Learning Internal Control Evaluation via An Internet-Based Expert System

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Abstract

Internal control issues are important to all organizations to insure the accuracy, reliability, and timeliness of the resulting financial reports. All accounting students must understand basic internal control concepts and learn how to evaluate weaknesses in an organization' s internal control system. Nevertheless, teaching this topic is very challenging. Students are often overwhelmed with examples of potential internal control weaknesses that are possible in one organization. An Internet-based expert system which allows students to practice with the activities of detecting the weaknesses in an internal control system might prove to be useful. This study intends to investigate whether it is feasible to develop such a system and use it as a teaching tool in the classroom environment.

1. Introduction

The issue of how to increase teaching effectiveness is a major concern to most educators. Understanding how to encourage a student to learn the material instead of simply trying to memorize the contents is one of the greatest difficulties faced in teaching. The nature of the topics taught contributes to this difficulty. The topics requiring a deep understanding make it hard for students to capture the main theme of the concept. This is the main issue concerning the teachings of internal control concepts.

With the traditional lecture, an overview lecture is given on the importance of internal controls to an organization. Examples of weaknesses and how they affect the organization are also covered. Then, students are given a case study describing a scenario about a fictitious organization. The case study contains approximately ten internal control weaknesses. The instructor leads the discussion on the internal control weaknesses in the case and why such events are considered internal control weaknesses (i.e., how such events could be harmful to the organization). In the examination, a new case study will be given. Students are asked to identify ten weaknesses from the case. Most of the students cannot even identify five correct weaknesses. The main reason for this is because they tried to memorize the weaknesses in the previous case study, instead of actually learning the technique of how to detect such weaknesses.

Experience with problem-based learning indicates that students can significantly improve their problem solving skills if students practice often with problems. However, with time constraints in class, there is only enough time to discuss two case studies. In addition, going over these case studies in class and trying to show students how to detect each weakness usually confuses students more because of the overload of information that they have to capture in a limited period of time.

The main purpose of this research effort is to address the question of whether an Internet-based expert system can be devised to teach students how to detect potential weaknesses of internal control systems more efficiently and/or more effectively. A subsequent experiment was also conducted to examine its value to students. If such a system can be shown to be both capable of development and beneficial, then it will be feasible to use the system as a teaching tool in addition to the traditional lecture.

2. Background

Internal control is defined as a process designed to provide reasonable assurance regarding the achievement of objectives in the following categories: reliability of financial reporting, effectiveness and efficiency of operations, and compliance with applicable laws and regulation [1, 20, 27]. Maintaining an effective internal control system is crucial to any business organization. Without the ability to ensure the accuracy and reliability of accounting information, a business organization could not survive in a competitive environment [5]. The problem of checking internal control weaknesses is a “nondeterministic polynomial” problem [6, 18]. Such problems are often solved best by using the rules of thumb of experienced auditors. When such rules can be incorporated as reasoning knowledge in an expert system, the potential of developing an expert system to aid in solving audit problems is quite high.

A wide variety of prototype and commercial systems have been developed for assisting auditors evaluate their clients' internal control systems [13, 21, 22]. Representative examples of prototype systems implemented for evaluating a client’s internal control system are shown in Table 1 [5, 9, 10, 15, 17, 23, 28]. These systems are generally designed to help auditors determine the extent of other tests they will perform in conducting an audit. If an auditor determines that the client’s internal controls are designed properly and are functioning as designed, he or she can reduce direct testing of account balances accordingly [14].

Name	Developer(s)
APE: Audit Planning and Evidence	Denna
Inherent Risk Analysis	KPMG Peat Marwick
PLANET	Price Waterhouse
IRE	Dhar et al.; Peters
Risk Advisor	Coopers & Lybrand
ANSWER	Arthur Young
CCR/36 Advisor	Ernst & Young
CFILE	KPMG Peat Marwick
C&L Control Risk Assessor	Coopers & Lybrand
ICE	Kelly
ICES	Grudnitski & Arthur Young
Internal Control Analyzer	Gal
Internal Control Expert	Deloitte & Touche
Flow Eval	Ernst & Young
Systematic	Price Waterhouse
TICOM	Bailey et al.

Table 1: Systems for Internal Control Evaluations

In addition to the use of the expert systems as decision aids, researchers have long contended that expert systems could be used to train non-expert users (3, 4, 7, 8, 19, 16, 25). Prior studies found that subjects who practiced making decisions with the aid of an expert system were better and quicker at reaching decisions than subjects who practiced without the support of the expert system (11, 12, 24, 26). However, there are no previous reported studies of an expert system developed as an Internet-based application in this regard. The Internet-based feature provides an open-enrollment atmosphere to students as it allows students to learn at their own pace. Students will be able to practice with the system at their convenience--during the workday, at night, or on weekends.

