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INFORMATION SYSTEMS EDUCATION JOURNAL

Teaching Business Intelligence through Case Studies

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Abstract

In teaching business students about the application and implementation of technology, especially involving business intelligence, it is important to discover that project success in enterprise systems development efforts often depend on the non-technological problems or issues. The focus of this paper will be on the use of multiple case studies in an information systems strategy course, taught to business majors, which highlight the importance of non-technological factors. Each of the cases reinforces the need for senior management support, effective change management procedures, focus on data acquisition and quality, attention to key business process, and the integration into the existing organizational infrastructure as key drivers in project success. This approach utilizes the work system framework as a basis for case study analysis.

Keywords: Business Intelligence, Project Success, Case Studies, Work System Framework, Business Students.

1. INTRODUCTION

Gartner defines business intelligence (BI) as:

> An umbrella term that includes the applications, infrastructure and tools, and best practices that enable access to and analysis of information to improve and optimize decisions and performance (Gartner, n.d.)

The goal of BI is to provide decision makers access to valuable information and knowledge by leveraging data; the value of business intelligence "is realized in the context of profitable business action" (Loshin, 2003, p. 6).

Being able to access and analyze information is a skill expected of the majority of business professionals. BI is a "new" set tools and techniques, largely borne out of information system developments that must be understood to effectively make critical decisions. Information system (IS) students are well placed to lead in the use of BI due to their technical background and the fact that "the information systems function in an organization has a broad responsibility to plan, develop or acquire, implement, and manage an infrastructure of information technology (computers and communications), data (both internal and external), and enterprise-wide information processing systems" (Topi, et al., 2010, p. 73).

2. COURSE LEARNING OBJECTIVES

As the boundary that divides business and information systems erodes "organizational managers [need to] recognize how integral knowledge and information management are to the bottom line" (Loshin, 2003, p. xiii). Future organizational managers are current business students who generally get exposed to

information systems (IS) topics through a single course. A key focus, of this singular IS course, should be on the issues involved in the development of information systems to solve specific business problems.

The basic skill sets for business students in regard to information systems are summarized in Ives, B., Valacich, J. S., et al. (2002). The authors cite that business students should be aware of eight "key information systems concepts". In particular, with regard to business intelligence systems, business students need to know (Ives, et al., 2002):

- How do information systems influence organizational competiveness?
- Why are technology infrastructures so important to modern organizations?
- What are the unique economics of information and information systems?
- How do information systems enable organizational processes?
- How do organizations develop, acquire and implement information systems?

The IS 2010 Model Curriculum focuses its capstone course (IS 2010.07) on these questions. The IS 2010.07 course "explores the issues and approaches in managing the information systems function in organizations and how the IS function integrates/supports/enables various types of organizational capabilities. It takes a senior management perspective in exploring the acquisition, development, and implementation of plans and policies to achieve efficient and effective information systems" (Topi, et al., 2010, p. 402).

The course described in this paper is modeled after the IS 2010.07 course. The five questions, from Ives et al. form the basis for the course's learning objectives. In particular, the course is intended to give both business and IS students an introduction in the development and application of key business intelligence tools and exposes the students to the key issues facing organizations in developing enterprise level information systems. Since the goal of business intelligence systems is to improve decision-making by leveraging data and information to make better decisions. Note the students do not actually develop the BI or analytic solutions as this is beyond the scope of this course.

In the next section, the use of case studies as a pedagogical tool in this course is described. A brief description of the literature on the impact of case studies on student learning is examined.

3. PEDAGOGICAL USE OF THE WORK SYSTEM FRAMEWORK IN CASE STUDY ANALYSIS

Case studies provide students with an "indirect, or vicarious, doing experience" (Fink, 2013, p. 120). "Case studies cut across a range of companies, industries, and situations, providing an exposure far greater than what students are likely to experience otherwise" (Corey, 1996, p. 1). The use of case studies as a pedagogical tool of many information systems (IS) educators is important to help students learn and appreciate the realities of IS-related decision-making situations. The case study allows instructors to *guide* student learning rather than *enforce* learning (Myers & James, 1993). Case studies create opportunities for the instructor "to assist students in gaining critical skills (problem solving, oral and written communication, teamwork, etc.) in a number of different ways through the preparation and presentation of the case study" (Pomykalski, 2013, p. 2). These skills have been shown to be highly valuable to potential employers (Alsop, 2004; Cappel, 2001).

The key aspect in developing these critical skills is in the preparation of the case (both by the student and the instructor). Student preparation can vary widely and guidelines for the preparation of the case by students do exist (Edge, 1982; Ronstandt, 1993; Corey, 1996).

