion was brought on in part by the seeming contradiction between the increasing visibility of digital technology in business and society, on the one hand, and the dramatic declines in enrollment in IS programs at many universities, on the other (Becker, Hassan and Naumann, 2006). This decline in IS enrollment has itself been the focus of research and discussion, resulting in a number of findings and recommendations.

One recurring theme has been the importance of the introductory Information Systems course in recruiting more students to the field. George et al suggested the importance of choosing both instructors and content for the required introductory IS course (George, Valacich and Valor, 2005). Walstrom et al found that one reason students are not choosing to major in IS is a lack of familiarity with the content, suggesting the importance of the introductory course as an opportunity to introduce students to this material and make the case for its relevance (Walstrom, Schambach, Jones and Crampton, 2008).

A number of specific proposals have been made for innovations in the introductory IS course, including: making content more relevant to students and shifting focus from technology itself to how it supports the business (Granger, Dick, Luftman, Van Slyke and Watson, 2007), avoiding the teaching of basic computer concepts that are familiar to tech-savvy students (George et al., 2005), and even simply making IS courses more interesting to students (Granger, Dick, Jacobson and Van Slyke, 2007). A comprehensive approach has been proposed by Firth et al (2008) in the form of a 12 step program for improving the effectiveness of the introductory IS course, in particular as it relates to boosting enrollment in the IS major.

In this paper we describe our efforts to address the design of the introductory IS course in a cross-functional setting in which the IS course must co-exist with introductory courses for marketing, operations, and finance in the context of supporting student teams in a semester long project to plan the manufacture and sale of a consumer product.

We believe that teaching IS in a cross-functional context is a promising strategy for imbuing students with a sense of the relevance of IS to business. Bullen et al specifically suggest the value of teaching information systems in a cross-functional context because it would emphasize the role IS can play in supporting business processes (Bullen, Abraham, Gallagher, Simon and Zweg, 2009). George et al emphasize the importance of relevance in the IS curriculum and giving students the understanding that IS is not just about technology but a means for attaining business goals and increasing business effectiveness (George et al., 2005). In discussing the results of his analysis of factors influencing student choice of a major, Zhang suggests that a key action to change current perceptions is to emphasize how IS is used to support business when presenting it in the introductory course (Zhang, 2007).

However, as we describe below, teaching an introductory IS course in a cross-functional context poses distinct challenges and has necessitated developing some additional content, that, while consistent with the 2010 model IS curriculum (Topi,

Valacich, Wright, Kaiser, Nunamaker Jr, Sipior and de Vreede, 2010), represents a more detailed view of how specifically IS can be deployed in the context of a startup consumer product business.

This paper represents research in progress: a preliminary case study of what problems we encountered in this context and the strategies we have developed to address these problems. Our hope is that this paper will call attention to the potential benefits of teaching IS in a cross-functional context and will provide some suggested strategies for others seeking to explore this possibility.

TEACHING CONTEXT

At the authors' university the introductory information systems course has been taught as part of a cross-functional set of four courses typically taken by all undergraduate business students during first or second semester of junior year. This sequence of courses, referred to as the "CORE" is designed to teach students key concepts in marketing, operations management, finance, and information systems in the context of a fourteen week team project in which students develop a business plan for a new consumer product (Brunel and Hibbard, 2006). Each of the four functional areas is taught as a separate course, which has a dual purpose. First, an introductory set of functional concepts and skills are taught to students. Second, faculty coach students in applying those skills to the task of developing the business plan for a new consumer product: the "core project". For example, in marketing students are taught the concepts of product awareness as well as techniques for generating and measuring product awareness as a key input to predicting sales based upon an adaption of the AC Nielsen BASES model.

Information systems faculty originally developed the course to cover the concepts traditionally encountered in an introductory information systems course, including hardware, software, telecommunications, enterprise software, database design, IS strategy, and systems analysis and design. The project deliverables for the information systems portion of the plan included an information systems budget, network design, and, most notably, a set of design diagrams as well as an Access prototype for a mission critical information system. The diagrams included an entity relationship diagram for the system and a set of data flow diagrams. The idea was to define the requirements for a critical business capability associated with the business plan.

