A Decision Support System for Student Transfer Advising

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ABSTRACT: *Many students start their academic careers at community colleges. After a year or two, they transfer to a university to complete their undergraduate degrees. Students who make poor course selections at community colleges may find that some of their course credits do not transfer to the university programs of their choice. A decision support system was developed to help community college students (1) understand the structure of university undergraduate degree programs, and (2) identify community college courses that meet university requirements. The system is designed to be easy to use and attractive for the typical community college student. It was constructed by a team of three undergraduate MIS students over the course of a single semester using a Windows-based hypermedia tool.*

Today's educational environment is increasingly diverse, particularly for urban universities [1]. Students starting college can choose between the main campus of a traditional four-year school, a branch campus, or a community college. Some begin at community colleges because of their proximity and low cost, and later transfer to a four-year school. Naturally, these students want to transfer all of their course credits and meet as many university requirements as possible. However, informing students of transfer issues is quite difficult for universities.

A computerized transfer advising system (TAS) is a decision support system to help students understand the transfer process. A system that is useful and easy to use could substantially help students better plan their community college courses. A TAS can also be more available and less expensive than a human counselor.

This paper describes a TAS that helps Oakland Community College (OCC) students understand the process of transferring to Oakland University (OU). The TAS described here is noteworthy in four respects. First, it is an inter-organizational system. The university supplied the developers and a workstation while the community college provided space in its advising center. Advisors at both institutions cooperated in identifying system requirements. Second, TASs are not common. Advisors at both institutions were unaware of any other systems of this type.

Third, the developers used emerging multimedia GUI technology to create a very polished and easy to use system. Students need only a mouse to use it so its workstation has no keyboard!

Fourth, three undergraduate MIS students developed the TAS during one semester. They did all requirements analysis, design, programming and testing. They had no experience with GUI or multimedia tools before the project but still built a high quality product. This attests to the usability of the tools and the students' ability.

PROJECT BACKGROUND

Oakland University (OU) is a state-supported university with 12,500 students about 25 miles north of Detroit. About half its undergraduate business students transfer from another institution. Many come from local community colleges, such as Oakland Community College (OCC), a two-year institution with courses designed to meet a university's general education requirements.

After initial discussions with OCC's counseling staff, it was decided that both OU and OCC would be served by a TAS. The initial project was to develop a system for the counseling center of one of OCC's five campuses.

Because usage of the TAS would be voluntary, advisers and developers felt it needed to be both highly useful and easy to use. Recent research suggests that an individual's intention to use a system voluntarily is highest when the system is useful and easy to use [2]. The student's attitude to the system and the university might also be improved if the system were attractive.

The TAS's usefulness in supporting students' decision processes depended on a number of factors. Most importantly, the system should help OCC students understand OU's requirements and show them which OCC courses satisfy those requirements. They also need to understand the structure of the undergraduate program to help them see why taking some courses might not benefit them. They need a general description of the university (location, services, philosophy, etc.) to help make their transfer decisions. The system should also answer frequently asked questions about the transfer process and university. Finally, the TAS would be more useful if the students could print information for future reference.

Ease of use was also important. Some potential users would not have taken any computer courses yet. Further, most would be casual users, perhaps accessing the system only once or twice. The system should thus be easy to learn as well as use.

Finally, the system should be attractive. Many students are becoming used to high quality software. Those with computer experience would expect a polished, professional

system. Anything less might reflect poorly on the university.

SYSTEM DEVELOPMENT

A team of three students in an MIS projects class developed the system over the course of one semester. The first author supervised the team. This section describes the team, the system development process, and the major challenges the students faced.

The Student Team

The students were all seniors in the undergraduate MIS program at OU. They had all taken classes in workstation techniques, Pascal and COBOL programming, IS in organizations, database management systems, and systems analysis and design. Some of them had taken a data communications class. One had taken a C++ class. Their systems analysis and design class focused on traditional methods such as the systems life cycle (or waterfall) model and prototyping. It did not cover newer techniques such as rapid applications development and joint applications design. Although the students had developed simple systems to meet class requirements, they had not built a complete one before.

