Delivery Of Accounting Information Systems Study Tools Through The Internet

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Abstract

This paper presents the Internet as an alternative mechanism for delivering Accounting Information Systems (AIS) study tools. First, a comparison between Internet and traditional delivery methods, such as pencil and paper, disk and CD-ROM is presented. The main advantages of the Internet over the other delivery forms are increased flexibility and ease of distribution. Next, we present an Internet study tool that was developed for students learning cardinalities, which is a difficult data modeling topic covered in many AIS courses. We first look at the design of the study tool. Then, we discuss some of the features of the study tool: interactivity, multimedia, distribution and flexibility. Finally, we report some of the lessons learned from the actual delivery of the AIS study tool through the Internet.

Introduction

Accounting educators use a variety of methods to teach and reinforce learning of accounting concepts including lecture, discussion, cooperative learning sessions, homework, case studies and study tools, among others. The Internet can be used to enhance many of these teaching methods. Sangster and Lymer (1998) note several advantages of using the Internet including unlimited access, direct access to other informational resources and ease of updating. Driscoll (1998, pp. 6-7) additionally notes that using Web based training eliminates platform changes, eliminates cost of duplicating, packaging and mailing materials, and ensures that revisions from a central point will reach all users. Internet uses in current accounting courses include course information available on Web pages, email contact with students including electronic class mailing lists and discussion groups, and information retrieval from other Web sites (Debreceny, Smith and White 1996).

Another use of the Internet for accounting education is for study tools. Many papers discuss the advantages of using a microcomputer based study tool, termed using the Computer as a Computational Tool by Bhaskar (1982, 1983). These papers include Helmi (1986), Abraham, Loughrey and Whalen (1987), Kachelmeier, Jones and Keller (1992), Roufaiel (1995), and Holcomb and Michaelsen (1996). We define study tools for the purpose of this paper as questions, problems or cases given to students to practice and reinforce material learned through reading, lecture and discussion. Although the Internet could be used to enhance

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many other areas of accounting education, this paper focuses on the added advantages of using the Internet as a delivery mechanism for study tools.

Using the Internet as an alternative delivery mechanism to pencil and paper or computerized study tools is analyzed first. The advantages of Internet study tools include increased flexibility and ease of distribution. Flexibility is increased because problems can be added, deleted or changed at any time by the instructor without impacting students' use of the tool. Since usage data is collected in real time, the instructor can see if students are having any particular problems and adjust classroom discussions accordingly. Also, distribution using the Internet is virtually effortless and costless. Once an Internet study tool is developed, all users can access the tool simultaneously any time of the day or night.

An Internet study tool developed by the authors for use in the Accounting Information Systems (AIS) course is discussed next. This section discusses the topic selection and design of the tool. A sample problem from the study tool is presented and the features of the tool are discussed: interactivity, multimedia, flexibility and distribution. The next section of the paper discusses the lessons we learned from the actual delivery of the AIS study tool through the Internet. We focus on both technological problems we encountered with a previous version of the tool and content issues we had to overcome. The paper ends with conclusions and suggestions for future research.

A Comparison of Study Tool Delivery Mechanisms

Table 1 presents an evolution of delivery mechanisms of study tools from pencil and paper to disk/CD-ROM to the Internet. There are also hybrid forms of delivery that will be discussed later in this section.

The first column of Table 1 presents the manual form of delivery. We define manual delivery as study tools that students solve completely with pencil and paper including homework problems or practice sets in traditional accounting texts. The most appealing feature of manual practice sets is their technological simplicity because no advanced technology is required. In order to have this simplicity, however, interactivity, multimedia, flexibility and ease of distribution are absent. Manual delivery is only interactive to the extent that a student looks up a manual solution from a text or other source. Multimedia presentations such as video and sound are, of course, not possible. Manual delivery is not flexible because changes require the instructor to reproduce and redistribute the study tool. Also, manual distribution requires students to buy the materials or instructors to produce and duplicate them.