3. The Construction of the System

The system developed in this research offers advice about weaknesses found in evaluating internal control systems in the sales and collection cycle of medium-size merchandising organizations. The system was developed using the ASP technology and the Visual Basic Script language. The knowledge incorporated into the system represents primarily the expertise of one expert auditor who is a partner in a major international accounting firm. The expert has more than ten years of experience in the area of internal control evaluation and demonstrated significant interest in the research project. The knowledge was acquired via a six-month series of interviews with the expert. The expert was asked to identify all potential weaknesses that may occur in the sales and collection cycle of a medium-size merchandising organization.

Once a prototype of the system had been developed, the expert was asked to test the expertise captured in the rule sets in order to ensure the validity of the system. Validation of the system is often considered the cornerstone of expert system evaluation [2]. It is the process of analyzing the knowledge and decision-making capabilities of the expert system [22]. Test cases were developed and used to examine whether the system did offer sufficiently good and timely advice compared to the human expert.

4. System's Utility

After constructing a system aimed at teaching students how to detect the potential weaknesses in an internal control system, an experiment was conducted to examine the system's utility.

4.1 Subjects

Subjects are students enrolled in the Business College at a University in the Midwest region of the US. Table 2 presents their demographic information.

Number of Subjects	18
Average GPA	3.08
Year	13 Senior, 5 Junior
Majors	15 Accounting, 2 MIS, 1 Other

Table 2. Subjects' Demographic

4.2 Hypotheses

The experiment was designed to allow testing of the hypotheses presented in Table 3 below:

Hypotheses	Descriptions
H1	Subjects can detect potential weaknesses of an internal control system more accurately after practicing with the Internet-based expert system.
H2	Subjects perceive that the internal control evaluation concept is easier after practicing with the Internet-based expert system.
H3	Subjects perceive that they can learn how to detect internal control weaknesses via the Internet-based expert system.
H4	Subjects prefer to learn how to detect internal control weaknesses via the Internet-based expert system than via a traditional lecture (i.e., via white board and slide presentation).
H5	Subjects perceive that it is not difficult to use the Internet-based expert system.

Table 3: Hypotheses

4.3 Response Variables

Five response variables were measured as follows:

1) Effectiveness

The scores that students obtained from accurately detecting internal control weaknesses were used as a measure of the system's effectiveness.

2) Student Perception with the Difficulty of Internal Control Evaluation Concept

A questionnaire was used to measure the student perception with the difficulty of internal control evaluation concept. Seven-point Likert scales were used in the questionnaire. The following question was asked to measure this variable.

- On a scale of 1 (very difficult) to 7 (very easy), how difficult was it to detect potential weaknesses in the case study?

3) Student Perception with the Learning via the Internet-Based Expert System

A questionnaire was used to measure the student perception with the difficulty of internal control evaluation concept. Seven-point Likert scales were used in the questionnaire. The following question was asked to measure this variable.

- On a scale of 1 (strongly disagree) to 7 (strong agree), I believe that practicing with the Internet-based expert system can help me learn how to detect internal control weaknesses.

4) Student Preference on the Teaching Technique

A questionnaire was used to measure the student perception with the difficulty of internal control evaluation concept. Seven-point Likert scales were used in the questionnaire. The following question was asked to measure this variable.

- On a scale of 1 (strongly disagree) to 7 (strong agree), I prefer to learn how to detect internal control weaknesses via the Internet-based expert system than via a traditional technique (i.e., via a white board and slide presentation)?

5) Student Perception on the Difficulty of Using the Internet-Based Expert System

A questionnaire was used to measure the student perception with the difficulty of internal control evaluation concept. Seven-point Likert scales were used in the questionnaire. The following question was asked to measure this variable.

- On a scale of 1 (very difficult) to 7 (very easy), how difficult was it to use the Internet-based expert system?

4.4 Experimental Materials

Aside from the expert system itself, two case studies (A and B) were generated from the manipulation of several cues for detecting the potential weaknesses in internal control systems. These cues were obtained from a review of auditing texts, accounting texts, and input from accounting professors and experienced auditors. In each case, the scenario dealt with the adequacy of internal control over a company's sales and collection cycle. Each case study contained ten potential weaknesses in an internal control system. Three experienced auditors and three managers were asked to pilot test these case studies to ensure their similarity with respect to the degree of difficulty in detecting the potential internal control weaknesses. Revisions to these case studies were made based on the feedback they provided.