The projects class gives students an opportunity to apply skills acquired in the classroom to a real-world problem. Students are exposed to the social and political issues that so often arise in system development, as well as the technical problems they have been trained to handle. This experience occurs in the relatively forgiving context of a class project, where students are expected to learn from their mistakes. Students generally evaluate the class very positively by stating that it is among their most valuable experiences at the university.

The System Development Process

The team used a combined life cycle and prototyping approach. The project's stages were:

Problem Definition

On the basis of the expressed concerns of the head of the OU advising office, the second author suggested the project to the instructor as one for the course. The instructor contacted the head of OCC's advising staff before the semester began. After agreeing on the overall goal and scope of the project, the adviser wrote a two-page general system requirements document. The team's first task was to meet with the advisor and develop a plan, outlining the project's goal, scope, and milestones.

Requirements Determination

The team developed a prototype over the course of about three weeks, working with OCC's senior adviser. Prototyping was used because (1) although the project's goal had been specified, neither the instructor nor OCC's advisers were sure which system features would best achieve this goal, and (2) the advisers were unfamiliar with GUI multimedia technology, and hence were unsure what it could do. The emphasis at this stage was on defining system functionality and structure, largely by establishing the content of the system's screens and defining the user's navigation paths through the system.

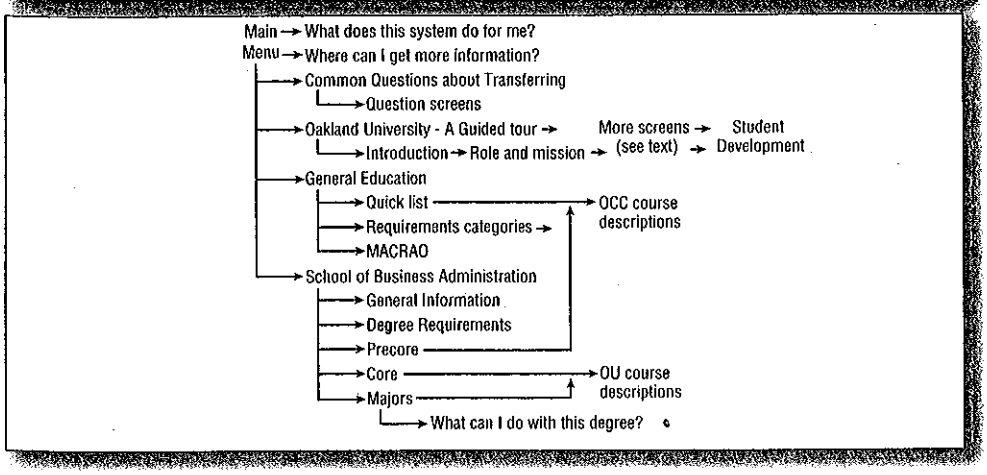
Implementation

The students completed the system based on the prototype. This was done largely independently of the OCC advisers, since the students felt they had a good understanding of the final system's structure and content at this point.

Review, Documentation and Installation

OCC's advising staff were given an opportunity to review the TAS in the final two weeks of the semester while the students completed the documentation. Few changes resulted from the review. Because of delays in equipment delivery, the system was not installed until about two months after the semester ended.

Figure 1: The Structure of the Advising System



Challenges

The students faced several challenges as they attempted to apply their IS knowledge to this real-world case. As they addressed them, they better appreciated issues that are difficult to teach in classroom projects. Three important issues were:

Project Management

The team was responsible for selecting its own leader and managing its own work. Although the instructor made the initial contacts with OCC, defined the project, and monitored the team's progress, the students created their own development plan, set their own goals, tracked goal achievement, and managed conflicts within the team. After the project was completed, the team leader said that this was the most difficult part of the project for him.

Managing Contacts with Various Constituents

The team worked with many people during the project, including (1) academic advisors at both OCC and OU, (2) OU's Instructional Technology Center (ITC) which supplied the multimedia material, (3) other OU offices, such as the admission office, which supplied supplementary information, and (4) the instructor. The team had to understand each group's perspectives and expectations, as well as cope with differences in expertise. For example, the advisers did not possess much technical literacy, although they understood the problem domain quite well. On the other hand, the ITC staff's skill set was exactly the reverse.