Computerized practice tools began to appear in business schools and in the accounting literature in the early 1980s. Many of the first computerized study tools were simply computerized versions of the manual study tools and interactivity and use of multimedia were absent or limited (Fetters, McKenzie and Callaghan 1986, Abraham et al. 1987). Use of advanced programming languages and CD-ROM has added multimedia and increased interactivity to study tools as noted in Table 1 (Paquette and Schwarzbach 1991, Jensen and Sandlin 1992, Roufaiel 1995). These newer tools can include graphics, video, and audio. Also, students can be informed whether their answers are right or wrong and they can be given further direction to help them through the study tool.

As noted in Table 1, however, technological simplicity is lost from the manual delivery form and flexibility and ease of distribution remain problems. Technological simplicity is lost because now the computer is involved. The first technology hurdle from the instructor's perspective is writing the software and making the disks or CD-ROMs required for the study tool.

Table 1
Comparison of Study Tool Delivery Mechanisms

	Manual Delivery Pencil and Paper	Disk/CD-ROM Delivery	Internet Delivery
Characteristics present or added by delivery method:	Technological simplicity	Interactivity Multimedia	Interactivity Multimedia (limited) Flexibility Ease of Distribution
Characteristics not present or lost by delivery method:	Interactivity Multimedia Flexibility Ease of Distribution	Technological simplicity Flexibility Ease of Distribution	Technological simplicity Multimedia is limited

The next technology hurdle is compatibility with computer hardware. Disks formatted for PCs may not work on MAC systems and other compatibility problems may exist with different versions of software. In addition, once these disks or CD-ROMs are made, they cannot be updated without interaction with the instructor or vendor and are therefore not very flexible. Also, disks and CD-ROMs are typically distributed manually which complicates distribution.

Changing the structure of study tools from a manual to a computerized environment shifts the learning paradigm of study tools from a less structured to a more structured environment. Studies have reported mixed results about the effectiveness of computerized tools (Borthick and Clark 1987). Some have argued that problems that require cognitive structure with technically difficult material can be enhanced by computerized instruction (Kachelmeier et al. 1992). Driscoll (1998, pp. 53-55) notes that computerized study tools (or Web/Computer Based Training as termed in her book) are best suited for cognitive, highly structured problems. Also, a study on the effectiveness of multimedia shows non-verbal learners perform better with multimedia presentation while verbal learners perform worse with multimedia presentation (Butler and Mautz 1996). Therefore, computerized study tools should be structured and use both verbal and non-verbal instruction.

Shifting from a computerized environment using disk or CD-ROM to the Internet does not change the cognitive structure of the study tool, but it does change the flexibility and ease of distribution of the tool as noted in Table 1. While a disk or CD-ROM must be revised and reissued every time content changes, an Internet study tool can be changed by the instructor at any time without interrupting student use. This way, the instructor can add, delete, change or correct problems with mistakes at any time. The distribution of the study tool is extremely easy using the Internet. The study tool can be used by an unlimited number of students, simultaneously, in locations throughout the world, for free, with minimal software and hardware requirements. Also, because these tools can automatically track student performance in real time, instructors can learn where students are having difficulties during the assignment and change class discussion accordingly. Using disk or CD-ROM, instructors must wait until students use office hours, email or turn in the assignment before they know there have been problems.

On the disadvantage side, as noted in Table 1, Internet study tools require technological sophistication to design and multimedia is limited. The design of an Internet tool such as the one discussed in this paper requires a rather high level of Internet programming knowledge. To use the system, however, requires little knowledge besides typing and button pressing. Although the Internet has multimedia capabilities, graphics are currently limited by bandwidth, which means that large multimedia files normally take a long time to download and play

on the computer. A possible solution for this problem is a hybrid CD (Hall 1997). The hybrid CD stores stagnant information and large multimedia files on the CD, but links to a Web site using software that comes with the CD to update information that changes frequently. The hybrid CD form could be useful if large multimedia files are warranted.

