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ABSTRACT

An appreciation for the complementary nature of manual and automated controls is fundamental for the proper evaluation and maintenance of accounting information systems (AIS). Additionally, the implementation of application access controls is often critical for ensuring an appropriate separation of duties and, ultimately, the reliability of a given transaction processing system. This paper describes a project where students act as consultants for Bellwether Garden Supply (BGS), a small retailer in Norcross, GA.[1] In the case setting, BGS is in the process of completing the implementation of Sage 50. BGS management has asked student consulting teams to evaluate its current purchases and disbursements processes and organizational structure, to make any revisions necessary to accommodate the new technology, and to document the post-implementation process using Business Process Model and Notation (BPMN). The case provides a rich, semi-structured setting where students can: improve their understanding of application access controls, separation of duties, and other key controls in the purchases and disbursements process; gain an appreciation of the importance of the context in which accounting applications are implemented; and enhance their communication skills using BPMN.

Keywords: Business processes, purchases and disbursements, separation of duties, access control, BPMN, Sage 50.

INTRODUCTION

Recent government regulation of the process of providing public company financial statement information requires these companies to document their information processing environments.[2] Firms are increasingly using graphical representations to depict the underlying tasks and controls that make up business processes. A recent survey of business managers, analysts, and consultants conducted by bptrends.com, a business process industry information website, found that 71% of participants indicate that they use graphical modeling software (Wolf and Harmon 2012). These developments underscore the importance of building the skills of students entering the accounting profession to both (a) develop process models and (b) understand and evaluate models produced by others.

Perhaps because of the ubiquitous nature of process diagrams, and the costs of communicating with disparate diagramming notations both within and across firms, a recent notation standard appears to be emerging in the business process management field--Business Process Model and Notation, or BPMN. The Object Management Group (OMG) maintains this vendor-independent standard.[3] As of 2014, the OMG website (www.omg.org) identifies 74 vendors supporting BMPN, including the 2013 professional version of Microsoft's Visio diagramming software.[4] Accounting scholars have also begun to prominently feature BPMN in educational cases (e.g., Borthick et al 2010, 2012) and accounting systems textbooks (e.g., Bodnar and Hopwood 2012, Richardson et al 2014). The importance of modeling and documenting an understanding of business processes to the accounting profession makes it likely that students will find BPMN-related skills useful after graduation.

In addition to graphical notation skills, and in particular BPMN, students must also become comfortable implementing technologies and evaluating systems where new technologies are implemented. As demonstrated by the increasing use of process modeling software itself, technological forces continue to affect the processing of accounting information and thus the accounting profession. In their professional careers, students will likely face either:

a. The implementation of a new technology that affects the control structure of accounting systems they manage, and the need to modify the ambient accounting system to accommodate the change; and/or

b. A client which has implemented a new accounting system affecting its control structure, and the need to evaluate the impact of the new system on the reliability of its financial reporting.

These types of changes will continue to require the re-evaluation and application of both manual and automated controls.

One key preventive control involved in the processing of accounting information is the separation of duties. Separation of duties controls exist in both manual and automated environments and in virtually all information processing contexts. Without a strong grasp of the strengths and weaknesses associated with separation of duties architectures in both manual and automated processing environments, future accounting professionals will be ill-prepared to make high-quality risk assessments. For firm managements, these complex risk assessments lead to greater misstatement risk. For auditors, error-prone risk assessment erodes audit quality.

The Bellwether Garden Supply (BGS) case provides students with the opportunity to hone important skills directly related to contemporary professional practice. The case requires students to develop a new purchases and disbursements process that includes both manual and automated controls. Students must also communicate their ideas using graphical representation of business processes via BPMN, a popular process design iconography specification. As part of the new process design task, students must make decisions about the appropriateness of BGS's current organizational structure, and determine which manual processes the application will supplant and which processes will remain. Additionally, students must develop role-based access control profiles in Sage 50 for various functions at BGS. The case is designed to prepare students to perform tasks they will undertake as accounting professionals.