Learning the Technology

The system was written in ToolBook, a Windows hypermedia product from Asymetrix [3]. ToolBook applications consist of individual screens, called pages, linked through buttons and text. A scripting language can be used to write event routines that are executed when a given event (such as the user clicking on a button) occurs. ToolBook is specifically designed to support the development of hypermedia applications such as the TAS. For example, it is significantly easier to create "hot text" (that is, text that the user can click to jump elsewhere in the application) in ToolBook than in C++ or even VisualBasic.

None of the team members had experience with GUI or multimedia tools prior to the project. They were naturally concerned about their ability to deliver a working product using a tool that was quite different from those they had used before. However, despite their fears, they were able to acquire the nec-

essary technical skills concurrently with the other project stages. They were very competent with the tool by the end of the project.

The students' ability to meet these challenges was probably attributable to three key facts:

1) The project's sponsor (OCC in this case) was committed to the project.

2) The student team was committed to the project.

3) The sponsor understood the business function (e.g., student advising) and clearly articulated the system requirements.

The advising staff gave the team as much time as it needed, and thought through the requirements. The students were committed to the project from the beginning. There were no significant technical problems. What might have seemed an overly ambitious project given the students' background was achievable within the time available.

SYSTEM STRUCTURE

This section describes the structure of TAS from the user's perspective and shows how someone might apply it. Because TAS provides computerized support for individuals making semi-structured decisions, it can be considered a decision support system (DSS) ([4], [5]). No complex mathematical modeling features are needed for the TAS application. Of course, many DSSs have no such models [5].

Figure 1 shows the structure of the system. After an introductory screen, the user proceeds to the main menu (see Figure 2). Note that the displays shown in Figures 2 to 9 have been edited to meet the constraints of the printed page. The screens that appear in the actual application are at a resolution of 800 x 600 with a palette of 65,000 colors, and contain elements that are not shown in the figures. However, the figures show the general contents of the screens.

A number of options are available from the main menu. All are accessed by clicking on Windows buttons with a mouse. The button "What does this system do for me?" displays text screens detailing the capabilities of the system. The button "Where can I get more information?" directs the user to various information sources at both OU and OCC, such as the academic counseling offices.

The button "Common Questions About Transferring" displays a screen similar to that shown in Figure 3. There are more buttons on the actual screen. Each button displays a text screen answering a question that students commonly ask about either the transfer process, or about OU. The list of questions and answers was gathered from academic advisors at both OU and OCC. The user can print the answer to each question.