Design and Use of an Internet Study Tool for the Accounting Information Systems Course

We designed an Internet study tool for the AIS course. The study topic is cardinalities, a difficult data modeling concept often taught in both undergraduate and graduate courses. Many of the AIS textbooks cover cardinalities and their use for the representation of business rules at length (e.g. Hollander, Denna and Cherrington 2000, Romney and Steinbart 2000). First, we briefly discuss the Internet study tool. Next, we discuss degree of interactivity, use of multimedia, flexibility and distribution of the tool to the students.

An Internet study tool for learning how to use cardinalities to express business rules

Figure 1 shows the user interface for the study tool. The tool is conceptually designed in five parts indicated by part numbers I through V in Figure 1. Part I on the left-hand side of Figure 1 lists the cardinality problems students can choose to solve. The system as shown contains twenty cardinality problems. Students can try as many or as few of these problems as they wish by clicking on the name of the problem. Each student can solve any problem as many times as they wish.

Once a student clicks on a problem, both the graphical representation of the problem in the upper-middle of the screen (part II) and the textual description of the problem in the upper right-hand corner of the screen (part IV) are shown. For the example in Figure 1 (problem 9), the student is asked to specify cardinalities for the described relationship between sale and cash receipt. Applied to the 'sale – cash receipt' relationship, cardinalities are used to express business rules such as whether a company accepts credit payments or installments and whether a company requires a down payment. Cardinality specifications come in two pairs. Each pair consists of a minimal cardinality and a maximal cardinality. Given the information in part IV of the problem, a sale can have a minimum of no cash receipts and a maximum of at most one cash receipt at any given time. Likewise, a cash receipt can exist without a sale, but each sale can have at most one cash receipt. This allows for prepayments, however, each cash receipt can be applied to one sale only. The correct cardinality pattern for this problem is Left Min: 0, Left Max: 1, Right Min: 0 and Right Max: 1.

The student uses the answer sheet in the lower-middle part of the screen (part III) to submit the answer. If the student answers an incorrect pattern, such as shown in Figure 1, color coded messages appear in part V of the screen for each incorrect cardinality. For the example in Figure 1, the student gave wrong answers for both maximal cardinalities. Instead of just telling the student s/he is wrong, the messages in part V of the screen inform the student why s/he is incorrect and the student is given a chance to model the problem again using another cardinality pattern in a subsequent attempt. If the student answers the correct pattern, then the tool congratulates him/her.

Interactivity, Multimedia, Flexibility and Distribution

Interactivity

The tool has two interactive components: the hyperlinks used for the problems and the answer sheet. The hyperlinks make the study tool learner controlled. The student chooses the order to solve the problems and the number of times a particular problem is solved. Our moni-

