Evaluating Web-Based Learning Systems

Teresa M. Pergola
The University of Tampa

L. Melissa Walters
The University of Tampa

ABSTRACT

Accounting educators continuously seek ways to effectively integrate instructional technology into accounting coursework as a means to facilitate active learning environments and address the technology-driven learning preferences of the current generation of students. Most accounting textbook publishers now provide interactive, web-based learning systems as a supplement to their textbooks. However, there are critical differences across publishers with respect to the system's interface, functions, content, features, and support. These differences directly impact the effectiveness of a web-based learning system as an instructional tool and as a corollary, may impact the ultimate utility of the associated textbook as a pedagogical resource. As such, an evaluation of available web-based learning systems is an essential component of the textbook review process and should consist of a meticulous evaluation of the system's functionality and features in light of instructor and student needs and preferences. Unfortunately, given the functional intricacies and disparity in features across web-based learning systems, this can be a daunting task. The purpose of this paper is to offer accounting educators some practical guidance on evaluating web-based learning systems prior to adoption. This guidance is presented in the form of a framework based on key processes underlying the systems development life cycle (SDLC), a logical process model used by systems professionals to guide the acquisition and/or development of information systems.

Keywords: accounting, instructional technology, web-based learning systems, systems evaluation

INTRODUCTION

Meeting the educational needs of students is a constant pedagogical challenge, particularly in courses that are rule-based and complex such as accounting (Lippincott, Matulich, & Squires 2007). Educators must continuously adapt to student learning styles and preferences to effectively engage them in the learning process. This requires educators to first, be aware of student learning preferences and then, introduce innovative ways to meet those preferences (Matulich, Papp, & Haytko 2008). The current generation of students, commonly referred to as "NetGen" learners, grew up surrounded by technology and bombarded by continuous technological advancements. Computers, multimedia, the Internet, cell phones, and computer games were and continue to be a central and intuitive part of their life. NetGen learners stay connected and their experiences are interactive and real time; as a result, they have little tolerance for delays, non-interactive environments, or lack of current technology (Oblinger 2003, Papp, 2010). They crave stimulation, support, and immediate feedback and have developed a trial-and-error style of experiential learning that has its roots in computer gaming wherein the fastest way to learn (i.e., master the game) is to fail and try again (Arhin & Johnson-Mallard 2003, Oblinger 2003, Matulich, Papp, & Haytko 2008). They also prefer self-paced, any-time-any-place learning environments in lieu of traditional structured classroom pedagogy (Matulich, Papp, & Haytko 2008). These factors have resulted in a student group that responds best to interactive learning environments in which they receive real-time feedback and can control the pace and depth of their learning; moreover, the current generation of learners expect to use technology to facilitate learning (Arhin & Johnson-Mallard 2003, Lippincott, Matulich, & Squires 2007, Lippincott, Pergola, & Squires 2006, Matulich, Papp, & Haytko 2008, Papp, 2010). As such, it should come as no great surprise that traditional textbook-based accounting pedagogy which relies on textbook readings, one-way lectures, and passive in-class problem-solving are less effective with this current generation of accounting students (Eisner 2004, Bryant & Hunton 2000, Lippincott, Matulich, & Squires 2007, Matulich, Papp, & Haytko 2008).

The integration of interactive instructional technology into accounting coursework as a supplement to traditional textbook pedagogy provides an effective means to address the technology-driven, interactive learning preferences of the current generation of accounting students (Lippincott, Matulich, & Squires, 2007, Lippincott, Pergola, & Squires 2006, Matulich, Papp, & Haytko 2008). The use of interactive instructional technology as a learning tool is strongly supported by behavioral and cognitive theory which suggests that reinforcement, active participation, and learner control are critical components of the learning process (Bryant & Hunton 2000, Thompson , Simonson, & Hargrave 1992). Behavioral theory holds that positive or negative reinforcement immediately following stimulus prompts learning suggesting that an instructional technology that provides real-time corrective feedback during problem solving will enhance learning for accounting students (Bryant & Hunton 2000). Cognitive theory holds that interactive participation heightens learning suggesting that an instructional technology that actively engages accounting students by way of two-way exchanges and an appropriate level of learner control will have a positive impact on learning (Bryant & Hunton 2000). Instructional systems that allow for such interactivity, learner control, and real-time feedback are now widely available in the form of web-based learning systems offered as supplements to accounting textbooks (e.g., Cengage: ThomsonNow,CengageNOW; Pearson: MyAccountingLab; Wiley: WileyPLUS; McGraw-Hill: Homework Manager/Connect).

Most accounting textbook publishers now offer interactive, web-based learning systems as a supplement to their accounting textbooks (e.g., see http://www.cengage.com/highered/, http://www.pearsonhighered.com/educator, http://www.wiley.com/WileyCDA/ , and http://connect.mcgraw-hill.com/). These web-based learning systems typically offer online learning environments that may include interactive book content, study management tools, multimedia activities, homework assignments, self-assessment tools, and grade book options. However, there are

critical differences across publishers with respect to system functions, content, capabilities, and support. These features can directly impact the effectiveness of a web-based learning system as an instructional tool for facilitating interactive learning and moreover, may impact the ultimate utility of the associated textbook as a pedagogical resource (Lippincott, Pergola, & Squires 2006, Pergola & Squires 2007). As such, an evaluation of available web-based learning systems is an essential component of the textbook review and adoption process and should consist of a meticulous evaluation of the system in light of both instructor and student preferences. Unfortunately, given the functional intricacies and disparity in content and features across available web-based learning systems, this can be an overwhelming task.