LEARNING OBJECTIVES

Specific Learning Objectives

The primary objective of the BGS project is to provide students with an opportunity to integrate their

understanding of the purchases and disbursements transaction cycle and related controls, the features and functionality of a specific accounting software package, and system modeling and documentation techniques. Specifically, the goals of the BGS case are to develop students' understanding in the following AIS content areas:

1) The contributions of both manual and application controls in accounting systems;
2) The key process and sub-processes that compose the purchases and disbursements transaction cycle; and
3) The importance of a critical preventive control activity, the separation of duties, in the process of purchasing goods and making payments.

In addition, the BGS project is designed to develop the following student skills:

1) Integrating disparate sources of data into a comprehensive understanding of an accounting information system;
2) Evaluating and designing accounting processes; and
3) Communicating the logic of a specific process appropriately using BPMN in a hierarchical model (processes and sub-processes).

One way to appropriately assess the BGS project's objectives is to compare them to the learning objectives academics and professionals consider important for accounting systems professionals. Borthick (1996) presents a set of high-level learning objectives for an AIS course that are designed to help prepare accounting students to fulfill their information systems-related roles and responsibilities. Borthick's objectives relate to building portable, technology-independent systems knowledge and skills in students entering the profession. Professional organizations of accountancy (e.g., AICPA 2012) continue to recognize the importance of developing these skills through accounting education.[5] The specific areas addressed by the objectives are information use, documentation, data modeling, system development, and internal control.

Table 1 maps the requirements of the BGS project into the AIS course objectives identified by Borthick (1996). Of the five objectives of the AIS course, the BGS project requires students to meaningfully engage four of them. In the BGS project, students must take and organize information from disparate sources (*information use*), communicate information about business process using symbolic representations (*documentation*), revise a purchases and disbursements process to include a new technology (*data modeling*), evaluate controls in an existing business process, and redesign a control system to include Sage 50 such that it meets specific control objectives *(internal control*). The only course objective the project does not address is system development. This objective, as described by Borthick (1996), relates to the development of data models for routine and non-routine tasks. Overall, the BGS project provides students with the opportunity to develop skills generally regarded as important to accounting professionals and consistent with generally-accepted objectives of the AIS course.

DESCRIPTION OF CASE MATERIALS

Appendix A contains the case materials.[6] These materials consist of four documents and two figures:

Document A1: The project setting and student deliverables.
Figure A1: The BGS Organization Chart.
Document A2: BGS Job Descriptions for the roles defined in the organization chart.
Document A3: The BGS Current Employee List, including job positions.
Document A4: Notes from a staff consultant on BGS's legacy purchases and disbursements process.
Figure A2: The Sage 50 Access Control Profile Worksheet.[7]

The focal company of the project, BGS, is a one-location retailer of garden products located in Norcross, GA. BGS has committed to implement Sage 50, but has neither redesigned its processes to accommodate the new technology nor determined appropriate employee access levels in the application. Student teams are hired by

TABLE 1

Alignment of BGS Project Objectives with Borthick's (1996) Learning Objectives for the AIS Course

Borthick (1996) Learning Objective	BGS Project Requirements
I. Information use	Students receive a general description of BGS, employee job descriptions prior to implementation, an employee list, an organizational chart, and a report from a subordinate consultant who interviewed BGS employees. They must use this data to gain an understanding of the firm and its manual processing environment for the purchases and disbursements cycle. Subsequently they use this information to determine how best to implement Sage 50, given the firm context.
II. Documentation	Students recall symbolic representations of business processes in BPMN and develop a new business process representation that includes a new technology.
III. Data Modeling	Students model a revised purchases and disbursements cycle to appropriately include Sage 50. Student models must incorporate the relevant Sage 50 application functionality in the purchasing, receiving, and disbursement cycle.
IV. System Development	N/A
V. Internal Control	Students must evaluate BGS's legacy purchases and disbursements process. They must then identify the key controls in the legacy process that will remain and those that will be replaced when Sage 50 has been implemented. In other words, students must place Sage 50 functionality in the BGS context. Students must then design a revised BGS purchases and disbursements process. This process must incorporate access controls in Sage 50 and an appropriate separation of duties across both manual and automated processing steps. Finally, students must re-evaluate their new business process using control objectives and the related assertions: occurrence, completeness, accuracy, authorization, timing, and classification.

