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The Development and Use of an Information System to Manage the Graduate Student Admissions Review and Advising Processes

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Abstract:

Graduate degree programs regularly review admission application portfolios that can include an application for admission, a resume, recommendation letters, and unofficial transcripts. Review of application portfolios is time consuming and labor intensive. To ensure the review process is consistent and fair to all applicants, it should follow a set review process that is well documented. Also, the admission review process should use an information system to reduce evaluation errors and to accumulate useful demographic data that can aid in the assessment of target marketing and program accreditation efforts. Furthermore, the system should allow programs to accumulate advising and degree program planning data that helps ensure students remain on track and successfully complete their programs of study. A small private college in Alabama developed a system in the fall of 2017 to address this need. Since then, the system has been used to manage an MBA program with various concentrations and four graduate certificates within the college's Business Division. This paper will describe the design and features of the system that can be replicated and used by other graduate programs. The paper will also provide suggestions for improvement through future revision to the current system.

Keywords: Graduate student applications, admissions software, student advising, information system.

1. Introduction

Academic institutions accumulate an enormous amount of data each year. This data can originate from student admission applications, transcripts from other academic institutions, student registration, financial aid, billing, assessment, advising, and other sources. Most of this data is housed in large database systems that are managed by information technology departments. These systems such as CX® from Jenzabar Inc. are designed to be generic in nature to accommodate more customers. Although these systems are generic, they undergo modifications to a variety of their parameters to meet the needs of each academic institution. This modification process is ongoing, expensive, and consumes a significant percentage of information technology departments' budgets.

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Although large systems such as CX® can be modified, they cannot meet the entire needs of an academic institution. Therefore, academic institutions utilize many other information systems. Some of those systems such as Canvas® or Blackboard® facility the learning process by housing course materials that are accessible by students and faculty, while other systems are used to manage data the larger systems such as CX® are not designed to support. For example, faculty credentialing software is usually not supported by these larger systems, which often requires the use of smaller database systems such as Sadona® that are designed for this specific purpose.

A significant problem with larger database systems such as CX® is the time, effort, and resources required to modify them. This drawback often pits academic administrators who need quick and flexible data management solutions against information systems departments with limited budgets and personnel. Therefore, academic institutions may need to develop small solutions using available inexpensive database technology, such as Microsoft Access®, to store and manage data that existing systems cannot.

Graduate programs in various academic institutions can benefit from small information systems, since they have different student admission procedures than undergraduate programs. These graduate degree programs regularly review admission application portfolios that can include an application for admission, a resume, recommendation letters, and unofficial transcripts. Review of application portfolios is time consuming and labor intensive. To ensure the review process is consistent and fair to all applicants, it should follow a set review process that is well documented. Also, the admission review process should use an information system to reduce evaluation errors and to accumulate useful demographic data that can aid in the assessment of target marketing and program accreditation efforts. Furthermore, the system should allow programs to accumulate advising and degree program planning data that helps ensure students remain on track and successfully complete their programs of study. A small private college in Alabama developed a system in the fall of 2017 to address this need. Since then, the system has been used to manage an MBA program with various concentrations and four graduate certificates within the college's Business Division. This paper will describe the design and features of the system that can be replicated and used by other graduate programs. The paper will also provide suggestions for improvement through future revision to the current system.

2. Literature Review

A review of existing literature revealed little research that explores the development and use of technology or database systems to manage academic administrative or admission review data at the department or program level. Most of the existing research on academic institution software seems to center on systems with a larger scope that can address the needs of multiple departments across campuses. One of these limited number of studies that address smaller and more specific needs explored the development of an early alert database system to improve Science, Technology, Engineering, and Mathematics (STEM) student retention (Khoury et al., 2012). In this study, the authors described the design elements and application of a database system that allowed faculty to submit early alert notices for STEM students that are experiencing difficulties that need intervention, with the aim of improving student retention and persistence in academic programs. A previous study by Arnold (2010) explored the benefits of such systems and their effectiveness in achieving their intended purpose.

Another study of limited scope discusses the use of technology to manage academic administrative data by exploring the use of web-based forms to manage student course exception data, where students would seek permission to enroll in closed classes or into classes where they do not meet the prerequisites (Khoury et al., 2015). The article describes the benefits gained by applying technology to address a common problem faced by all academic programs of study that attempt to manage student exception data each semester.