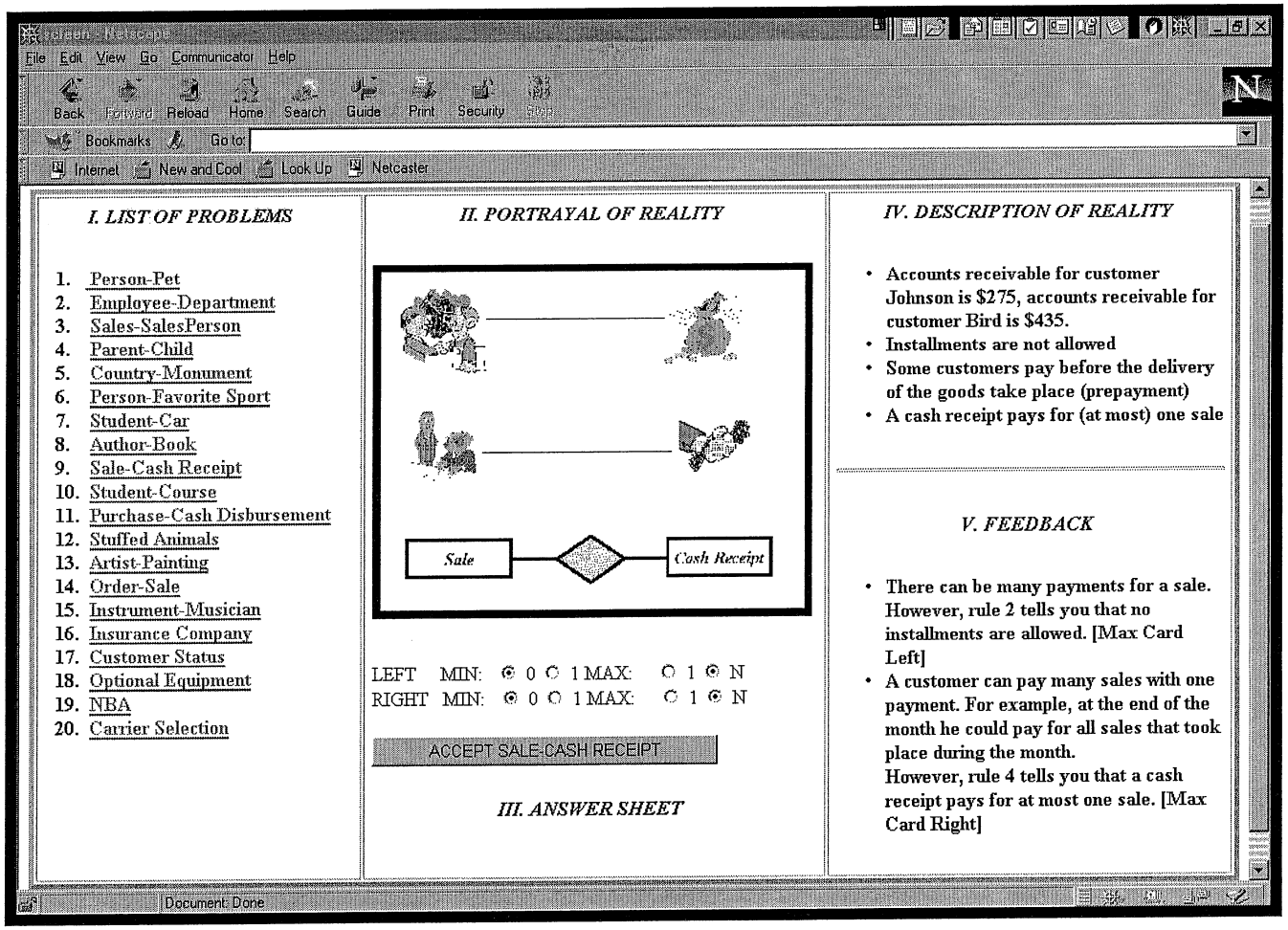

Figure 1
Example Problem

toring of students' behaviors shows that more than 90% of the students that used the tool solved the problems in sequential order.

The answer sheet is the other interactive part of the tool and creates a dialogue between the student and the tool. When the student submits an answer, the system looks the answer up in a database and generates feedback. There are sixteen different cardinality patterns and thus sixteen possible answers for each problem. The database stores an explanation for each answer, including congratulations for a correct answer.

Use of Multimedia

Given current restrictions of the Internet, especially for students who work at home and rely on telephone lines, we chose text and simple graphics over more complex multimedia representations including video. Even then, students complained that the graphics slowed down the use of the tool. With file transfer over the Internet expected to get much faster in the near future, adding video could be very useful to represent problem situations to be modeled by the students. Students could be shown a store where customers pick up goods during the week and pay their bills at the end of the week. They could then be asked to express the business rules for that store in terms of cardinalities.

Flexibility

Flexibility is a main advantage of Internet study tools compared with study tools delivered through disk or CD-ROM. Figure 2 shows that the tool primarily relies on two pieces of software. The Internet tool software retrieves problem descriptions from the database when the student clicks on a problem and locates the answer for a certain problem in the database when the student submits an answer. The database management software allows instructors to add new problems to the database and change or delete existing problems.