BGS management to help resolve these issues prior to fully committing the company to processing transactions using the new technology.

BGS management would like student teams to begin with the purchases and disbursements cycle. Management provides the group with an organization chart (Figure A1), a list of job descriptions (Document A2), and an employee list (Document A3). In addition, one of the consulting team's assistants conducted initial interviews with selected BGS employees and submitted summary notes to the team (Document A4). These documents represent the sources of information student consulting teams use to construct models of BGS's manual purchases and disbursements cycle.

As described in Document A1, BGS's management also has concerns about the current job responsibilities of the four office administrators. All of the administrators currently handle accounting-related duties and participate in fulfillment of certain shipments. BGS management is uncomfortable granting all four of these individuals access to all of the accounting functions in Sage 50. Management communicates to the student teams that it is open to the redesign of any roles in the organization, especially if it helps the firm to adapt more readily to the new application and reduce the possibility of errors and fraud.

Once student teams have a good understanding of BGS's current processes and the office administrator functions, they must judge how best to implement Sage 50. As part of this determination, students must be comfortable with the functionality in Sage 50's Vendors and Purchases navigation center, and make non-trivial decisions about which manual tasks and controls should remain and which will be superseded by the implementation of Sage 50. Concomitantly, student teams must make assessments about access controls in Sage 50 that will enforce an appropriate separation of duties in purchasing, receiving and payables, and disbursements. Students must then document the revised purchases and disbursements process using BPMN.

Students provide three deliverables in order to successfully complete the BGS project:

1) A process diagram that describes the revised BGS processes for purchases and disbursements transactions.
2) An MS Excel spreadsheet (Figure A2) populated with the Sage 50 functionality for each employee role to ensure reliable processing at BGS. This worksheet includes drop-down menus and recreates the access control decisions allowed in Sage 50 security. The document enables student teams to describe all access roles simultaneously and provides instructors with a vehicle to review student decisions without inspecting Sage 50 company data files directly.
3) A memo to BGS management describing the major design features of the revised purchases and disbursements process. The document should identify any employee groups that don't need access to Sage 50. For each specific control objective in the purchasing and disbursement cycle identified in Document A1, the memo should list at least one control activity enabling the company to meet that objective.

Students spend the majority of their time in the recursive process of developing deliverable #1. They implicitly make judgments about how to populate the Sage 50 access control spreadsheet during the development of the process diagram. Thus, employee application access profiles naturally emerge out of their evaluations of the purchases and disbursements process. The work of populating the access control profiles (deliverable #2) becomes another way student teams express their judgments of how to revise BGS's purchases and disbursements processes. To the extent student teams also fully consider control objectives in the design of their processes, deliverable #3 efficiently communicates those decisions in prose. If, however, students discover that they have not fully considered these objectives in their process redesign, then they tend to find the memo considerably less structured and more time consuming.

CONTRIBUTION

The BGS project provides students with an opportunity to engage in critical thinking about the appropriate separation of duties in the purchases and disbursements transaction cycle. Students must further consider how this critical control can be implemented through policies both outside of and inside a specific software application, Sage 50. Accounting systems scholars have recently developed educational materials that require graphical representation of business processes from narratives (Borthick et al 2010) and evaluation of controls over these processes (Borthick et al 2012). These cases also provide students with the opportunity to develop skills communicating via BPMN. The BGS case extends these learning objectives by requiring students to:

1) Develop an understanding of a specific purchase and disbursements process from disparate information sources;
2) Integrate their general knowledge about controls and the features and functionality of a particular accounting application (Sage 50);
3) Design a new purchases and disbursements process to accommodate the new technology; and
4) Communicate the control objectives that the redesigned process achieves.

The scenario facing students in the BGS project is less structured than the requirements in Borthick et al (2010) or Borthick et al (2012). Beyond requiring expression in BPMN and process evaluation, students undertaking the BGS project must build a new process that incorporates their understanding of BGS's current situation and the application to be implemented.