Preparation begins with a close reading of the case to identify key issues, major players, and important facts and scenarios. Pre-case writing assignments, which could be assigned as part of the preparation process, can include a range of activities; from a series of discussion questions focused on the major issues in the case to a formal written analysis (Pomykalski, 2013).

Work System Framework Application in Pre-Case Assignment

In this course, the pre-case assignment is based on the student's understanding and application of the elements in the Work Systems Framework (Alter, 2013).

The work system framework (WSF) "provides a perspective for understanding systems in

organization, whether or not those systems use IT extensively" (Alter, 2013, p. 75). The framework's "domain of greatest relevance is IT-reliant work systems" (Alter, 2013, p. 75); business intelligence certainly fits this classification.

Terms	Definition
Work System (WS)	A view of work that is occurring through a purposeful system
Work System Framework (WSF)	A model for organizing an initial understanding of how a particular WS operates and what it accomplishes
Customers	People that receive, use or benefit from products & services that the WS produces
Products & Services	Combination of all the physical things, information, and services that the WS produces for its various customers
Processes & Activities	Includes all of the work practices within the WS, including structured business processes and unstructured, perhaps improved activities
Participants	People who perform the work
Information	Includes the codified and non-codified information used and created as participants perform that work
Technology	Tools that help people work more efficiently
Strategies	Includes the articulated business strategies that the WS is operating under
Environment	Includes the organizational, cultural, competitive, technical, and regulatory environment impacting the WS
Infrastructure	Includes human, informational, and technical resources that support the WS; often shared with other work systems

Table 1: Work System Framework Key Terms

A work system (WS) is defined as "system in which human participants and/or machines perform work using information, technology, and other resources to produce products and/or services for internal or external customers" (Alter, 2006, p. 11); a list of key terms are shown in Table 1 (adapted from Alter, 2006). The framework views IT-reliant systems through nine elements: customers, products & services, processes & activities, participants, information, technology, strategies, environment, and infrastructure.

In order to provide a basis for student understanding and discussion of the cases the WSF of nine elements is introduced and applied to each of the cases in the course. The WSF is used as the basis for student preparation and the pre-case assignment.

The pre-case assignment requires that each student identify and list the "instances" (direct references) of each of the nine elements that are found in the case. The students prepare a listing of the instances, with page numbers, where they find each of the nine elements discussed; the page numbers are for future reference in discussions and post-case analysis.

The benefit of using the WSF of nine elements is that, in the preparation of the case, students can focus on each element separately in identifying these "instances", then in-class discussion can focus on the integration of the elements and their influence in the success (or failure) of the information system.

Discussion

The largest value of teaching with a case is in the discussion. Brookfield (2005) states that "some discussions veer back forth between the analysis of a problem and considerations of how participants might act in response to it" (p. 28-29). Furthermore, two of the four aims of discussion to develop, critical, informed understanding and to help people take informed action align with the case study process. In the context of a case study discussion, this means that the instructor must prepare a set of focused, directed questions that lead to an analysis and meaningful understanding of the issues and complexity in the case. Case study discussion has been shown to lead to enhance both oral and written communication skills of students (Dallimore, Hertenstein, & Platt, 2008) as well as skills in synthesis and integration (Brookfield, 2005).

In general, discussions fail for a variety of reasons. Instructors can minimize the possibility of failure by setting realistic expectations, providing ground rules, modeling good discussion behaviors, and providing well-defined reward systems. Student behavior is also important to successful discussions Barnes,

Christensen & Hansen (1986) define positive student behaviors as:

- Participate and listen actively throughout class discussions.
- Contribute ideas, analysis, and personal experiences instead of simply presenting case facts.
- Build on each other's comments and critique and debate different points of view

The discussion, in the current course iteration, begins by examining the key WSF elements that are driving the case. Usually, key elements are identified by the number of instances found in the case so students are asked to identify the key elements in this way.

Discussion then moves to more of an integrative approach in which key elements are linked together, usually by the students through prompting from the instructor. The discussion continues until all integrative components are discussed.

Post-Case Analysis

Finally, a post-case analysis assignment is utilized to finalize the learning experience. From the case study literature, these assignments are in-depth analysis; usually the formal analysis document is used to develop the students' analytical thinking and problem solving skills (Pomykalski, 2013). Rosier (2002) found that through the use of reflective reports as a post-case assignment, "with appropriate guiding questions", improved the value and relevance of the case to students.

Currently, a series of integrative questions are used to elicit the understanding of the students about the case particulars. Starting with the second case, integration, in the form of compare-and-contrast questions are used to show the relationships between the materials in previous cases to the current case. Currently, this is a weakness in the learning process because reflective assignments (Dehler & Welsh, 2014) are seen as a necessary part "learning" of any technical (business) profession.