The purpose of this paper is to offer accounting educators some practical guidance on evaluating web-based learning systems prior to adoption. This guidance is presented in the form of a framework based on key processes underlying the systems development life cycle (SDLC), a logical process model used by systems professionals to guide the acquisition and/or development of information systems. The remainder of this paper is structured as follows. The next section discusses the relevance of the SDLC for evaluating web-based learning systems offered with accounting textbooks. The following sections apply key SDLC processes to the evaluation of web-based learning systems and discuss an assessment framework developed to assist accounting educators in evaluating such systems. The final section of the paper presents brief concluding remarks followed by an appendix containing the assessment framework.

THE SDLC AND EVALUATION OF WEB-BASED LEARNING SYSTEMS

The SDLC is a logical process model describing the conceptual phases of an information systems development endeavor from inception to completion (see Dennis, Wixom, & Roth 2009, Gelinas & Dull 2010, Hall 2011, Shelly & Rosenblatt 2010). The SDLC is used by systems professionals as an abstract framework to manage systems development projects to ensure that development processes are efficacious and that resulting systems meet organizational needs (Gelinas & Dull 2010). There is some variability in the definition, perceived importance, and application of SDLC phases, especially across differing development methods (e.g., sequential vs. iterative vs. agile methodologies); however, the SDLC is generally considered to include systems survey, systems analysis, systems design, systems implementation, and systems operations phases (see Dennis, Wixom, & Roth 2009, Fitzgerald, Russo, & Stolterman 2002, Gelinas & Dull 2010, Shelly & Rosenblatt 2010).

SDLC concepts are applicable to the in-house development of information systems as well as the acquisition of information systems solutions from external parties (Gelinas & Dull 2010). The SDLC phases applicable to a system acquisition project are analogous to system development phases; however, since the focus is on acquiring (rather than developing) systems solutions, certain subprocesses within the design phase are adapted to focus on acquisition concerns relating to the identification and evaluation of feasible solutions and the selection of a solution that best meets system requirements (Gelinas, Sutton, & Hunton, 2005). Since, the adoption of a web-based learning system is essentially a systems acquisition decision, SDLC concepts as adapted for systems acquisition considerations may be used to guide the process of evaluating available solutions and determining a final solution that best meets the pedagogical objectives and requirements of accounting instructors and students. The SDLC phases most relevant to evaluating web-based learning systems include systems survey, system analysis, and systems selection processes. Each is discussed with respect to evaluating web-based learning systems below.

SYSTEMS SURVEY

The systems survey is a preliminary planning process that involves defining problems, establishing objectives, determining feasibility of proposed solutions, proposing a course of action, and devising a project plan (Dennis, Wixom, & Roth 2009, Gelinas & Dull 2010, Gelinas, Sutton, & Hunton, 2005, Shelly & Rosenblatt 2010). With respect to evaluating web-base learning systems, key aspects would involve defining pedagogical problem areas, determining pedagogical objectives, and assessing the feasibility of a web-based learning system as a solution.

Problem Identification & Objectives

As mentioned above, the central problem with traditional textbook-based accounting pedagogy is that it does not meet learning preferences of the current generation of accounting students. The traditional approach to teaching accounting involves assigned textbook readings, instructor lectures, and end-of-chapter homework assignments followed by instructor review of homework assignments during class. Lectures typically result in a one-way exchange of information as large class sizes along with time constraints often limit interactivity. Homework assignments typically involve multiple exercises and/or problems selected and assigned from each chapter and are typically completed by students in paper-and-pencil form. Instructors generally review homework solutions during normal class meeting times, but may or may not collect, grade, and provide individual feedback on student homework performance. If homework is not collected and graded, the primary feedback mechanism becomes exam performance which means that feedback occurs subsequent to the central learning process. Attempts to grade and review homework to allow for adequate feedback during learning results in instructor inefficiencies in the form of time spent grading and recording homework, class time spent reviewing homework, and sometimes significant delays in the feedback provided to students. In a nutshell, the traditional approach to accounting pedagogy is typically characterized by an absence of technology, insignificant interactivity, nominal learner control over the pace of learning, and delayed feedback which results in a pedagogical approach diametrically opposed to the learning preferences of current accounting students. Key problems may be summarized as follows (Matulich, Papp, & Haytko 2008, Lippincott, Matulich, & Squires 2007)

- The traditional textbook medium may not motivate students as current students prefer use of online technology.
- Traditional lectures are passive which may result in lack of attention and retention as current students prefer interactive two-way exchanges.
- Lack of control over the pace of learning frustrates students as current students prefer self-paced learning.
- Lack of immediate feedback may impede learning and reinforce incorrect solution approaches as current students prefer real-time feedback as support for computer-game like trial-and-error learning approaches.
- Attempts to provide feedback to students result in instructor inefficiencies in the form of time spend grading/recording homework, class time spend reviewing homework, and delays providing individual feedback.