A defining characteristic of the BGS project is that it facilitates learning-by-doing. Through critical analysis of existing processes and the revision of these processes to accommodate the integration of a new specific technology, students' levels of appreciation for the complementary nature of manual and automated controls and a proper separation of duties naturally emerges. Given that students discover the importance of these core accounting system concepts while designing a new process, they associate these concepts with the transaction processing threats that they overcome. Thus, when students are presented with similar sets of problems,

they will more readily recognize the tools that can best mitigate them. These defining characteristics of the BGS project are also hallmarks of the problem-based learning (PBL) approach.

PBL, as defined by Savery (2006), is "an instructional and learner centered approach that empowers learners to conduct research, integrate theory and practices, and apply knowledge and skills to develop a viable solution to a defined problem." Initially introduced by medical schools in the 1950s, scholars developed PBL in response to general dissatisfaction with knowledge retention, reasoning ability, and general preparedness for problem-solving when actually practicing the discipline (Barrows 1996). That is, a significant gap existed between the skills the educational institutions developed in students and those required for success in the profession. The recognition of this gap in the medical profession is not unlike similar circumstances accounting educators (e.g., Kimmel 1995, Albrecht and Sack 2000) and practitioners (e.g., AICPA 1996, 1999) acknowledged in the 1990s.

In the problem-based approach to learning, teachers act as facilitators of student learning, not fountains from which information flows that students must acquire and retain for the purposes of exam preparation. Further, in PBL, scholars suggest that the situations presented to students form the basis students use to organize new knowledge (Barrows 1996). Thus, new knowledge, rather than acquired as a set of independent facts, is accumulated along with a natural link to the problems it mitigates or alleviates. Although there has been some recent criticism of the effectiveness of such an approach to student learning (e.g., Kirschner et al 2006), meta-analysis and meta-synthesis studies have found that students involved in PBL curricula:

1) have more elaborate knowledge structures and better recall of knowledge obtained (Dochy et al. 2003);
2) have a better understanding of the principles that link concepts and links between concepts and principles (Gijbels et al 2005); and
3) are superior when it comes to long-term retention and skill development, and are more satisfied with the learning experience (Strobel and van Barneveld 2009).

A recent study of the most effective college and university teachers finds that they "create what we might call a natural critical learning environment in which they embed the skills and information they wish to teach in assignments that students will find fascinating - authentic tasks that will arouse curiosity, challenge students to re-think their assumptions and examine their mental models of reality. … [Students] recognize the importance of measuring their own work intellectually as they do it, and in the process they routinely apply the intellectual standards of a variety of disciplines" (Bain 2004, p. 47). The types of projects described by Bain (2004) are consistent with problem-based learning generally and the objectives of the BGS project specifically. Thus, to the extent the BGS project meets its objectives, it is consistent with the types of projects that Bain (2004) associates with high quality instruction.

In addition to potentially capturing some of the learning advantages associated with PBL in an AIS course, the BGS project also helps to resolve a problem related to the difference between the education materials widely distributed for AIS courses and the skills most needed by the entrants into the profession (e.g., Borthick 1996). AIS textbooks (e.g., Hurt 2012, Gelinas et al 2011, Romney and Steinbart 2012), because they are so widely distributed, face a high level of uncertainty with respect to any particular classroom context, as the availability of both diagramming and accounting system software packages varies by institution. Consequently, it is difficult for AIS textbooks to provide students with the opportunity to engage in important AIS concepts in a relatively realistic setting, and thus don't directly facilitate a problem-based learning pedagogy. Other educational materials tend to focus on specific software packages (e.g. Arens and Ward and Henry 2012). These materials, however, tend to specialize in providing students with a level of comfort using the specific software functionality (e.g., navigating menus, entering transactions, obtaining reports, user access controls). These skills are helpful for understanding how modern accounting systems operate, but are not sufficient to equip students with, for example, process evaluation and design skills. Thus, there remains a need for educational materials that require students to develop skills most applicable to the situations they will encounter as professionals.

To our knowledge, the BGS case represents the first accounting systems educational material that incorporates all of the following:[8]

1) Placing students in a realistic setting where they must integrate knowledge from several sources: (1) the legacy system and existing firm structure, (2) the objectives and controls prominent in the purchases and disbursements cycle, and (3) a specific accounting technology;
2) Requiring students to develop an updated transaction processing model that requires a re-definition of job roles and enforces a separation of duties through a combination of application and manual controls; and
3) Requiring students to express themselves using tools ubiquitous in the profession.