Figure 3 shows how instructors can add a problem description to the database by simply completing a form. The instructor needs to enter the Problem Name, Picture URL (where the picture is stored on the instructor's local system), the Problem Description, and Advice Descriptions for each of the sixteen possible solutions. Figure 3 shows the form for entering all of this information except it only shows the first of the sixteen advice boxes. Instructors can enter text only or text with HTML code for more advanced formatting.

The same instructor can also use a different set of problems for undergraduate and graduate courses. Also, instructors can incrementally extend the set of problems after a set of learning objectives has been accomplished. Such flexibility is a major advantage over disk or CD-ROM as delivery form.

Distribution

The worldwide distribution of the Internet study tool is virtually effortless. It suffices to make the URL, the place where the tool is located, available to the students. Our tool has been used by students at three different universities, thousands of miles apart. We assigned individual usernames and passwords to students to track them for research purposes. Assignment of usernames and passwords in the database complicated the distribution of the tool. However, the online recording of students' answers provides an extra advantage over other delivery forms such as manual delivery, disk or CD-ROM.

Lessons Learned about Delivering a Study Tool through the Internet

We started this project with the implementation of a prototype. We used a scripting language (JavaScript) to implement the tool and data was collected through e-mail. This was a simple solution implemented by one of the authors on a home computer. Neither complex