Although there is limited research on the use of technology to manage academic administrative data on the department level, there is some literature that points to the need for such technology. Some studies looked at the use of technology to manage the admission review process throughout academic institutions (Fujo, 2019; Hoover, 2017; Mincer-Daszkiewicz, 2004; Purnomo et al., 2019; Tuhuteru & Siwalette, 2022). Due to a decrease in enrollment throughout the United States, schools are taking proactive steps by using technology and experimenting with different approaches to attract and retain students (Honey & Carrasco 2023; Hoover, 2023; Mishra, 2016; Rios, 2021). Some schools are now going as far as using artificial intelligence (AI) to aid in academic administrative tasks (Clark, 2023). Although the use of technology to aid in the student admission process is getting more attention lately, there is evidence in the literature that shows it was valued by faculty and program directors many years ago (Mincer-Daszkiewicz, 2004), but has since taken on a new sense of urgency.

There is also limited current research on the use of academic advising software or automated advising solutions. In one of these studies, community college transfer students were surveyed and interviewed to determine the features they would like to have in a new online advising software solution and found that students would like a system that automates arduous academic advising tasks, reduces ambiguity, helps avoid mistakes in course planning, and enables online advising (Nguyen et al., 2023). Some of the other studies identified in the literature review that looked at the use of technology for academic advising include Nachouki and Naaj (2019), Mendez et al. (2021) and Laghari (2014), while other studies such as Hart-Baldridge (2020) looked at faculty perceptions of the advising process. A common perception among the literature is that advising is time consuming, not consistent, and a disliked task, yet most faculty realize the value student advising provides, if done correctly. To improve the advising process some researchers such as Noaman and Ahmed (2015) have developed frameworks, while others evaluated proposed or current solutions (Laghari, 2014; Nachouki & Naaj, 2019; Mendez et al., 2021).

Other technologies such as Radio Frequency Identification (RFID) have been used to manage administrative processes for years as well (Kurniawan, 2018). In addition to RFID, schools have used business intelligence (BI) software for years to aid in administrative tasks (Sujitparapitaya, 2012). Another common type of information system that has been widely used for years in schools is enterprise resource planning (ERP) systems (Scott & Wagner, 2003). These systems, commonly referred to as ERP systems, integrate various information systems into one centralized database system that utilizes networking technology to allow various faculty, staff, and students to interact with the same set of data in real-time. As noted above, these large campus wide systems such as Banner® are expensive and difficult to modify, because they are large, complex, and designed to fit the needs of many different schools. Therefore, they are not likely to meet the entire or specific needs of every academic department within various academic institutions.

Implementing ERP systems in schools can take years and cost millions of dollars, yet as much as 80% will end up not meeting expectations (Mehlinger, 2006; Shatat & Al Burtamani. 2019, Ullah, 2018). Regardless of this grim statistic, academic institutions adopt these complex systems because they can improve customer service levels, integrating an organization's various information system needs, and lead to the same benefits realized in industrial ERP implementations (Abdel-Haq, 2020; Chaushi, 2018; Soliman & Karia, 2016).

Despite the wide use of ERPs on college and university campuses, there still appears to be a need for specialized smaller systems that can be quickly implemented within an individual department. This paper will describe the design and use of such a system in a small private college and ultimately address an area of research that has not received much attention.

3. Background

A small private college in Alabama utilizes CX®, an ERP system provided by Jenzabar Inc. to manage most of its information management needs. This system integrates areas such as billing, student registration, course and program completion data, and other student related data. A separate system is used to manage graduate student admissions applications. Graduate student applications for programs within the Business Division are received and managed using Salesforce®. When applicants complete an online application in Salesforce®, they select from one of four concentrations within the MBA program or one of four graduate certificates. Once an application is completed and unofficial transcripts and the applicant's resume are received, the graduate program director is notified through email by the Center of Online Learning that the application packet is ready for review. The director will then review the materials and application in Salesforce® before deciding on the applicant's admission. A student can be accepted conditionally or unconditionally, or they can be rejected for not meeting the minimum requirements. Once the new student is accepted, their demographic and program related data is entered into CX® by the Center of Online Learning, since all graduate programs in the Business Division are fully online.

The Business Division, with the aid of the Center of Online Learning accepts applications on a rolling basis. Students can begin their fully online program during one of the six accelerated seven-week semesters throughout the year. Since the programs are accelerated, students can complete the program in little as 10 months or they can take their time by taking one class a semester or they can even skip semesters if they need to. To remain active in these graduate programs, students must take at least one class in a calendar year and complete the program of study within six years. They must also maintain a 3.0 grade point average (GPA) and meet other academic standards.