The BGS case, by providing such an environment, represents a useful aid for AIS scholars to improve the preparedness of students entering the accounting profession.

EMPIRICAL EVIDENCE OF EFFECTIVENESS

The key objectives of the BGS project are to develop a strong appreciation for the importance of both manual and automated controls, to increase student understanding of a key control – separation of duties, to develop a better appreciation for the importance of process design and evaluation skills during implementation, and to improve students' ability to communicate business processes using BPMN. Additional objectives include improving student understanding of the many components of typical accounting systems in general and the important parts of the purchases and disbursements cycle in particular. To assess the effectiveness of the BGS project in achieving these key objectives, we distributed surveys to 20 students who completed the BGS project, but had not yet learned their assigned grades.

Table 2 presents statistics that describe student responses to the BGS project and the results of one-tailed t-tests and non-parametric ordinary sign tests against the null hypothesis that students did not find the BGS project effective in meeting its objectives. In Panel A, the descriptive statistics show that students responded with greatest agreement with respect to the project improving their understanding of the importance of both separation of duties (mean = 3.9), communicating via BPMN (mean = 3.90), and process design and evaluation (mean = 3.8). Mean student responses for all items, however, were above 3.5, greater than the 2.5 midpoint of the scale. Also in Panel A, the results of our one-tailed t-tests of student response means being statistically significantly greater than 2.5 indicate that these differences are significant at conventional levels. For each question the p-values are less than .01.

Panel B of Table 2 shows the results of non-parametric ordinary sign tests of the null hypothesis that the population median is less than or equal to the 2.5 scale midpoint. In each case the null hypothesis is rejected at conventional levels of significance, as p-values are all less than or equal to .01. Based on our analysis of the student survey, we find that, at least as far as students are concerned, the BGS project was effective in meeting the implementation objectives.

CONCLUDING REMARKS

Consistent with problem-based learning theory, the BGS project provides students with a rich setting in which to both learn and apply what they have learned in the AIS course about transaction processing, accounting-related technologies and key control activities. Students use information about a client firm's business processes and their knowledge of an accounting system to help the client to redesign its processes and customize the system to achieve specific internal control objectives. Students must also communicate their recommendations effectively in words and graphical representations using the BPMN process diagramming standard. The BGS project functions as a capstone case in which students use a variety of systems-related knowledge and skills. We provide preliminary evidence that students find the case beneficial to their learning in several aspects of the AIS course.

TABLE 2

Analysis of Student Response Data

Panel A - Descriptive Statistics and T-test Results

	Obs.	Min	Mean	Max	Std. Dev	T-statistic	P-value[a]
Manual & Automated Controls	20	1.0	3.7	5.0	1.3	4.3	0.000
Separation of Duties	20	2.5	3.9	5.0	0.9	6.9	0.000
Purchases and Disbursement Controls	20	2.5	3.8	5.0	0.9	6.5	0.000
BPMN	20	1.5	3.9	5.0	1.1	5.9	0.000
Process Design and Evaluation	20	2.5	3.8	5.0	0.8	7.7	0.000
Overall AIS Understanding	20	2.0	3.6	5.0	0.9	6.0	0.000

Panel B - Ordinary Sign Tests of Agreement [b]

	Obs.	Probability Agree	# Expected Agree	Observed Agree	Percent Agree	P-value[c]
Manual & Automated Controls	20	0.5	10	16	80.0%	0.010
Separation of Duties	20	0.5	10	19	95.0%	0.000
Purchases and Disbursement Controls	20	0.5	10	19	95.0%	0.000
BPMN	20	0.5	10	18	90.0%	0.000
Process Design and Evaluation	20	0.5	10	19	95.0%	0.000
Overall AIS Understanding	20	0.5	10	18	90.0%	0.000

Notes: Student responses were based on a scale that ranged from 0-Disagree to 5-Agree, with a midpoint of 2.5. Survey questions are as follows: Q1 - This project helped me to better understand the importance of both manual and automated controls. Q2 – This project helped me to understand the concept of separation of duties. Q3 - This project helped me understand the key controls in purchases and disbursements. Q4 - This project helped me to become more fluent in BPMN. Q5 - This project helped me understand the importance of process evaluation and design when implementing new accounting systems. Q6 - Overall, I found this project to be a useful in helping me to better understand accounting information systems.