In light of these problems, the general objectives of acquiring a web-based learning system would be to first, provide a learning approach that supports the technology, interactivity, learner control, and feedback preferences of current students and second, to provide a pedagogical tool to improve instructor efficacy in supporting such preferences.

Feasibility Assessment

Feasibility assessment involves determining the practicability of addressing identified problems and objectives with the proposed solution. Three key aspects of feasibility are technical feasibility, operational feasibility, and economic feasibility (Gelinas & Dull 2010, Gelinas, Sutton, & Hunton, 2005, Hall 2011). Economic feasibility refers to the costs of the proposed system, the availability of funds to implement the system, and how a system solution compares to other projects competing for available funds (Gelinas, Sutton, & Hunton, 2005, Hall 2011). Since web-based learning systems are supported on publisher websites, there is negligible cost to universities or instructors; however, students must purchase access to the web-based system so the central economic feasibility issue will be the cost of student access to web-based learning system resources.

Technical feasibility relates to whether or not a problem has a technically feasible solution that can be addressed using available hardware and software technology (Gelinas, Sutton, & Hunton, 2005, Hall 2011). The web-based learning systems considered in this paper are developed by textbook publishers, supported on publisher platforms, and accessed via a web interface. High-speed Internet access and a compatible web browser are required (both of which are normally readily available within a university environment) but no additional investment in either hardware or software is necessary.

Operational feasibility refers to consistency between the operational requirements of the new system and existing procedures and personnel (Gelinas, Sutton, & Hunton, 2005, Hall 2011). A new system may result in changes to procedures, need for new personnel, behavioral reactions to the change, and need for training. With respect to the web-based learning systems considered in this paper, relevant considerations include changes to instructional methods, instructor and student competency with technology, student and instructor reactions to the implementation of a web-based learning system, and university tolerance for alternative delivery models. A key operational feasibility concern is often change management as personnel will often resist a new system because they fear the implications of the change; as such, adequate training and user support are central to effectively managing technological change (O'Brien & Marakas 2010). With respect to web-based learning systems, some instructors may resist or even refuse to use a web-based learning system due to unfamiliarity with the system and/or impacts on their current pedagogical approach so system usability, training resources, and system support will be central considerations in evaluating the system.

SYSTEM ANALYSIS: USER REQUIREMENTS

System analysis involves specifying user requirements and defining system specifications to meet identified requirements (Dennis, Wixom, & Roth 2009, Gelinas & Dull 2010, Gelinas, Sutton, & Hunton, 2005, Shelly & Rosenblatt 2010).With respect to evaluating a web-base learning system, this would involve identifying student and instructor requirements for the system and translating user requirements into logical system specifications that may be used to guide the evaluation of different web-based learning solutions. The user requirements analysis should address the needs and preferences of all affected users (Gelinas & Dull 2010). In the case of a web-based learning system, this would include both instructors' and students' needs. Likely requirements were constructed based on basic functionality of web-based learning systems in light of the student learning preferences and problem definitions discussed above. These requirements are presented below from both student and instructor perspectives.

Student-Related Requirements

The integration of web-based instructional technology into the curriculum should facilitate interactive learning, allow for student control and flexibility, and provide real-time feedback and guidance to meet the learning preferences of current accounting students.

- The system should provide appropriate content, assignments, and study tools to help students manage learning.
- The system should provide interactive access to textbook material relating to assignments or study tools.
- The system should provide alternative delivery methods (different media, problem types, and study tools) to appeal to different learning styles.
- The system should allow access to content, assignments, and study tools anytime from anywhere.
- The system should allow user control over types of activities performed and pace at which activities are performed.
- The system should provide immediate feedback to students as they work.
- The system should provide problem solutions as study aids for students.
- The system should provide self-assessment activities to help students determine progress.

Instructor-Related Requirements

A web-based instructional technology into the curriculum should also allow for instructor control and flexibility, promote interactive learning without direct intervention of the instructor, and improve instructor efficacy.

- The system should provide an adequate selection of exercises, problems, and self-assessment exercises relating to chapter material.
- The system should provide mix of different problem types to support learning objectives of the instructor.
- The system should automatically grade student responses in the manner that instructors define.
- The system should automatically provide correct answers and solution guidance to the student.
- The system should support uploading and downloading of content to support instructor responses to student questions.
- The system should allow instructors to review student performance and progress.

SYSTEM ANALYSIS: SYSTEM SPECIFICATIONS

There are innumerable considerations to take into account when performing a systems analysis of a web-based learning system, some of which have been identified in previous research (e.g., Pergola and Squires 2007). For the purposes of the framework developed in this paper, system specification considerations were derived from the feasibility concerns, student requirements, and instructor requirements discussed above with respect to basic functionality of web-based learning systems. General software selection considerations and previous research on electronic homework systems were also considered in identifying relevant considerations (ASA Research 2010, Pergola & Squires 2007). System specification considerations are organized into four categories: feasibility considerations, system functionality, available content, and relevant features and are briefly discussed below.