Figure 2: The Main Menu

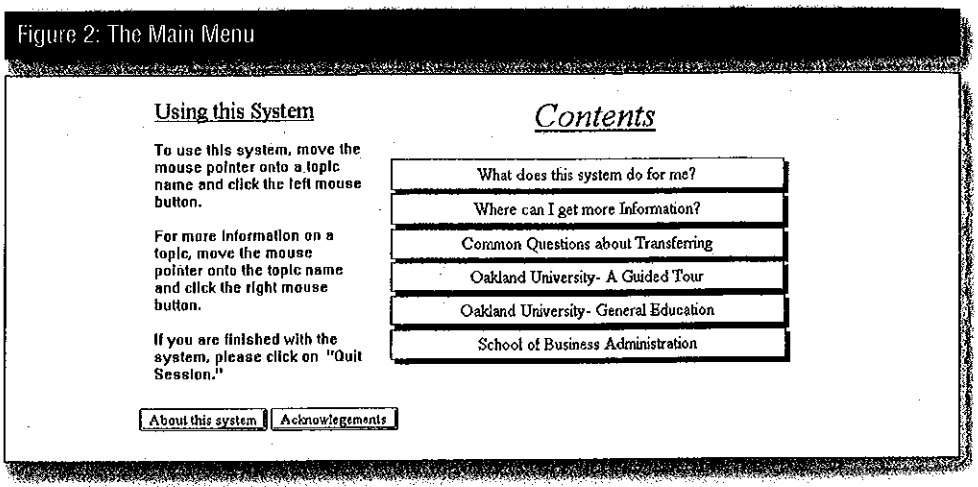


Figure 3: The Common Question Screen

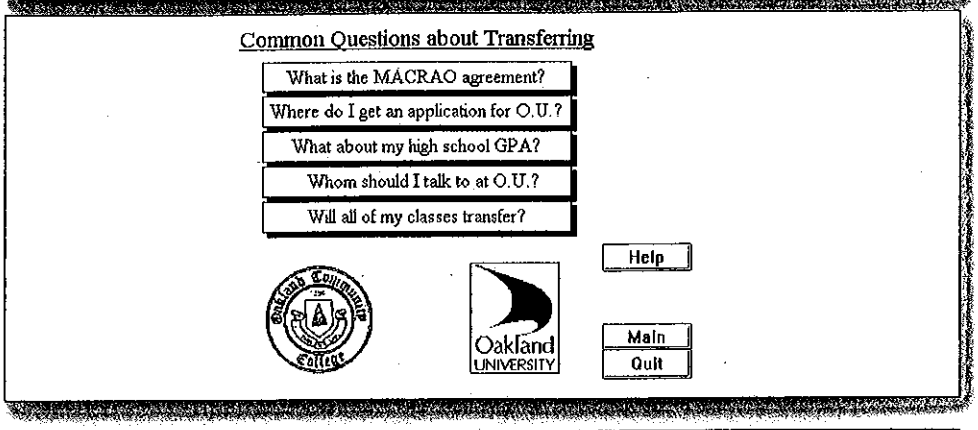
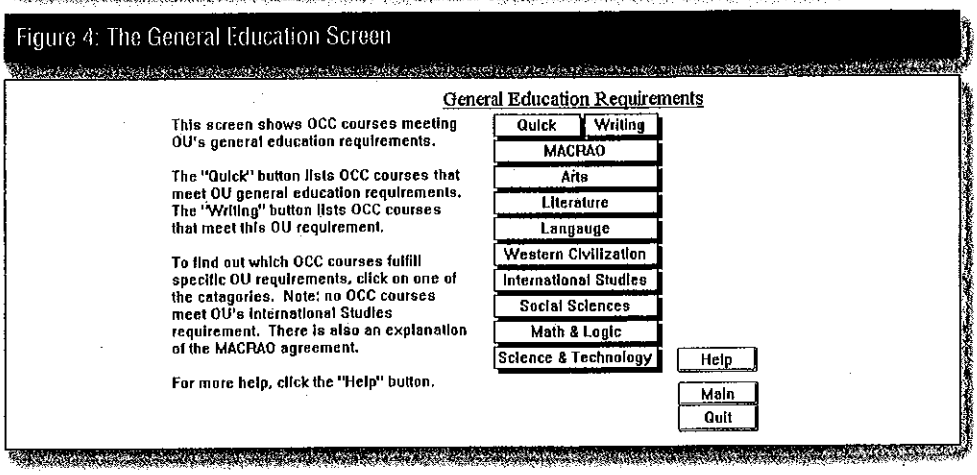


Figure 4: The General Education Screen



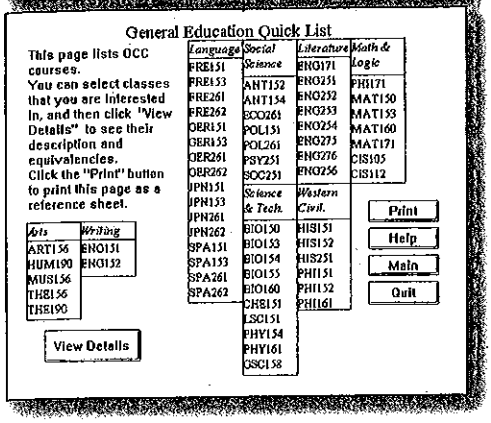
The next button on the main menu screen is "Oakland University - A Guided Tour." This shows the user a sequence of screens describing the university. The sequence consists of a series of subsequences:

1) Introduction
2) Role and Mission
3) Instruction
4) Research and Scholarship
5) Public Service
6) Student Development

As shown in Figure 1, the user can examine the entire set of screens from beginning to end, or can start at the first screen of any of the subsequences. Each screen includes a picture that is appropriate to the text, such as a building, a classroom, a student, and so on. The pictures are high-quality images, digitized with the help of OU's Instructional Technology Center.