To maximize the chances of student success and program completion, each student is assigned one or more advisors. The advising process is mostly a manual process, since the college does not utilize advising software and instead faculty and directors utilize paper-based program check sheets for each program to advise and track student progress within each program. A copy of the advising sheet is maintained in the student's advising file. Advisors also utilize CX® while advising students by using the system's degree audit and unofficial transcript features.

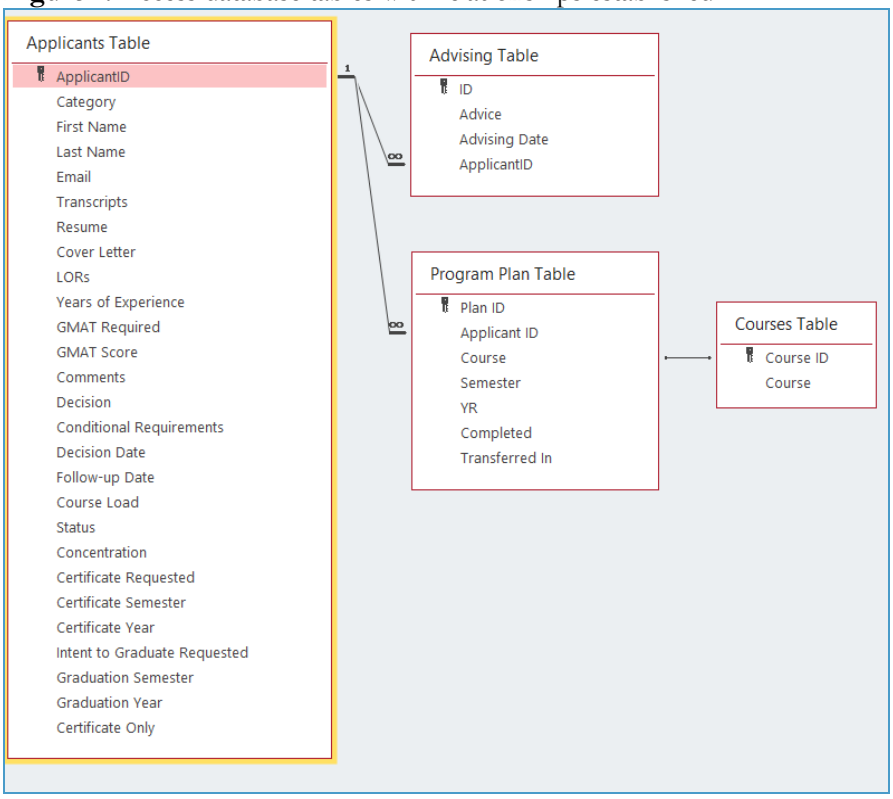
Graduate student advising in the division can occur at any time, since there are six different semesters when students can start a program and register for classes. Also, since students can skip semesters and register for classes when they return, the graduate program director may need to advise and clear students to register for classes anytime during the year.

The manual application review, advising, and degree planning processes described above are time consuming and prone to errors. To streamline these processes and facility data gathering, a Microsoft Access® database system was designed, developed, and deployed in 2017. This system automated the graduate student application review, graduate student advising, and degree planning processes. This system also reduced the time to complete these tasks and enabled routine reporting that aids in marketing efforts and decision making.

4. System Design and Features

Microsoft Access® was selected as the database management system to use for this system because it is readily available, flexible, and ideal for small database systems that can be developed quickly. During the systems analysis and design process, an entity relationship diagram was developed that resulted in the database tables with the established relationships depicted in Figure 1. The Applicants Table serves as the main table in the database, where initial data is entered into the system. This initial data comes from the online applications and admissions packets the director reviewed for each applicant. Once the director makes an admission decision on an applicant, the decision information is also entered into the Applicants Table.

Figure 1: Access database tables with relationships established.



To reduce the chances of input error or the editing of the wrong record, input forms were designed and built to facilitate data entry and editing. Figure 2 depicts the main applicant data entry form that feeds data into the Applicants Table. All input forms in the system include data integrity rules, dropdown lists of choices for certain fields, and other constraints to further reduce input errors. One example is the category field that allows the user to select from a dropdown list of possible categories the applicant falls into. This field enables the categorization of each applicant into a specific demographic, which helps with the assessment of the department's target marketing efforts. The built-in category count query can be accessed anytime and filtered for a specific period, since it searches for data in this field. Table 1 displays a sample category count query.