Feasibility Considerations

Feasibility includes basic economic, technical, and operational feasibility concerns. Basic feasibility considerations for web-based learning systems includes cost, access code, and compatibility considerations.

- **Cost**: The cost refers to the price of the access code. Prices vary significantly between products and some products have options pricing dependent on the content. Some vendors bundle the textbook with the access code, which can result in cost savings if properly negotiated. Most vendors allow direct purchase of the codes on their sites, which can potentially save students bookstore markups.
- **Access code life**: Each system requires students to purchase an access code. As noted above, the code can be bundled with the book or students can buy the codes directly from the publisher web site. The life of the access code differs among vendors. Some allow multiple year access, some single-year, and some single-semester. The single semester code limit requires students to buy an additional code if they drop/fail the course and have to take it again in a subsequent semester. Inquiries about access code life and the vendor's willingness to negotiate longer terms are important factors to consider. The price of the code and students' economic status are additional issues that may impact how an instructor evaluates access code life.
- **Compatibility with other applications:** As mentioned above, the web-based learning systems discussed in this paper are maintained on vendor platforms with a web interface and as such, are accessible via Internet access and a compatible web browser. However, it is important to ensure that they are compatible with university learning management programs (such as Blackboard or Web CT) and that they support exporting of grades and importing/exporting of content to other programs.

Operational feasibility also includes training, product support, and vender reliability considerations.

- **Instructor training**: The types of instructor training vary by product and include on-site training, web-based training, manuals, and peer support services. An advance copy of training materials or a request for a training demonstration can help instructors to evaluate the adequacy of the training.
- **Instructor support**: There is a wide variation in the availability and type of technical support assistance. Types of support include interactive online support, email, and telephone support.
- **Hours of instructor support**: Some products offer support from 9 to 5 Central Time, Monday through Friday. None of the products offer 24 hour 7 day a week live help.
- **Response rates**: Statistics detailing response rates for each communication mode, including telephone wait time and email turnaround time, can help in the evaluation of response rates.
- **Instructor feedback**: The vendors have different processes for instructor-reported errors, suggestions, and/or desired features.
- **Student enrollment and system use instructions**: Students, especially freshman, have trouble enrolling if the process is unclear or complicated, resulting in instructor intervention, late assignments, and high levels of frustration. Preview of the student enrollment process and review of the student instructions can help assess the quality of the process.
- **Student technical support**: There is a wide variation in the availability of technical support assistance. Some products offer support from 9 to 5 Central Time, Monday through Friday. None of the products offer 24 hour 7 day a week live help.

- **Type of student support**: Types of support include interactive online support, email, and telephone support. Student response rates for each communication mode, including telephone wait time and email turnaround statistics, are critical to the success of the system. Students may blame their instructor for system glitches which are beyond the instructor control.
- **Vendor Reliability**: Students and instructors work from the publishers' networks. Reliability is critical to students completing homework on time and easing frustration with the technology. In addition, if the network is overloaded because the publisher has oversold the capacity, students and instructors cannot access the site when needed. For these reasons, it is critically important to assess capacity and performance statistics.

System Functionality

Functional considerations include a number of factors relating to the ease of setup, system administration, and system use (Pergola & Squires, 2007).

- **Course administration procedures**: On each system, courses must be created at the start of the semester and closed at the end of the semester. The processes differ among vendors. Some products define a school administrator who performs these functions; some products require the instructor to request course set up from the vendor. The latter process requires setup requests 2 or 3 days in advance of when access the course is desired. It is important to ask about the setup process and response times if the vendor controls the process.
- **Ease of creating assignments**: Each system contains certain end-of-chapter exercises and problems that can be used to create assignments electronically. Potential adopters of systems should review the process for creating assignments for ease of use.
- **Ease of authoring problems/exercises**: Most systems allow instructors to add their own questions and problems. However, not all systems are user-friendly in this regard. The best way to assess this issue is to ask for a demonstration or for access to try it out.
- **Ability to support desired problem format**: Most systems allow instructors to add their own problem sets but may have some restrictions with respect to problem format. Most support multiple choice formats and true/false but may not support more complex formatting.
- **Ability to change assignment parameters**: Each system allows the user to define assignment parameters, such as the due date, the number of attempts allowed, whether the student can see the solution after the due date, whether the student can submit late assignments or not, etc. In some systems, changes to these parameters after students have begun the assignment results in lost grades. It is important to understand the system parameters, to determine which can be changed, when they can be changed, and the potential impact of those changes.
- **Student view**: Some systems allow the instructor to toggle to "student view". This allows the instructor to see what the students see. Some systems also treat the instructor as a student when in this view, which enables instructors to try problems in advance of assignments. This helps instructors determine if the course set up selection options created the desired result and to identify any grading problems.
- **Transfer of student access between classes**: Students enroll in the electronic class related to their class section. Sometimes, students enroll in the wrong section or need to transfer their code from a class they dropped in the prior semester to the class in the current semester. Review the procedures for making these types of changes with respect to who is authorized to process the change and how difficult or easy it is to do. While this may not sound like a significant issue, these problems arise at the beginning of the semester when it is most hectic.