Questionnaires were also developed to gather data about participants' perceptions of their experiences in using the expert system, as well as their demographics. These questionnaires were pre-tested with ten MBA students to ensure their clarity.

4.5 Experimental Task

The experiment was conducted in an isolated, controlled environment in a college laboratory. Students took the first internal control evaluation test. They were asked to detect ten internal control weaknesses from the first case study (Case A). The case described a scenario in an organization on the policy and procedure of the sales and cash receipt cycle. A questionnaire was also given to measure their perceptions about the task performed as well as their attitudes on their internal control knowledge.

After taking the first test, students were instructed to practice with the Internet-based expert system for internal control evaluation. Then, in the following week, students took the second internal control evaluation test. As with the first test, they were asked to detect ten internal control weaknesses from the second case study (Case B). A questionnaire was also given to measure their perceptions about the task performed as well as their attitudes on their internal control knowledge.

5. Experimental Findings

In order to examine the value of the system in teaching students how to evaluate the internal control weaknesses, an improvement in students' accuracy score and their perceptions with the task and the systems were measured. T-tests were employed to test hypotheses about the differences on their accuracy scores and perceptions, before and after they practiced with the system. The major findings are summarized in Table 4, which shows means and t-test results pertaining to the hypotheses.

Ho	Response Variables	Measurements/Questions	Before	After	P-Value
H1	Accuracy Score	Test Scores	52.78	79.86	**0.00023***
H2	Task Difficulty	On a scale of 1 (very difficult) to 7 (very easy), how difficult was it to detect potential weaknesses in the case study?	1.83	3.56	**0.000009***
H3	Usefulness of the System	On a scale of 1 (strongly disagree) to 7 (strong agree), I believe that practicing with the Internet-based expert system can help me learn how to detect internal control weaknesses.		4.22	0.48
H4	Learning Preference	On a scale of 1 (strongly disagree) to 7 (strong agree), I prefer to learn how to detect internal control weaknesses via the Internet-based expert system than via a traditional technique (i.e., via a white board and slide presentation)?		4.39	0.26
H5	System Difficulty	On a scale of 1 (very difficult) to 7 (very easy), how difficult was it to use the Internet-based expert system?		5.28	**0.00002***

* represents the significance at $\alpha = 0.01$

Table 4. Summary of Findings

6. Result and Discussion

Regarding hypothesis H1, the result shows that students performed much better after practicing with the system ($\mu_{Before} = 52.78$ vs. $\mu_{After} = 79.86$). The t-test confirms that there was a significant difference in students' accuracy in detecting an internal control weakness, before and after they practiced with the system (p-value = 0.00023). Concerning hypotheses H2, H3, H4, and H5, students' answers to the questions revealed their attitudes toward the using of the Internet-based expert system as follows:

- Task Difficulty - Students perceived that the task of internal control evaluation is much easier after practicing with the system ($\mu_{Before} = 1.83$ vs. $\mu_{After} = 3.56$, p-value = 0.000009).
- Usefulness of the System - Although students slightly agreed that the system was useful, it is not significantly different from feeling neutral towards the system ($\mu_{After} = 4.22$ vs. Neutral Response = 4, p-value = 0.48).
- Learning Preference - Although students slightly preferred the system for learning the internal control evaluation technique, it is not significantly different from feeling neutral towards the system ($\mu_{Before} = 4.39$ vs. Neutral Response = 4, p-value = 0.26).
- Difficulty of the System - Students perceived that it was not difficult to use the system ($\mu_{Before} = 5.28$ vs. Neutral Response = 4, p-value = 0.00002).

7. Conclusion

The primary finding of this study suggests that it is feasible and beneficial to build an Internet-based expert system aimed at teaching students how to evaluation internal control systems. The system helps students not only learn the technique of internal control evaluation, but also make them feel more comfortable learning such a technique. Students are able to work through problems as needed to familiarize themselves with the technique of internal control evaluation. The system also allows students to take charge of their learning while simultaneously teaching students new, innovative skills. For the instructor's standpoint, the system will allow instructors to expand on what is currently being done with traditional teaching methods. The instructor will be able to keep track of how many times and how long each student is practicing the system. All of the statistical data gathered will provide guidance to the instructor on the relationship between a student's effort and the improvement in his/her performance. For the university's standpoint, the system will help facilitate the circulation of expertise in evaluating internal control systems to a wide number of students.

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