Figure 2: Applicants form.

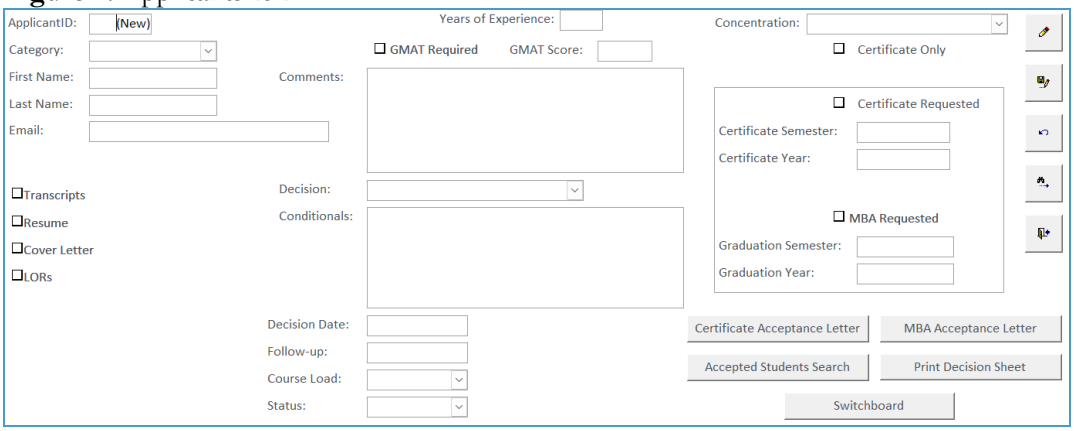


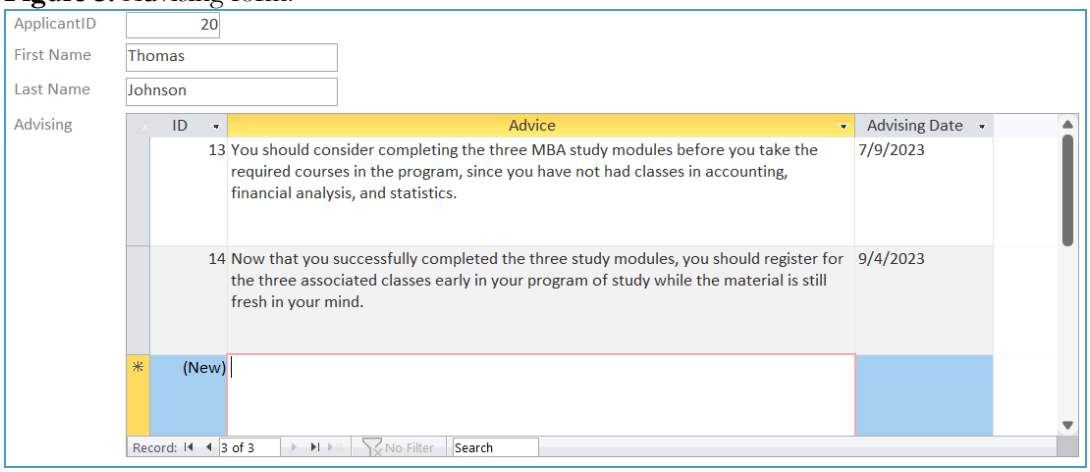
Table 1: Sample Category Count Query.

Category	Count
Other	124
Coast Guard	92
Previous Undergraduate Student	68
Staff	21
International	5
3+1 Student	3
Chamber of Commerce	2

Another field that contains a dropdown list is the decision field which allows the user to select from one of three categories: Accepted Unconditionally, Accepted Conditionally, and Rejected. A different decision letter is generated based on the value of this field. The automatic generation of decision letters saves the director a considerable amount of time because the applicants name, the decision, and conditions are automatically added to each letter. The letter can then be emailed to the applicant, which reduces the amount of paper used in the admission review process.

The Advising Table depicted in Figure 1 is used to accumulate advice given to students accepted into one of the various graduate programs in the division. The director, who serves as the advisor for all graduate students in the division, will be able to see every piece of advice they give to each student they advise. This information is helpful for continuity purposes, should the director's position have a change in assigned personnel. Also, the Advising Table can serve as a documentation trail. An input form is also used to enter and edit data in the Advising Table for each student. Figure 3 provides a screenshot of the Advising form that is directly connected to the Advising Table.