Reliance on the vendor or difficulty in making the change can delay students accessing the system and from doing the required work.

- **Screen view**: When instructors respond to student questions, they generally have both the question and solution screen open simultaneously. Some systems open multiple windows allowing you to toggle back and forth or to move the windows on the screen. Some append the solution to the problem, which means you have to scroll across the screen to see the solution and then scroll back to see the problem. A review of the screen view for the product can help to ensure that they system meets your preferred method of navigation.
- **Providing student feedback**: Some problems and exercises include short essay answers, which the instructor must grade. Some systems allow for electronic feedback for each problem and some do not. If they do not, then instructors must devise a way to give feedback and explanations of points awarded/deducted to students.
- **Print view**: When working face to face with a student, it is convenient to be able to print out the student's homework as well as the correct solutions. It is important to know the print options as it is impossible to print out the solution in some systems.
- **Ability to adjust student grades**: All systems allow instructors to adjust grades. However, some systems only allow an adjustment if the student has attempted the assignment. In some cases, instructors may elect to accept a hard copy assignment (i.e., because the student was ill, because the student could not access the electronic system, etc.) In these cases, if the grade cannot be entered on the electronic system, the instructor must keep a separate record of that assignment until homework grades are downloaded at the end of the term.
- **Time out rules**: As with any electronic system, there is a time out feature, resulting from non-use. Some systems warn users and some do not. Students tend to print out problems, work the solution, and then enter their answers. If they do not log out and back in, they may enter all their answers only to be told that they were "timed out" when they click "submit". Knowing the time-out parameters can help alleviate user frustration and acceptance of the technology.

Available Content

Content may vary significantly across textbook publishers with respect to both the type and quantity of content and homework problems available. Central considerations relate to the breadth of electronic content and homework problems available.

- **Electronic technology content**: The content available to students varies among products. The most comprehensive products include an electronic text, self-study questions and quizzes, and audio and power point lectures in addition to the homework. The least comprehensive include only the homework. Knowing what is included in the standard product will help when comparing alternative systems. If the product is only available with text plus ancillaries including web based homework, its cost and access code life will be significantly higher than a standalone homework system.
- **Quantity of problems available**: The problems and exercises included in the electronic system are comprised of end-of-chapter and/or test bank problems and exercises. However, some systems include only selected homework items. It is important to understand what percentage of the possible problems is available electronically, and what types of problems are included. Some instructors do not want test bank questions included in the problem set. The answer will vary by textbook.

Relevant Features

Web-based learning systems have unique features that may differ significantly across textbook publishers. The following represent key feature concerns (Pergola & Squires, 2007).

- **Algorithmic assignments of problems and solutions for instructors**: One of the features of the systems allows for algorithmic creation of some problems and exercises, a feature that reduces cheating. This feature results in each student having a different set of values for each problem and in some cases, for each attempt. As students have questions about homework, the instructor must respond to their unique problem. An important consideration is whether the system allows instructors to view solutions to each problem attempt. Some systems do not allow instructors to view the solution until all attempts are used. This necessitates working the problem each time a student has a question. Ask if the system allows the instructor to view the solution for each attempt. The importance of this feature will differ depending upon type of course, material level, etc. Some instructors have indicated that they don't care about algorithmic solution availability in principles courses because it's easy to calculate the answer manually. In upper level classes where students have learned to appreciate the value of doing and learning from the homework, algorithmic problems may not be necessary.
- **Rounding issues**: Student answers are sometimes marked incorrect because they have rounded their response differently than the answer key. Some systems allow an adjustment for rounding to avoid this.
- **Answer formats**: There are a variety of vendor approaches to formatting. Some vendors define solution sets with all feasible formats (whole number, two decimal, currency formats, decimals, percentages, etc….); some vendors provide specific instructions that students must follow for an answer to be counted as correct; some vendors provide an answer field that is formatted in the desired format. It is important to understand how the system treats formatting to avoid student frustration and confusion that results in students questioning their understanding of the concept when their answer is, in fact, correct but formatted incorrectly.
- **Attempts parameters**: The systems allow the instructor to define the number of attempts allowed for the assignment. However, some systems define attempts as the number allowed per problem and some define them as the number of attempts per problem set. In the latter case, instructors must decide how many attempts for each problem and then set the total attempts as a function of the number of problems and the number of attempts per problem (3 attempts per problem, 4 problems, 12 total attempts). Students, however, can use all 12 attempts on the first problem and have none left for the remainder of the assignment.
- **Grading parameters**: Systems differ in recording of grades. Some systems record the final attempt grade and some record the highest grade of all attempts. There are also systems that allow the instructor to choose which grade is accepted.
- **Grading metrics**: It is important to understand if the system supports your method of assignment points, i.e., points per problem, problem weighting, percentage assignment, etc.
- **Link-to-book option**: One feature included in some systems is the ability to link to the book when answering questions. If a student submits a response that is incorrect, the link feature points them to the learning objective section for the question that they missed.
- **Ability to work ahead**: Some systems allow students to work on subsequent assignments even if a previous assignment due date has not been reached. Some systems allow forward progression but block students from previous assignments once a new one has been started.
- **Solution (not just answer) provided to student**: The systems differentiate between answers and solutions, where the solution shows how to derive the answer. Some systems provide the

solution to students after the final submission, if the instructor has chosen this as an allowed feature, and some do not. If no solutions are provided, instructors may have to post solutions elsewhere and/or work the problems in class.