The remaining selections on the main menu give the user access to the most important parts of the system. The button labeled "Oakland University - General Education" takes the user to the screen shown in Figure 4. This part of the system explains OU's general

Figure 5: The Quick List Screen



education requirements (a set of requirements that all undergraduates must complete), and lists the OCC courses that meet those requirements. By selecting courses from this list, OCC students can ensure that they are meeting OU requirements.

Figure 1 shows the structure of this part of the system. The "Quick" button lists the number and name of OCC courses that meet OU general education requirements, as shown in Figure 5. Printing the Quick List screen gives the user a convenient summary of these courses. From the Quick List screen, users can access detailed descriptions of each course, as shown in Figure 6. The text box at the bottom of the screen contains a course description as well as any comments by academic advisors, such as when students should take the course. These can also be printed.

Each section of the general education requirements has its own screen, listing the OCC courses that meet that particular requirement. They are accessible from the general education screen (Figure 4). The user can access individual course descriptions from general education section screens as well as the quick list. The "Writing" button shows the OCC courses that meet OU's writing requirement. Finally, clicking the "MACRAO" (for Michigan Association of Collegiate Registrars and Admissions Officers Articulation) button gives the user a description of an agreement among state educational institutions.

Clicking the "School of Business Administration" button on the main menu takes users to the screen shown in Figure 7. This screen describes the requirements for a major in business at OU. The first two buttons give some general information about the School of Business Administration (SBA) and a brief description of the undergraduate degree programs. The next two buttons list the courses that comprise SBA's precore and core classes. Credit for precore classes such an introductory accounting, economics and statistics may be transferred from OCC. Clicking on the "SBA Precore" button shows the OCC courses that are equivalent to courses in the OU SBA precore.

Classes in the SBA core and business majors must be taken at OU. The "SBA Core" button lists the OU courses that comprise the core of OU's business degree. Other buttons on the SBA screen (Figure 7) take the user to a description of the business majors. The screen for the MIS major is shown in Figure 8. Screens for the other majors are similar. The button labeled "What can I do with this degree?" describes the type of employment that someone with an MIS degree can anticipate. Clicking on the "Print" button prints both the screen shown in Figure 8 and the employment description. The courses that make up the degree are also shown. The user can examine the detailed descriptions by clicking on one or more of the course codes and clicking the "View Details" button. This will show a screen like the one shown in Figure 9. This screen can be printed.

TYPICAL USE OF THE TAS

Consider how a typical student might use the TAS. Suppose the student has already completed one year's work at OCC. He is planning on completing another year, and then transferring to OU. From the main menu, the student selects the general education requirements screen, and then the quick list. He knows what OCC classes he has taken, and can see immediately what OU requirements they meet (recall that the general education quick list screen shows which OCC classes meet which OU requirements). The student can also see what requirements he has yet to complete. Printing this screen will give him a convenient summary of OU's general education requirements.

The student now wants to select courses that meet the OU requirements that he has not satisfied. Suppose he wants to see what OCC classes will meet the arts requirement. The student returns to the general education screen (Figure 4), and clicks the Arts button. He will see a description of each OCC course that meets the OU arts requirement (these are the same courses shown in the quick list), one after the other. If the student sees a course that he is interested in, such as MUS 156 in Figure 6, he can print the screen. This will give him a description of the course, the number of the OU equivalent, and the general education requirement that the course meets. The student can take the output home, and make his decisions at leisure.

Now suppose the student is considering pursuing a business degree at OU, and wants to make sure that he makes the best use of his OCC credits. From the main menu, he selects the SBA screen (Figure 7), and reads a general description of the degree. The student is unsure about what major he would pursue. He knows he is interested in accounting, but also enjoys using computers. The student selects the MIS screen, clicks on the "What can I do with this degree?" and prints out a description of what an MIS professional does. He prints the equivalent accounting screen as well. The student can also see and print descriptions of the courses that make up the various majors (Figure 9). This information can help him make a decision.

The student returns to the SBA screen (Figure 7) and clicks on the "SBA Precore" button. He is shown OCC courses that meet OU SBA's precore requirements. He can then plan which OCC courses to take to finish his OCC associates degree, while at the same time helping complete a bachelors degree at OU.