While it might be argued that many of the skills taught in this version of the course were relevant to those embarking on information systems careers, the case was more difficult to make for the majority of students pursuing careers in other disciplines. Indeed, a review of student course assessments indicated that students did not find the IS course relevant to the team project and their careers. Students perceived that the required IS content would be unlikely to make their business plan more convincing to a potential investor and thus students tended to devalue the information systems portion of the integrated course.

In response to these concerns we undertook a redesign of the curriculum. Our goal was to improve the performance of this IS course by increasing its relevance to the core project, student careers, and, as we shall discuss below, the requirements and expectations of potential employers.

THE CURRICULUM DESIGN PROCESS

The process that we employed went beyond gathering input from current students through end of semester course evaluations, to include input on course content from recent alumni and hiring managers. We conducted a series of telephone interviews with managers who were involved in hiring students for both internship and full time IS positions. We also interviewed managers who hired business students for non-IS positions. Lastly we interviewed CORE alumni who had been in the workforce for between two and five years. We believe the involvement of these practitioners is especially important. Granger et al argue that industry should be included in discussions about curriculum (Granger et al., 2007). In reporting on a survey of what capabilities employers require from new hires, Bullen et al express concern that IS curriculum changes are not keeping up with the needs of the marketplace (Bullen et al., 2009).

CORE alumni confirmed our assessment that, given the central focus of the core project, content that does not tie into the project in a substantial way is not considered relevant. It also became clear that relevance to CORE depends on the degree to which the curriculum provides input to the project business plan and, in particular, the spreadsheets utilized to develop the detailed financials for the plan. The curriculum from the other three disciplines, marketing, operations management and finance, drove the calculations in the project spreadsheets. Information Systems input to the spreadsheets was limited to a set of minor expense line items related to the procurement of hardware and software required to support financial and managerial accounting. Therefore, the impact of the Information Systems curriculum on the business plan was trivial and the perception of the course marginalized.

Certain themes ended up repeating with almost every hiring manager that we interviewed. Although the hiring managers represented very different industries, we found support for four themes as we reviewed and categorized the interview data:

1. *Digital Marketing*. The Internet has fundamentally changed the way that people make buying decisions. Most firms are experimenting with the use of digital media and value students who are conversant in strategies and tactics utilized in the world of digital media marketing.
2. *Collaboration*. Managers commented on their growing use of technology to communicate with colleagues across the globe, even those with whom they had no face-to-face contact. This kind of interaction employs virtual collaboration tools and draws upon different skills, behaviors and norms than are typically utilized in face-to-face discussions. Most firms expect that students “who have grown up in the digital world” could help those that were not used to living online with these new skills. Hiring managers indicated that they valued students who possessed skills and experience with virtual collaboration tools and techniques.
3. *Web 2.0*. Ubiquitous access to information has transformed industries. Hiring managers value innovative thinking that could help their firms grasp how technology can transform the way that work gets done. Hiring managers expect students to understand evolving Web 2.0 strategies that rely on access to large amounts of data including user generated input (Oreilly, 2007), and to apply them to what they encounter in the workplace.
4. *Analytics*. Last and probably most important to both alumni and hiring managers is the need to demonstrate analytical skills using contemporary tools and techniques.

These findings led to the following design goals:

First, find a way to connect IS to the revenue side of the business plan developed during the team project.

Second, add content to address the four areas that were identified by hiring managers as growing in importance and that we were not covering in our curriculum.

CONNECTING IS TO THE TEAM PROJECT

We realized that for the IS curriculum to contribute substantively to the business plan, we would need to consider two factors:

- We would need to tie into the project spreadsheet calculations in a meaningful way.
- The calculations would need to be grounded in reality, leveraging tools, techniques and data currently utilized by industry. This is consistent with the finding that use of state of the art tools which represent current industry practices leads to an increase in students’ self-efficacy as well as an increased expectation that majoring in IS will lead to a positive outcome (Akbulut and Looney, 2007).

We focused on providing three specific inputs to the master worksheets utilized to calculate financial projections for the business plan:

1. *Determining Consumer Product Awareness generated through digital media*. The existing plan took into account awareness generated by traditional marketing methods. In consultation with marketing faculty we developed a set of techniques for calculating the additional awareness generated by the company’s website and by its investments in online marketing techniques such as search engine marketing and banner ads. The IS curriculum was revised to teach the concepts necessary to understand and develop digital marketing plans.
2. *Forecasting units and revenue through direct online sales*. The existing plan allowed for sales through traditional brick and mortar channels. Again, in consultation with the marketing faculty, we revised the project to allow students to sell online and to incorporate online sales into their forecasts. The IS curriculum was revised to include material on the strategic issues related to the decision to sell online.
3. *Predicting operational costs associated with selling directly to end consumers*. We provided students with a set of methods for projecting the cost of fulfilling online sales. The IS curriculum was revised to discuss the issues related to online order fulfillment and how it differs from the traditional fulfillment of orders through brick and mortar retailers.