[a] P-vales for the t-test are based on a one-tailed test of the observed mean being greater than that of the scale midpoint (2.5).

[b] Student responses were categorized based on their relationship to the midpoint. If a response was >2.5, then we inferred that the student agreed with the statement. If a response was <=2.5, then we inferred that they disagreed.

[c] P-values for the ordinary sign test are based a one-tailed test of the probability of obtaining the observed number of students who agree with the statement, given a null hypothesis of equal probabilities of agreement or disagreement or a greater probability of disagreement.

We suggest that an important contribution of the BGS project is the degree of realism it achieves by requiring students to demonstrate their systems-related skills utilizing the technologies available at a given institution. The degree to which the BGS project depends on the availability of certain technologies may limit the number of academic settings in which it may be fully implemented. Any technological specificity, however, does not prevent the underlying philosophical approach (problem-based learning in a realistic setting, integration of a wide spectrum of core AIS learning objectives into a single problem, and fuller utilization of institution technology available) from application in educational settings with different technologies than those discussed here. The case can readily be modified to include, for instance, Microsoft Great Plains functionality and access controls in lieu of the Sage 50 accounting system presented here. The accompanying teaching notes contain a more comprehensive discussion of the technological tools that can be used with the project.

ENDNOTES

[1]Bellwether Garden Supply is a fictitious company file included in the educational versions of Sage 50 (formerly Peachtree) accounting software.

[2]For example, the Sarbanes-Oxley Act of 2002 states, "An assessment of the effectiveness of internal control over financial reporting must be supported by evidential matter, including documentation, regarding both the design of internal controls and the testing processes. This evidential matter should provide reasonable support: for the evaluation of whether the control is designed to prevent or detect material misstatements or omissions; for the conclusion that the tests were appropriately planned and performed; and that the results of the tests were appropriately considered." (SEC (2003)).

[3]OMG defines the purpose of BPMN in the following manner: "The primary goal of BPMN is to provide a notation that is readily understandable by all business users, from the business analysts that create the initial drafts of the processes, to the technical developers responsible for implementing the technology that will perform those processes, and finally, to the business people who will manage and monitor those processes. Thus, BPMN creates a standardized bridge for the gap between the business process design and process implementation." (OMG 2011)). BPMN, when viewed within an accounting system development framework such as the Resource-Events-Agents (REA) ontology, could be readily employed in the development of a task-level REA model. At the task level, the focus is on workflow and communications and not primarily on the data model (Dunn, Cherrington, and Hollander 2005, 91).

[4]The BPMN vendor population has more than doubled in the past seven years. Recker et al (2006) documented over 30 vendors as of their writing.

[5]While technology has certainly changed since Borthick's article was published nearly 20 years ago, accounting students' need for the general skills necessary to competently use, design, and assure information systems, regardless of technology, has not. Subsequent analyses and proposed designs of AIS curriculum content are highly consistent with Borthick's skills-based objectives (see, e.g., Dull et al. 2005, Daigle et al. 2007, and Callaghan et al. 2011).

[6]In addition to the materials in Appendix A, Teaching Notes are available on the AISEJ website. These notes provide specific guidance on project administration, grading (including a grading rubric), and a suggested solution.

[7]The MS Excel file depicted in Figure A2 enables students to select specific access control profiles for each employee role they define via drop-down menus. The file is available to instructors via the AISEJ website.

[8]As one reviewer for the 2013 AISEA conference noted, schools in the SAP Alliance appear to be developing projects designed to achieve similar objectives to those we associate with BGS.

[9]The MS Excel file that allows students to select access levels for different BGS employee roles is available on the AISEJ website.

[10]The MS Excel file pictured enables students to select specific access control profiles for each employee role they define via drop down menus. This file is available at the AISEJ website.

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