The system has been installed on a PC in the OCC Advising Center, Auburn Hills Campus. The machine is a 80486-based Compudyne machine with 8 Mb RAM, a 200 Mb

Figure 6: OCC Course Description

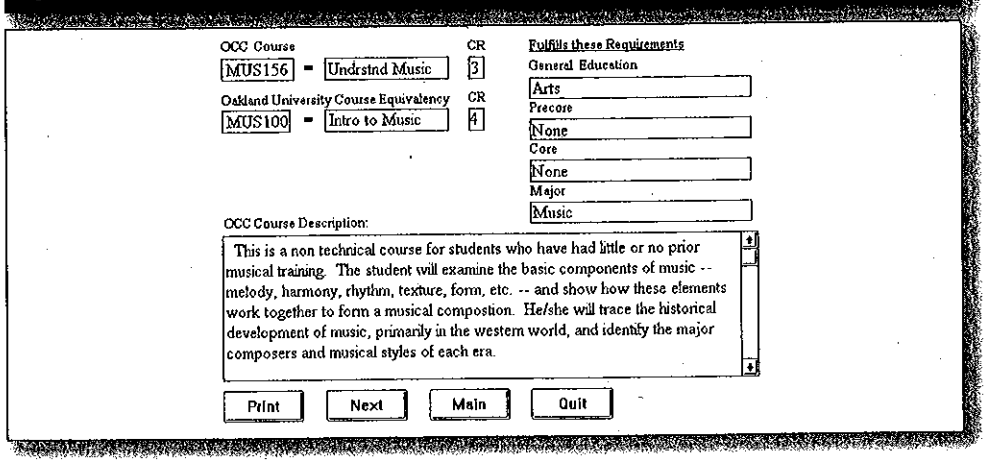
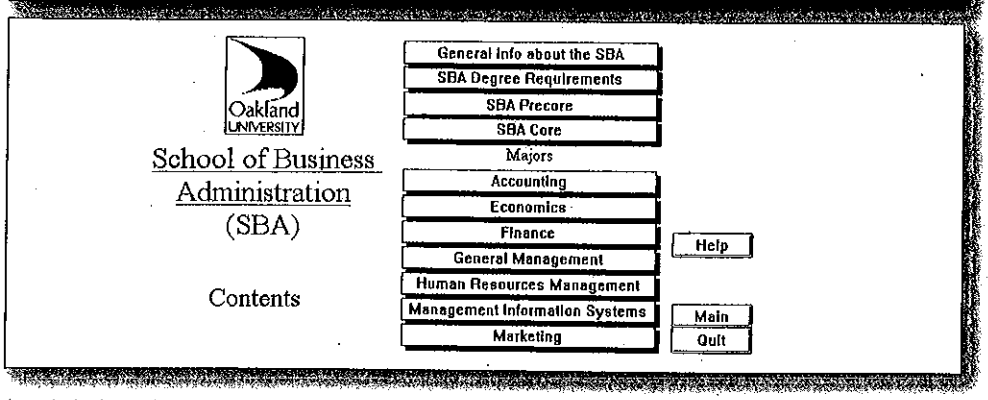


Figure 7: The School of Business Screen



hard disk and a super VGA monitor. The printer is an HP DeskJet, selected because of its low cost and quiet operation. The PC does not have a keyboard attached to it during normal use. A mouse is all that is necessary to use the system.

EVALUATION

Reactions to the system from students, faculty, advisors and other university and community college administrators (including OU's president) have been uniformly positive. They have been particularly impressed with the system's ease of use, saying that it is one of the most straightforward systems they have encountered. The advisors at OCC stated that the system contains the information students need to understand the transfer process. Students who have tested the system found it easy to use effectively. The OCC advisors were also satisfied with the development process, saying that the team was skilled and professional.

To further evaluate the system, students at OU were asked to examine TAS and complete a questionnaire measuring its usefulness (U) and ease of use (EOU). The technology acceptance model (TAM) includes U and EOU as predictors of intentions to voluntarily use an information system [2]. The model applies well to this case, since TAS use is voluntary. TAM has been shown to predict intention to use a variety of technologies, including word processors [2] and spreadsheets [6]. Existing instruments for U and EOU have good psychometric properties ([2], [6]).