These three initiatives not only connected the information systems course to projected revenues for the team project, but did so in a way that was particularly relevant given the nature of these projects: students were designing small startup businesses that would need to tap into the potential of the web to level the playing field with respect to their established competitors. The use of digital marketing and online sales in the business plan provided access to this potential.

In addition to the specific content described above, we found it necessary to add additional coverage of related concepts and technologies, including: web design, search engines, digital marketing, and web analytics.

ADDING NEW COURSE CONTENT

The principle changes to the course are summarized in Table 1. This table includes the content we added or modified and how it is connected to both student careers and the course projects. Some faculty actually used something like this table in class to give students an understanding of the relevance of the new IS curriculum to their semester. In addition to the content listed in Table 1 we continue to address traditional IS content such as basic hardware and software concepts, networks, enterprise software, Internet security, and ethics. This material has been revised to a limited extent to better connect it to the new material and the core project. The extent to which we cover such topics continues to be an open question in our curriculum design. There is an emerging consensus, in part based on conversations with employers and students that some of the most technical material (hardware, operating systems, networks) is of limited relevance and needs to be eliminated or at least curtailed.

Systems analysis and design topics including entity relationship diagrams and dataflow diagrams have been dropped from the course because of their limited relevance to the semester project and in order to make room for the new content. These topics are addressed fully in subsequent courses taken by students who elect to concentrate in IS.

Topic	Value to the Project	Value to Career
Collaboration. New topic.	Learn about tools and techniques to support collaborative editing of project documents and to help manage the team project.	Collaboration has been identified by employers as a key workplace skill.
Strategic Use of IT. Existing topic. Focus changed to emphasize concepts related to web strategy including long tail strategies (Anderson, 2004) and Web 2.0 (Oreilly, 2007).	Team projects inevitably rely heavily on digital strategies to gain consumer awareness. Most teams adopt a long tail distribution strategy, at least initially. The discussion of web strategy gives teams language to articulate these strategies to investors in the business plan.	Understanding Web 2.0 and other emerging digital strategies has been identified by employers as a key workplace skill.
Web Design. Existing topic. New emphasis on giving all students a hands on experience with building a website rather than leaving this to one or two teammates. We have experimented with several web design technologies including Joomla! and Dreamweaver. Our current approach is to teach WordPress.	Web design is presented as tightly connected to the online marketing strategy, which contributes directly to sales forecasts. Students are expected to connect web design decisions to specific goals for the website such as educating consumers and differentiating from competitors. The website which each team constructs is the platform on which students implement their search engine optimization strategy.	Students gain experience creating a website using Wordpress and are able to critique website design and relate it to business strategy.
Database. Existing topic. Students learn the basic concepts of relational databases and build a simple database using Microsoft Access.	We elected to keep database as a topic, but it is now repositioned as a basis for understanding the nature of how information is organized in order to support decision making. This relates to the development of KPIs, which have become an important part of the business plan (see below).	For some students, experience with Microsoft Access is a valuable addition to the resume. Exposure to database concepts is an important foundation for the discussion of web analytics which relates to the employer-identified need for exposure to analytics.