- **Feedback prior to submission**: Some systems provide a "check my work" or "how am I doing" feature that allows students to check their work prior to submission for grading. It is important to know if such a feature exists, if the instructor can control access to that feature, or if the instructor can control how that feature is accessed in the system.
- **Student access to homework after due date**: Some systems allow students access after the due date as a function of the system, some require instructors to define accessibility, and some do not allow access at all. For systems that allow access after the due date, students can continue attempting the problem until they get it right without the attempts affecting their grade. The system will score the grade from the allowed attempts only. For systems in which instructors define access, they are a variety of options including no access, view only, and view with help. It is also important to know how late submissions are distinguished from those that are on time.
- **Hints**: Some systems provide hints to the students as they work the problem. If the system has this feature, it is important to understand how it works. Consideration include if hints are predefined, if instructors can author hints, and if instructors can control how and when hints are used.

SYSTEMS SELECTION

Systems selection involves identifying feasible solutions and evaluating solutions based on the ability to satisfy system specifications (ASA Research 2010, Gelinas & Dull 2010, Gelinas, Sutton, & Hunton 2005). With respect to evaluating web-base learning systems, this would involve identifying the systems to be considered, evaluating system functions and features based on system specifications, and assessing system suitability based on system functions and features.

Identifying Feasible Solutions

As mentioned above most accounting textbooks now offer web-based learning systems as supplements to their accounting textbooks. Instructors must first identify the web-based learning system accompanying each textbook under consideration for adoption. This is easily accomplished by accessing publisher websites and reviewing the supplemental resources available for the textbooks of interest (e.g., see http://www.cengage.com/highered/, http://www.pearsonhighered.com/educator, http://www.wiley.com/WileyCDA/, and http://connect.mcgraw-hill.com/). The most prominent web-based systems accompanying accounting textbooks are CengageNOW (Cengage-Thompson-Southwestern), MyAccountingLab (Pearson-Prentice Hall), WileyPLUS (Wiley), and Homework Manager/Connect (McGraw-Hill). While there are a number of web-based learning systems available, not all web-based learning systems are created equal. There are significant differences across publishers with respect each system's interface, functions, content, features, and support. These differences may directly impact the effectiveness of a web-based learning system as an instructional tool and as a corollary, issues or problems related to system functionality, features, and/or support may impact the ultimate utility of the associated textbook as a pedagogical resource. Consequently, an evaluation of available web-based learning systems is an essential component of the textbook review process and should consist of a meticulous appraisal of system elements in light of instructor and student requirements and system specifications.

Systems Evaluation

Systems evaluation involves assessing each potential system based its ability to satisfy systems specifications identified during the systems analysis phase (Gelinas & Dull 2010, Gelinas, Sutton, & Hunton 2005). Once potential web-based learning systems have been identified, instructors should schedule vendor demonstrations, survey instructors currently using the potential systems, and/or, if available, request trial instructor access as a basis for evaluating each system's ability to satisfy user requirements and systems specifications. This can be a difficult and time consuming task given the functional intricacies, numerous features, and disparities in capabilities across available web-based learning systems, further complicated by the fact that the relative importance of system specifications will likely vary by instructor depending on pedagogical needs and preferences. To assist instructors in organizing and completing a systems evaluation for a web-based learning system, an assessment framework was developed based on the systems survey and systems analysis performed in the previous sections of this paper. The assessment framework is organized around the feasibility, functionality, content, and features specifications defined above and contains an assessment rubric explaining least desirable, adequate, and most desirable conditions for each specification consideration. The Framework for Evaluating Web-Based Learning Systems is presented in table form in the appendix.

The framework maybe used as a reference tool by instructors during vendor interviews or demonstrations, peer interviews, beta testing, and/or trial testing. Instructors may also assign a point scale to the assessment rubric dimensions (e.g., 1 = least desirable, 2 = adequate, 3= most desirable) as a basis for facilitating relative assessments across different web-based learning systems. Additionally, instructors may want to adapt the point scale allowing greater or lesser emphasis for particular system specifications to represent relative importance of system specifications based on instructor preferences. The framework may also be used as a basis for comparing textbook adoption proposals. Finally, although this framework was developed for use in evaluation of web-based learning solutions accompanying accounting textbooks, it could be easily adapted to other functional areas that have an interest in evaluating similar web-based learning products.

CLOSING REMARKS

Today's students require innovative teaching methodologies that appeal to their unique learning styles and technology expectations. Web-based learning systems provide a means to address the learning preferences of the current generation of accounting students and aid instructors in addressing these preferences. However, each system has unique features and differing capability levels that impact the ultimate utility and learning effectiveness of the system. This makes assessing web-based systems as part of textbook adoptions a critical and complicated task, particularly for instructors who have not used such systems in the past.