The instruments were adapted from [2], substituting the name of the system and the name of the task as appropriate. Each instrument consisted of six items. Figure 10 shows a sample item from each instrument. Rather than ask subjects to evaluate the TAS in a structured setting, the system was made available in an open PC laboratory. The subjects used and evaluated the system at their leisure. This procedure reflects the way TAS would be used in practice.

Table 1 shows the results. The data suggest that the students found the system to be useful as well as easy to use. To provide a comparison with other systems, the ratings were contrasted with those found in [6] using independent t tests without assuming equal sample variances. Welch's correction for the Behrens-Fisher problem (which occurs when the sample variances are not assumed to be equal) was applied, reducing the degrees of freedom [7]. The analysis showed that the usefulness and ease of use scores for TAS were significantly higher than those found in [6].

A limitation of the data is that OU, rather than OCC, students were asked to examine TAS. However, (1) many of OU's students are drawn from community colleges (including 10 of the 24 in the sample), and (2) the means for U and EOU are so high that even a significant drop in their values would still result in positive evaluations.

ENHANCEMENTS

Many enhancements could be made to the system. First, the system could be installed on other campuses within the OCC system. This would involve a more significant hardware expenditure, but little system development effort. Second, the system could be adapted to other community colleges. This would require a relatively small amount of programming. Third, the system could be extended to include other majors besides business. This would require more development resources, although the general architecture of the system would not change.

Other changes would be more significant. It would be possible to link the advising system to OCC's student information system. The advising system could then download a student's academic history, and adjust its output accordingly. This could be done at varying levels of complexity, from simply noting which classes a student has taken, to considering scheduling and prerequisites. This would be a complex undertaking. Many inter-organizational administrative issues as well as technical challenges would have to be addressed.

It is possible that the TAS could change the tasks that advisors perform. Many students' questions are routine. If students are initially referred to the system, the TAS could answer many of these questions. Advisors could then focus on cases that require more expertise. However, whether the system has these effects depends on whether the advisors are willing to make the necessary organizational changes. If they still want to review every student's case, then, while the students will still benefit from TAS, the advisors' roles will not change.

SUMMARY AND CONCLUSION

Students, particularly those in urban environments, can pursue their educational objectives at a variety of institutions. Those transferring between institutions often find that some of their hard-earned credits are useless at their destination university. This paper describes a transfer advising system (TAS) that

Figure 8: The Management Information Systems Screen

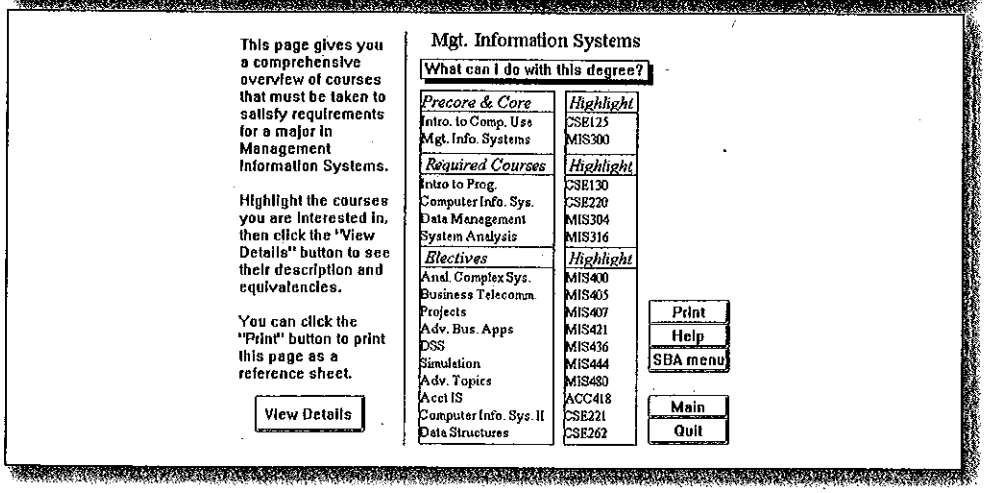
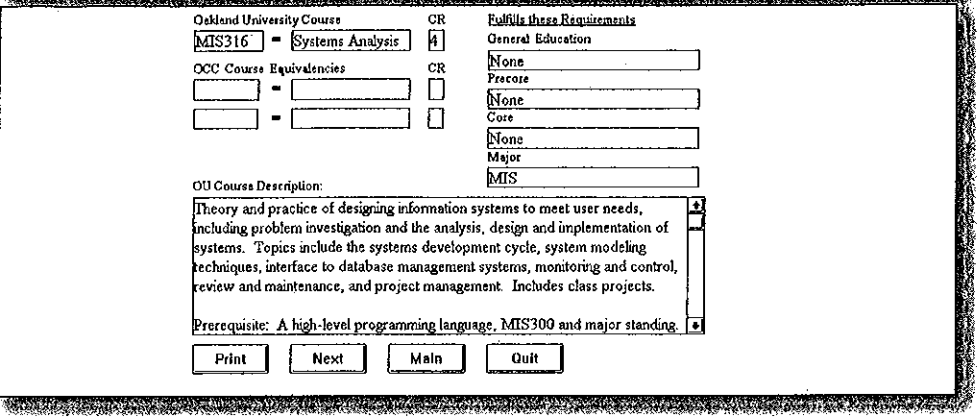