4. RATIONALE FOR USE OF WORK SYSTEM FRAMEWORK AS ANALYSIS TOOL

The primary reason for using the WST approach is precisely because it incorporates, directly, the "socio-technical" aspects of a system. This contrasts with the view of the "system-as-a-technical-artifact" perspective espoused by many systems analysis textbooks (Whitten & Bentley, 2007; Dennis, Wixom, and Roth, 2009; Hoffer, George & Valacich, 2014; Kendall & Kendall, 2011; Mathiassen, Munk-Madsen, Neilsen & Stage, 2000).

The "socio-technical" view serves two primary purposes: (1) it addresses the final two items business students need to know, as presented in section two, about business intelligence systems and (2) it provides a firmer grounding for business students who often have the "system-as-a-technical-artifact" perspective due to prior coursework and lack of experience with organizational dynamics.

5. FACTORS IN SUCCESSFUL IMPLEMENTATION

The course, taught primarily to junior and senior level business majors, analyzes five cases throughout the semester. The first two cases are focused on the integration of Enterprise Resource Planning (ERP) systems within organizations. These cases highlight unsuccessful implementation efforts where the primary reason for the unsuccessful implementation rests on the "participants" within the system. The last three cases in the course all deal with implementation efforts, largely deemed as successful, of business intelligence tools and techniques.

A predominant number of "instances" in the initial ERP cases discuss the shortcomings of both the participants and the human infrastructure set up for the implementation of the ERP; primarily senior management and front line employees abdicating their responsibility in the development effort (Edwards & Humphreys, 2005; Paper, Tingey, & Hok, 2003). It is easy therefore for the students to understand that this technological solution implementation was derailed by the human elements.

The other ERP case (Zarotsky, Pliskin, & Heart, 2006) contrasts the upgrade for a functional ERP system to the original implementation process. This case illustrates the change in attitude exhibited by upper management; "this upgrade project was perceived by both business and IS management as a pure IS project, requiring minimal involvement of business management" (Zarotsky, Pliskin, & Heart, 2006, p. 18). In addition, this case illustrates the influence of the environment element on the upgrade. The

company was forced to undertake the upgrade project, although reluctant to do so due to multiple uncertainties, due to SAP dropping support of the current ERP software version (Zarotsky, Pliskin, & Heart, 2006).

The first of the BI cases describes the benefits derived from the development and use of a data warehouse at Whirlpool Corporation (Haley, Watson, & Goodhue, 2006). This case is a stark contrast to the previous ERP cases. Upper management exhibits a firm commitment to create an integrated infrastructure that allows the participants to be "informated" (Zuboff, 1998); to have their jobs radically changed and expanded by the introduction of the data warehouse. This case is rich in examples of how the project aligns with stated business strategies, positive participant examples, and a well-integrated technical infrastructure focused on problem solving (Haley, Watson, & Goodhue, 2006).

The second BI related case deals with an investigation into the use of data mining (by an Australian insurance company) in order to set automobile policy rates (Yeo & Smith, 2003). This case illustrates the need for capable and knowledgeable participants to perform data mining activities. While the insurance company has a strong technical infrastructure (an existing data warehouse) for analysis purposes, they lack a knowledgeable human infrastructure (participants that understand data mining activities). Outside assistance is used, in the form of a graduate student and her professor, to examine the feasibility of using data mining to rethink pricing strategies. A three step approach (set of processes and activities) is described that led to a new profitable, pricing strategy.

While data mining proves feasible in the creation of the pricing strategy, the primary issue facing the insurance company going forward is the hiring of technical participants to continue these efforts. This case focuses on the processes and activities, participants, and information (in the form of data to create customer clusters and neural networks) necessary to carry out analytics work (Yeo & Smith, 2003).

The final case examined in the course is a description of a mature business intelligence strategy utilized at Norfolk Southern Corporation (Wixom, et al., 2011). Facing a new competitive landscape due to deregulation and the acquisition of Conrail (a service-oriented railroad) Norfolk Southern embarked on a strategy to build data-driven applications to serve customers and minimize previous inefficiencies in operations.

The case discussion focuses on the processes and activities, participants, and technologies that were part of the transition to a customer-facing, data-driven work environment. These technologies, which included a data mart and an operational dashboard, were used to meet multiple corporate objectives designed to transform Norfolk Southern into a competitive, customer responsive railroad. In addition, organizational structures used to support the BI development are also highlighted.