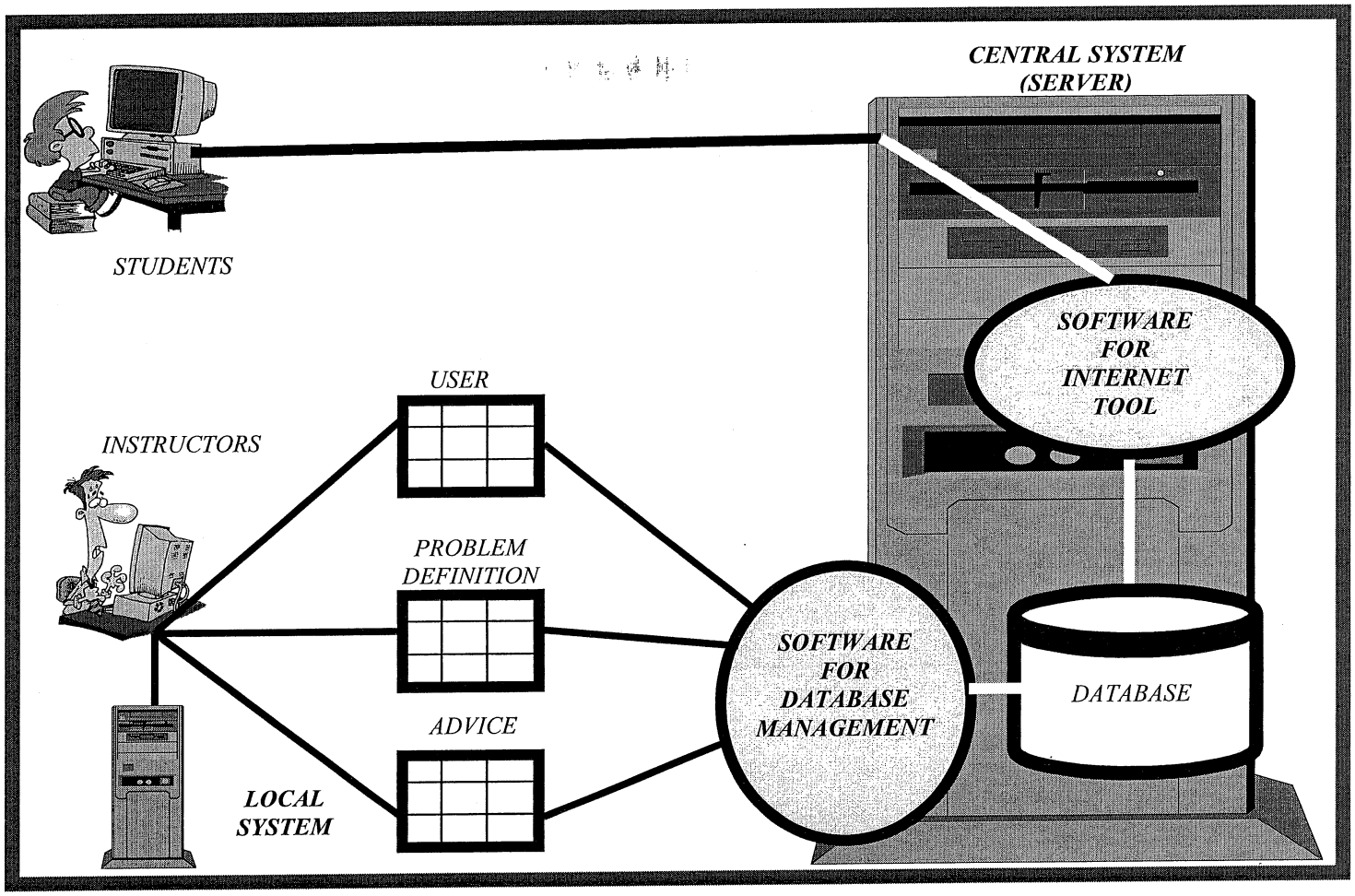

Figure 2
The Design of the Study Tool

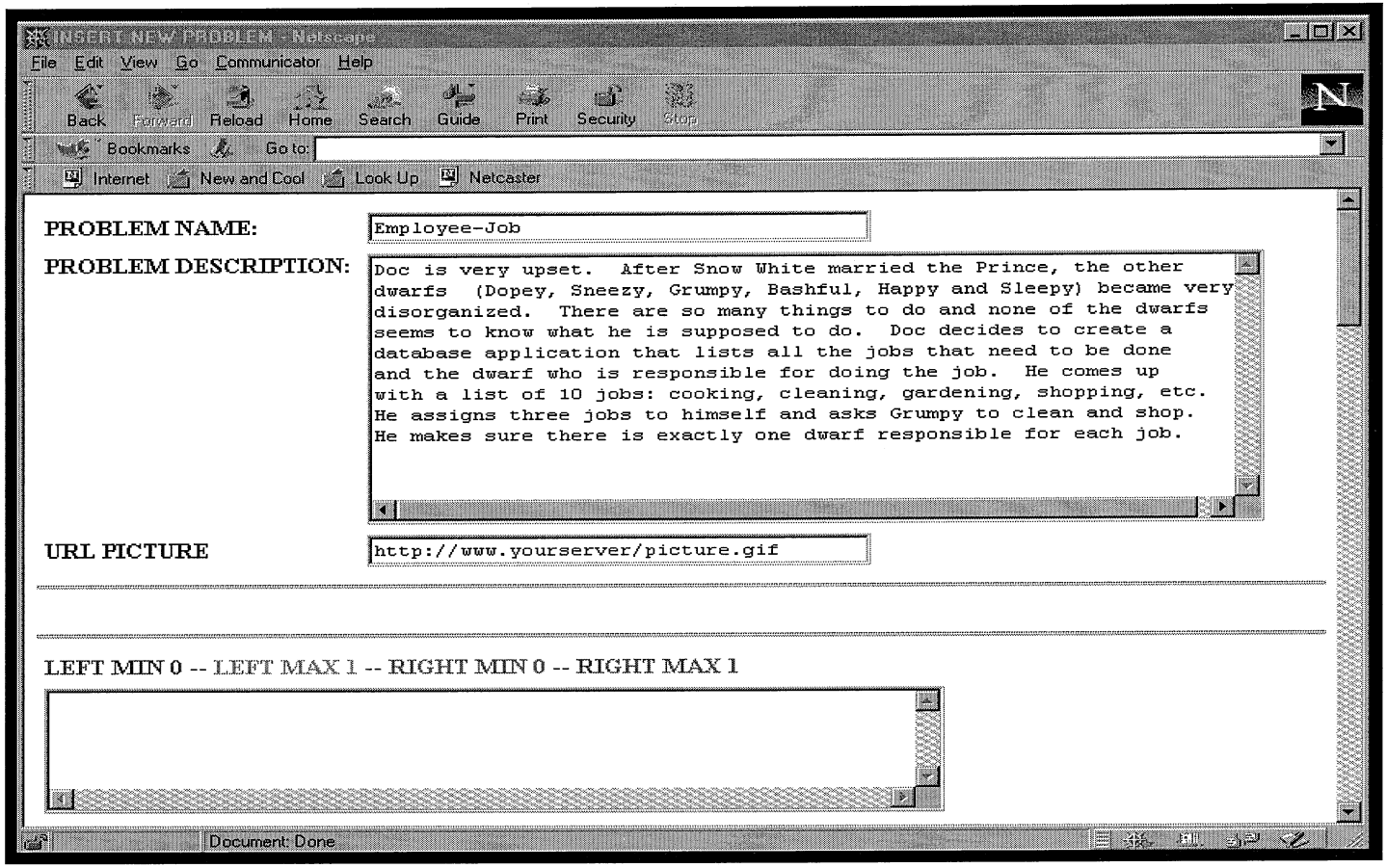

Figure 3
Insert New Problem

programming for data processing on a server nor a backend database was needed. The system showed three major problems. First, many students reported compatibility problems and were not able to use the system from home. Second, students could decide to turn off the e-mail submission causing data not to be recorded. Third, students with some Internet knowledge could look up the answers.

As a result, the main goal of the tool, to make a study tool for cardinalities available to all students at any time, could not be accomplished and the data collected were at best incomplete. One of the authors consulted with Internet experts at one of their universities. The Internet experts recommended that we implement the system illustrated in Figure 2, provided the necessary hardware and software and helped with the implementation of the first version of the tool. The software used is ColdFusion, a middleware product that supports data processing on the central system or server and the use of a backend database. The implementation required a mixture of skills including HTML, Cold Fusion programming, Structured Query Language and design and implementation of a relational database such as Access. The revised system solves the three problems reported above. First, the users reported any compatibility problems. Our data show that students primarily relied on Netscape, Microsoft explorer and AOL, in that order, and they used 46 different versions of these browsers including a beta-version of Microsoft Explorer that was not even available for purchase at that time. Second, e-mail is no longer used and answers are directly recorded into a database. Students get feedback from the study tool only when they submit an answer. Third, solutions are stored in a backend database on a server and cannot be directly assessed by the student.