Figure 9: A Typical Course Description Screen



(1) explains the structure of university undergraduate degree programs, and (2) identifies community college courses that meet university requirements. By carefully choosing which courses to take at community college, students can make sure that their credits can be applied to their university degree. The TAS also provides general information about the university and the transfer process. It employs a graphical user interface and a pointing device to enhance ease of use. The system was developed by a small team of undergraduate MIS students using ToolBook, a hypermedia product.

A number of lessons were learned during the project. First, community colleges and universities can cooperate with each other to the benefit of transfer students. Universities often adopt their own set of rules and demand that others abide by them. Students are the ultimate casualties of such policies. While institutional cooperation can benefit the community college and the university, those who gain most are students, who can make an easier transition from one campus to another. We thus recommend that other MIS instructors seek opportunities for their projects class to contribute to such cooperative efforts.

Second, the student development team was able to deliver a polished system in a single semester. This included the time needed to learn the tool itself. Even though ToolBook is not particularly difficult to use, it required the students to learn a set of concepts (e.g., event-driven programming) they had not encountered before. The project also gave the team a better perspective on the realities of project management and interpersonal cooperation, something that is often difficult to achieve in the classroom. We thus recommend that other MIS instructors adopt emerging technologies in their projects class even though at first glance the technologies may appear challenging to the students.

Third, based on the factors to which we attribute the success of the project, we recommend that project course instructors seek project sponsors who are committed to the project and understand the business function well. Instructors should also encourage student commitment to the project.

The system is currently being used at a single site, but if it is successful it may be extended to others. Although it does not replace human advisors, it is a useful tool in simplifying the transfer process.

Figure 10: Sample Usefulness and Ease of Use Items

Sample Usefulness Item:

Using the transfer advising system (TAS) would enable me to quickly identify classes that transfer.

Sample Ease of Use Item:

I would find it easy to get the TAS to do what I want it to do.

Table 1: Usefulness and Ease of Use Ratings for TAS

		U	EOU
TAS	Mean	5.92	6.42
	SD	0.92	0.60
	n	24	24
Mathieson (1991)	Mean	5.28	5.084
	SD	1.21	1.26
	n	139	139
Comparison	t	2.50	5.09
	df	161	161
	significance	< 0.01	< 0.001

TAS ratings are compared with data from Mathieson (1991). The t tests were both two-tailed.

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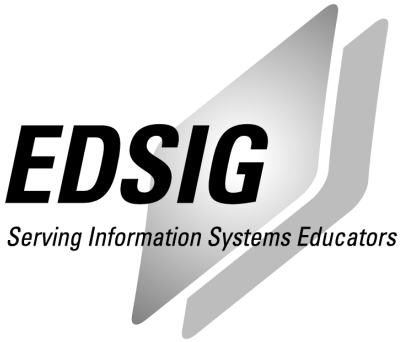

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