Topic	Value to the Project	Value to Career
Search Engine Optimization (SEO). New topic.	Students implement SEO strategies for the website they have designed (see web design above). The actual performance of their website is evaluated using industry tools such as Hubspot’s Marketing Grader. The SEO strategy is documented in the business plan and allows students to make the case for awareness (and thus projected sales) garnered via SEO.	Digital marketing has been identified by employers as a key workplace skill. Students quickly realize that even a little knowledge of SEO is incredibly useful, especially to small businesses. Some students have begun careers in the SEO industry.
Internet Marketing. New topic.	As with SEO (above) students implement a detailed online marketing plan for their business, including search engine marketing, banner ads, and social media. This allows students to project additional online awareness and hence increase their sales forecast.	Students learn to spend advertising dollars wisely to drive traffic to a website and generate awareness. Digital marketing has been identified by employers as a key workplace skill.
Web Analytics. New topic.	Students use web analytics to develop a plan for managing their digital marketing. The plan is used to make a convincing case to investors that they will be able to implement their marketing plan.	Analytics has been identified by employers as a key workplace skill.
Key Performance Indicators (KPIs). New topic introduced in place of Critical Success Factors.	Students develop KPIs as part of making the case to investors that they will be able to manage the business, and in particular address the most mission critical aspects of their business. Students are encouraged to use the results of the sensitivity analysis they conduct as part of their finance course to identify the elements of the business plan most in need of measurement using KPIs.	Students learn that KPIs allow them to make more effective use of a company's information system by knowing what metrics to monitor and how often.

Table 1. New and Modified Course Content

REVISED CURRICULUM EXAMPLE

To illustrate how these new topics integrate into the cross-functional project, we will describe the model that we developed to calculate consumer product awareness generated through use of digital media. Product awareness is an important input to calculations that forecast revenue streams in the master worksheet for the business plan. The marketing faculty has developed a set of “rules of thumb” to translate expenditures in traditional media such as magazines, TV, radio, and billboards into a level of consumer product awareness.

To be consistent with the master worksheet, our curriculum requires a method for translating resources expended using digital media into projected consumer product awareness. Use of digital media is very different than traditional marketing approaches that cannot directly measure consumer response to an advertising campaign. For example, search engine marketing has enjoyed a huge following due to the ability for consumers to signal interest in a product or service by entering a particular search query into a search engine. Our model calculates awareness in this context as a function of the number of searches made for a particular keyword and the website visits that result from that search (click through rate).

Students are able to influence the awareness generated from search by using search engine optimization (SEO). The goal of SEO is to improve the chance that a link to a website will appear in an advantageous position in an organic search engine results page (SERP). Research has shown that click through rates (CTR) are higher at the top of organic SERP than at the bottom of the SERP (Fiorini and Lipsky, 2011). Therefore SEO is not only about the choice of the search terms to feature on a company's website but also about investments made to improve SERP rank for that website and those specific terms.

The revised curriculum addresses other marketing methods that leverage digital media including paid advertising on search engine sites, banner ads, and social media. Each marketing method requires a different return on investment model. Output from each of these models is aggregated to obtain total digital awareness, which in turn is an input to the consumer product awareness calculation.

Our goal is to provide a set of models and basic assumptions to allow students the opportunity to explore the impact of various strategies on their online marketing results. As an example, students are encouraged to experiment with different keywords and make use of various SEO tactics to increase the return on their investment. On the other hand, we strongly discourage students from use of inappropriate Internet marketing tactics such as spam or trying to "game" the search engines. We help them to understand the negative impact such techniques could have on a small growing business.

What follows is a brief walk-through of the awareness calculation for organic search. As noted above, each of the other online awareness calculations has its own unique logic.

Our organic search model requires students to choose up to ten keywords to target for their product. To calculate awareness for a keyword, students will estimate the number of people who will find their product website by searching on that keyword using a search engine. The assumption is that each person who reaches the website in this way becomes aware of the product. To make this calculation, students need to estimate where their website will rank on the SERP and then how many people will search on the keyword and click on the link (taking into account its SERP rank).

Estimating SERP Position and Click Through Rate

Keywords differ in their competitiveness, that is, in the number of firms that are actively using that term to promote their product. Google's AdWords traffic estimator tool provides a measurement of competitiveness for every keyword search phrase (high, medium, low). We provide students with a table (Table 2) that translates annual investment in SEO to SERP position for keywords based upon the level of competitiveness. More competitive keywords require more investment over a longer period of time to improve SERP position. A position of 0 indicates that the student website would not appear on the first page of search results and would generate no clicks. The other numbers indicate numerical position on the SERP, with 1 being the top of the page.

This table is intended to give students a rough estimate they can use in their calculations. It is designed to help students arrive at an understanding of two important aspects of SEO: (1) achieving an advantageous SERP position typically requires a sustained effort and (2) it typically requires greater effort to achieve a given position for a more competitive keyword. Students use the data obtained about the competitiveness of each keyword to estimate the SERP position for searches on that keyword in each year of their business plan.