Although the technological issues we encountered in the prototype were addressed in the revised tool, content issues surfaced when the tool was used by different instructors at different universities. The topic addressed in the tool, cardinalities, is covered in different ways by different instructors. Instructors use different notations, different levels of complexity, and different subject matter in their courses. As such, the set of problems designed by one instructor may not fit the needs of other instructors. Therefore, we added the interface that allows instructors to add their own problems and select a subset of problems that fits the needs of their course. The user interface allows instructors to add and select specific problems without any specialized Internet skills.

Conclusions

This paper explores using the Internet as a new delivery mechanism for study tools. Alternative delivery forms were first compared and the advantages and disadvantages of each discussed. The main advantages of using the Internet for study tools are the flexibility to change the tool and the ease of distribution. Next, an Internet study tool developed by the authors for use in the AIS course was discussed including delivery challenges and content issues and how they were overcome.

Suggestions for Future Research

There are several areas for future research. First, the impact of Internet study tools such as the one discussed in this paper on student performance should to be assessed. Second, alternative uses could be explored. Examples include the design of study tools for AIS topics other than cardinalities and the cooperative design of tool content. We are currently exploring the latter. Finally, the impact of emerging Internet technologies on the design and use of study tools delivered through the Internet should be explored.

Tool Availability: This study tool is available free of charge to any instructor who wishes to use it. Please contact either author for access.

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