6. CONTRIBUTIONS TO AWARENESS OF INFORMATION SYSTEMS IMPACTS

As Alter (2013) states information systems have been considered to be sociotechnical systems. However, while sociotechnical theory attempts to separate the social systems from the technical system, the WSF views the social and technical as part of a single system. This view is easier for business students to comprehend using the nine elements of the work system framework to guide their initial analysis.

One of the benefits extracted from using this nine element framework is that students see that system implementation issues (both positive and negative) are not largely due to just the technical side but are a blend of the "fit" between the social and technical systems. Students can see that user involvement, knowledge, and training are key elements in the social side that need to be the focus of any new systems development project.

7. FUTURE WORK IN USING THE WORK SYSTEM FRAMEWORK

To date, students have viewed the use of the WSF to analyze cases as both positive and negative.

One of the most significant negatives is the time needed to introduce each of the nine elements. The time utilized to create the base knowledge of the elements has shortened the time available for detailed consideration of the cases; both individually and collectively. One particular option being considered is to create a blended classroom environment where the burden for understanding the nine elements is shifted to

the student. However, this still leaves the problem of giving students adequate time to digest and comprehend the nine elements before embarking on the case study analysis.

Another issue that has limited the effectiveness of the WSF elements is the inability of students to see the integration of the nine elements. Without sufficient understanding of the sociotechnical nature of information systems the students do not comprehend the impact of one element on another, for instance, the impact of an insufficient infrastructure for development on how participants perform the relevant processes and activities. One possible method that has been tried once is devoting class time for small group discussion of the elements and their interaction using directed questions.

There are also two changes contemplated for the administration of the case studies. First, a change in the administration of the discussion of the cases to enhance the learning process is under consideration. Dehler (2009) suggests using a discussion focused pedagogic strategy to enhance the learning and critical thinking skills of students. Dehler (2009) emphasizes the need for a mutual student-teacher responsibility for the learning process.

In the future, small groups (3 to 4 students) will be used prior to the whole class discussion. Techniques for facilitating small group discussions, from Barkley (2009), Bean (2011), and Fink (2013) will be considered.

A second change considers a complete rethinking of the post-case assignment. Hibbert (2013), in outlining the work of both Dehler (2009) and Hedberg (2009) suggest the use of learning journals to ask "students to monitor their own learning trajectory in relation to subject and personal and critical goals before, during, and after the execution of a class". Management educators should develop a "pedagogical approach asking students to explicitly identify and articulate their learning" (Dehler & Welsh, 2014, p. 877).

The use of learning logs (Baker, 2003) or reflective reports (Rosier, 2002) have been reported in the IS literature and could lead to deeper learning and help students develop critical thinking skills. A single important caveat to this type of assignment is the requirement of a reduction in the amount of content is a necessary consideration to make time for reflection (Hedberg, 2009).

8. CONCLUSIONS

Once understood, the use of the work system framework has met with generally positive results. Table 2 shows the results of three primary evaluation questions and the average student response. The students ranked the questions on a 1 to 5 scale; with 5 being Excellent and 1 being Poor.

As can be seen from these results the students saw value in using the work system framework. Only two students (out of 68 students) rated the WSF either fair or poor. The students also saw value in the use of the case studies as well. Only five of the 68 had an unfavorable response to the case studies. The students were less impressed with the Alter textbook; however, student comments suggested that they better understood the cases based on the thorough review of the elements and the text was a critical component of that learning.

Question (N=68)	Average Response
Value of the Alter textbook for understanding & learning the course concepts	3.56/5
Value of the work system framework for understanding & learning the course concepts	4.25/5
Value of the case studies for understanding & learning the course concepts	4.00/5

Table 2: Student Course Evaluations

The combination of the use of the WSF and the case studies served to improve the understanding and learning of the students. One student commented that "the course covered a broad range of topics and applied it to real-life situations". Another student believed that a major strength of the course was gaining "a fundamental understanding of information systems in a corporate environment". Finally, one student cited, as a major course strength, "making students realize how important BI implementation is and how involved one must be while the system is being implemented".

From the course evaluation questions and the student comments, the author believes that the students are:

(1) more aware of the influence of information systems on the bottom line of an enterprise (from all cases), because the students see that implementation failure is costly,
(2) able to see the importance of technical infrastructures (the BI cases), through the application of elements in the WSF,
(3) able to understand the unique economics of information and information systems (the BI cases), through seeing the impact on an organization,
(4) able to see how information enables organizational decision-making (all cases); the decision makers in the cases are "informated", and
(5) able to understand the development, acquisition, and implementation of information systems; the major steps and obstacles in development are shown.

The use of the WSF, in combination with the selected cases, has given students a better understanding of the complexities of information systems, especially BI systems, and why it is crucial for enterprise success to get the implementation correct.

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