The purpose of this paper was threefold. The paper was intended first, to explain the relevance of web-based learning systems for addressing the learning preferences of the current generation of accounting students and second, to emphasize the importance of carefully evaluating web-based learning systems as part of a textbook adoption decision. The final and central purpose of this paper was to offer accounting educators some practical guidance to assist them in evaluating potential web-based learning systems. It is hoped that this paper will encourage accounting educators to consider the importance of web-based learning systems as pedagogical tools and as such, motivate them to carefully evaluate each potential system as a central part of the textbook review process.

REFERENCES

ASA Research (2010). Blueprint for Selecting the Right Accounting Software. Accounting Software Adviser, http://www.asaresearch.com/articles/blueprint_select.htm

Arhin, A. O., & Johnson-Mallard, V. (2003). Encouraging Alternative Forms of Self Expression in the Generation Y Student: A Strategy for Effective Learning in the Classroom. ABNF Journal, 14(6), pp. 121-122.

Bryant, S. M., & Hunton, J. E. (2000). The Use of Technology in the Delivery of Instruction: Implications for Accounting Educators and Education Researchers. Issues in Accounting Education, Vol. 15, No. 1, pp. 129-162.

Dunn, R., Gemake, J., Jali, F., & Zenhausern, R. (1990). Cross-cultural Differences in the Learning Styles of Elementary-age Students of Four Ethnic Backgrounds. Journal of Multicultural Counseling and Development, 18, pp. 68-93.

Eisner, Susan P. (2004). The Class Talk Show: A Pedagogical Tool. S.A.M. Advanced Management Journal, 69(1), pp. 34-49.

Fitzgerald, B., Russo, N. L., & Stolterman, E. (2002). Information systems development: Methods in action. London: McGraw-Hill.

Gelinas, U. J. & Dull, R. B. (2010). Accounting Information Systems, 8e. Mason, Ohio: Thompson-Southwestern.

Gelinas, U. J., Sutton, S. G., & Hunton, J. E. (2005). Acquiring, Developing, and Implementing Accounting Information Systems. Mason, Ohio Thompson-Southwestern.

Hall, J. (2011). Accounting Information Systems, 7e. Mason, Ohio: Southwestern-Cengage.

Lippincott, B., Matulich, E., & Squires, K (2007). To Learn or Not to Learn: The Effect of Educational Technology in Accounting Courses. Journal of College Teaching and Learning Vol. 3 No. 12, pp. 55-60.

Lippincott, B., Pergola, T., Squires, K. (2006). Web-Based Homework Learning Tools for You. Colloquium on Change in Accounting Education, Sedona, AZ, Oct 18-20.

Matulich, E., Papp, R. & Haytko, D. (2008). Continuous Improvement with Teaching Innovations: A Requirement for Today's Learners. Marketing Education Review, 18, pp. 1-7.

Oblinger, D. (2003). Boomers, Gen-Xers & Millennials: Understanding the New Students. EduCause Review, July/August, http://net.educause.edu/ir/library/pdf/ERM0342.pdf.

O'Brien, J. & Marakas, G. (2010). Introduction to Information Systems, 15th Edition. McGraw-Hill/Irwin

Papp, R. (2010). Virtual worlds and social networking: reaching the millennials. Journal of Technology Research, 2, pp. 1-15.

Pergola, T. & Squires, K. (2007). Key Factors to Consider When Adopting Web Based Homework Systems. Colloquium on Change in Accounting Education, Scottsdale, AZ, Oct 3–6.

Shelly, G. B., Rosenblatt, H. J. (2010) Systems Analysis and Design. Eight Edition Course Technology-Cengage Learning.

Thompson, A., D., M. R. Simonson, and C. P. Hargrave (1992), Educational Technology: A Review of the Research, Washington, D.C.: Association for Educational Communications and Technology.

Whitten, J., L. and Bentley, L. (2007) Systems Analysis and Design Methods, Seventh Edition, McGraw-Hill-Irwin.

APPENDIX: FRAMEWORK FOR EVALUATING WEB-BASED LEARNING SYSTEMS

SPECIFICATIONS	LEAST DESIRABLE	ADEQUATE	MOST DESIRABLE
Feasibility Considerations			
Pricing	High	Medium	Low
Option Pricing	Price per option	Package pricing	All inclusive
Access code life	One term	Two terms	Longer-term
Compatibility with other applications	Is not compatible	Allows exporting to Excel, Word	Allows both importing and exporting
Instructor training and support	Training is in the form of manuals.	Training includes a combination of manuals and web-based training.	Training includes, manuals, webinars, peer support, and/or on-site training.
Type of instructor support	Telephone support	Telephone support and/or email support	Interactive online support.
Hours of instructor support	Support is available Monday through Friday, 9-5.	Support is available Monday through Friday extended hours.	Support is available seven days a week, extended hours.
Response rates	Response rates for each communication mode are not available and/or are too slow	Response rates for each communication mode are acceptable	Response rates for each communication mode are good.
Instructor feedback	There is no formal process for instructor - reported errors, suggestions, and/or desired features.	There is a process for instructor reported errors, suggestions, and/or desired features but the vendor does not provide response statistics or feedback.	There is a process for instructor reported errors, suggestions, and/or desired features that provide feedback to instructors.
Student enrollment and system use instructions	Vendor provides student instructions but they lack clarity.	Vendor provides student instructions that are reasonably easy to follow.	Vendor provides instructions that are reasonably easy to follow and live enrollment support.
Student technical support	Support is available Monday through Friday, 9-5.	Support is available Monday through Friday extended hours that more closely fit student needs.	Support is available seven days a week, extended hours.
Type of student support	Telephone support	Telephone support and/or email support	Interactive online support.