Investment	SERP Position		
	High Competition	Medium Competition	Low Competition
1	0	10	6
2	0	9	5
3	10	8	4
4	9	7	3
5	8	6	2

Table 2. Estimated SERP Position Based On SEO Investment

We also provide students with a table that provides an estimated click through rate for a given SERP position. This table has gone through an evolution as we find better resources for making this estimate. The latest version (Table 3) is based upon data gathered by industry analysts in 2004, 2007 and 2010 (Enquiro Search Solutions, Inc., 2007; Optify, Inc., 2011). The higher the SERP position the greater the click through rate. Students use the estimated SERP position for a keyword, obtained using Table 2 above, to estimate the click through rate for each keyword.

Organic SERP Position	Click Through Rate
1	36.4%
2	12.5%
3	9.5%
4	7.9%
5	6.1%
6	4.1%
7	3.8%
8	3.5%
9	3.0%
10	2.2%

Table 3. Click Through Rate Based on SERP

Calculating Awareness

Students use Google's AdWords traffic estimator tool to get an estimate of the monthly searches on Google for each keyword. Students then combine this data with the estimated click through rate (CTR) obtained using Table 3 to calculate awareness using the following formula for each keyword:

$$\text{Annual Awareness} = (\text{number of monthly searches}) * 12 * \text{CTR}$$

CHALLENGES

These changes to the course have led to several challenges. First, the world of digital products and services continues to evolve at an increasing pace. The tools, services and pricing provided by Hubspot, Google and Amazon have changed from semester to semester requiring adjustments to the curriculum to reflect the current state of the art in both search engine marketing as well as in direct Internet sales. Second, the models we developed had significant impacts on the traditional sales and cost projections established by the marketing faculty. Adjustments have been needed to correct for unintended consequences such as imbalances between traditional and digital marketing and brick and mortar vs. online sales. Some elements of the models we developed were confusing to students and had to be clarified and in some cases simplified for the classroom setting. Third, these ongoing adjustments to the models required additional investment by faculty in classroom preparation. IS faculty also had to become better acquainted with details of the marketing curriculum in order to connect the models to the marketing techniques that students were learning.

Perhaps the greatest challenge is the one raised by a reviewer of this paper, who expressed concern that while focusing on topics such as digital marketing, for example, may increase perceived IS relevance, this material can also be taught in a marketing class and thus does not demonstrate the value added by the information systems discipline in particular. If we heed the advice of George et al (2005) and Bullen et al (2009) to teach IS in the context of particular business concerns, then we are inevitably going to focus at least in part on business issues which are external to IS and thus encounter this challenge. We believe that the answer here is to present the material in a way that emphasizes unique insights obtained from an IS perspective. This key ingredient in our approach is perhaps not entirely apparent above in our brief discussion of the

mechanics of how digital awareness is calculated, but it is something we strive to do in the classroom. While the calculations themselves could easily be taught in the marketing class, we believe that the conversation about digital awareness takes on much greater richness when embedded in a context of the enabling web technologies, such as search engines and website design.

CONCLUSION

Perhaps the strongest case for the changes we have introduced into the IS curriculum is that, as a result of these changes, decisions students make about their website design and online marketing efforts now translate into increased consumer awareness which in turn translates into additional projected sales and hence increased revenue. Since the website design and online marketing techniques are taught in the information systems course, this means that, for the first time in the history of the course, IS content is linked *directly* to the bottom line and hence the NPV and ROI of the student business plans.

As the changes have been a work in process, a formal evaluation has yet to be done, but student evaluations do provide anecdotal evidence that the closer connection to the core project has been well received. As it turned out, because of some of the challenges detailed above, not all instructors fully adopted the new strategy. Interestingly, those instructors who did adopt the approach saw evaluations of the course content moving above 4.0 (on a 5 point scale), a limited occurrence in the past. Since the adoption of the new curriculum in September 2009, the number of students choosing to concentrate in IS has moved up and down, but, most recently, the (estimated) number of concentrators among students graduating in May 2012 (39 students) represents an increase of 44% over 2011 (27 students). While such informal observations are no substitute for a more formal evaluation, we believe these preliminary results are encouraging enough to suggest that cross-functional learning experiences are worth further investigation as the IS community seeks to create a compelling classroom experience for prospective IS students.

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