SPECIFICATIONS	LEAST DESIRABLE	ADEQUATE	MOST DESIRABLE
Vendor Reliability	Capacity and performance data are not available	Capacity and performance data show that the publisher network is overloaded.	Capacity and performance data show that the publisher network is reliable and accessible to students when needed.
System Functionality			
Course Admin Procedures	Vendor controlled	School administrator	Instructor controlled
	Difficult	Moderately difficult	Easy
Ease of creating assignments	Difficult	Moderately difficult	Easy
Ease of authoring problems/exercises	Difficult	Moderately difficult	Easy
Ability to support desired problem format	Cannot	Can to some degree	Fully supports
Ability to change assignment parameters	Once created, cannot be changed	Can be changed but may result in lost grades	Can be changed and will not impact student attempts
Student view	Does not allow "student view"	Allows "student view" but cannot "take assignments as a student"	Allows student view and can take assignments as if you were the student
Transfer of student access between classes	Vendor controlled	Can be done but is difficult	Can be done and is easy to administer
Screen view	Solution is appended to the problem; must scroll back and forth to view	System allows open windows of both the problem and solution; can toggle between them	System allows open windows of problems and solutions open on the same screen
Providing student feedback	System does not allow student feedback	System allows student feedback in comment form only	System allows student feedback in multiple forms
Print view	Students cannot print the problems	Students can print the problems but formatting cuts off part of the problem	Students are provided with formatted printable problems
Ability to adjust student grades	Cannot adjust grades	Cannot adjust grades if student has not attempted assignment	Can adjust grades whether student has attempted the assignment or not.

SPECIFICATIONS	LEAST DESIRABLE	ADEQUATE	MOST DESIRABLE
Time out rules	System has a time-out feature but does not warn the student.	System has a time out feature and warns the student when they are "timed out".	System has a time out feature and tells the student they have timed out if they attempt to enter data.
Available Content			
Electronic Technology Content	System includes only homework problems	System includes homework and electronic text	System includes homework, electronic text, and other features (audio lectures, power points, self-study etc…)
Quantity of Problems Available	The problems/exercises include only some of the end-of-chapter content	The problems/exercises included contain all of the end of chapter content	The problems/exercises included contain end-of-chapter content, test bank content, and self-study content
Relevant Features			
Algorithmic problems and solutions	Does not allow algorithmic problems	Allows algorithmic problems but instructor cannot see the solution until after all attempts are used	Allows algorithmic problems and instructor can see solution for each problem and attempt
Rounding	System does not accommodate rounding	System accommodates rounding but the rounding parameter is too broad	System allows for rounding within a "normal" rounding range
Answer formats	System is rigid, accepting only one format for an answer.	System is somewhat flexible in answer formats.	System anticipates most answer formats and accepts them as correct.
Attempts Parameter	Attempts definitions are too broad (unlimited) or too narrow (1 attempt)	System allows for user defined number of attempts but it is for the problem set, not per problem	System allows for user defined number of attempts per problem, not problem set.
Grade parameters	System uses final attempt grade; instructor cannot define	System uses the best of the attempts	User can define which attempt should be used as the grade

SPECIFICATIONS	LEAST DESIRABLE	ADEQUATE	MOST DESIRABLE
Grading metrics	System does not allow any (or very little) flexibility in grading metrics.	System allows some flexibility regarding grading metrics but is limited in choice	System allows user to define the grading metrics - points, percentages, weights etc…
Link-to-book Option	System does not include an e-book and/or link to e-book feature	System includes an e-book but link to the content is too broad	System includes an e-book and the link to the book is specific to the problem the student is having
Ability to work ahead	Students cannot access a new problem until the current problem or assignment is complete	System allows forward progression but does not allow access to previous assignments once the new one is started.	System allows forward progression with no restrictions.
Solutions/Answers	System provides the answer to the problem, but not the solution.	System provides both the answer and the solution but not until after the due date.	System provides both the answer and the solution after the final submission.
Feedback prior to submission	System provides a "check my work" or "how am I doing" feature that allows students to see if their answer is correct prior to submission.	System provides a "check my work" or "how am I doing" feature that allows students to see if their answer is correct prior to submission but the feature is controlled by the instructor.	System does not provide a "check my work" or "how am I doing feature".
Student access to homework after due date	System does not allow student access to homework after the due date.	System does allow access to the homework as a function of the system.	System does allow access according to instructor-defined accessibility
Hints	System does not provide hints.	System provides pre-defined hints	System provides pre-defined hints and also allows instructor-defined hints.