Figure 3: Advising form.



Since there is a one-to-many relationship between the Applicants Table and the Advising Table through the ApplicantID field, each student's one or more advising records in the Advising Table is directly related to an associated student record in the Applicants table. Referential integrity with cascade update related records and cascade delete related records was set when the relationship between the two tables was established in the relationship dialog box as depicted in Figure 4. This ensures that records in the secondary table (Advising Table) are always related to associated records in the primary table (Applicants Table). The primary table is often called the parent table, while the secondary table is often called the child table. By setting the cascade delete related records option when establishing the relationship, orphan records are avoided. Orphan records are created when a record in a parent table is deleted but the associated records remain in the child table. The cascade delete related records feature will force the automatic deletion of child records when a parent record is deleted.

The Program Plan Table depicted in Figure 1 is used to create and manage the degree plan for each student in the system. A one-to-many relationship was created between the parent table (Applicants Table) and the child table (Program Plan Table). Referential integrity with cascade update related records and cascade delete related records was also set when the relationship between these tables was created. Since a student may decide to complete another graduate program in the division, allowing more than one degree program plan to be associated with a student record in the system prevents duplication of student data in the Applicants table if a student continues their studies to earn more than one graduate degree.

Also, allowing more than one program plan record in the Program Plan Table for a student will allow the director to maintain historical degree plans for prior programs. Like other input and edit forms that allow the director to feed and edit data into other tables in the system, the Degree Plan form was created that directly links to the Program Plan Table depicted in Figure 1. Figure 5 presents a screenshot of the Degree Plan form. A significant feature of the system is the ability to produce a current degree plan by clicking on a button on the Degree Plan form shown in Figure 5. A sample degree plan is depicted in Figure 6. This plan can be printed or emailed to the student from within the system.

Figure 4: Relationship dialog window.

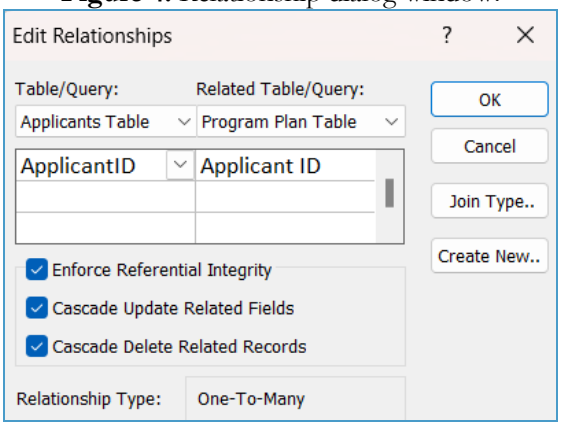


Figure 5: Program plan form.

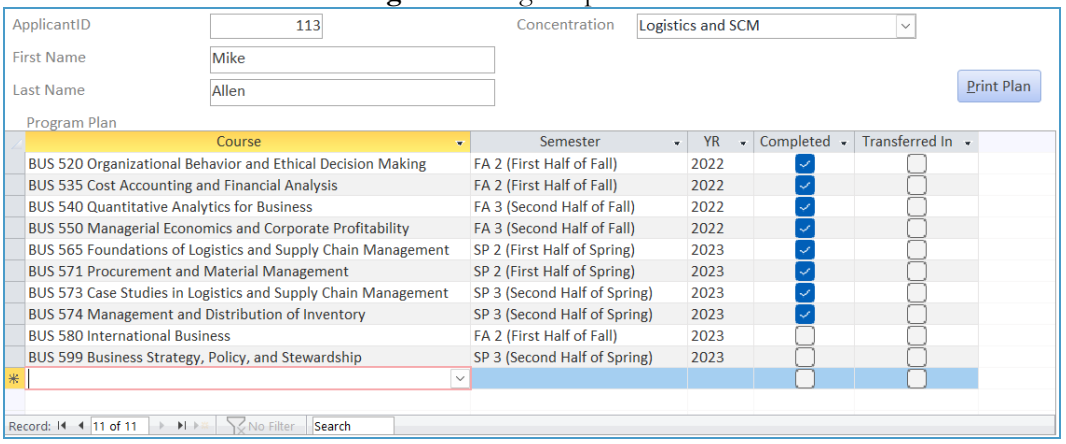


Figure 6: Sample program plan.

Program Plan Report

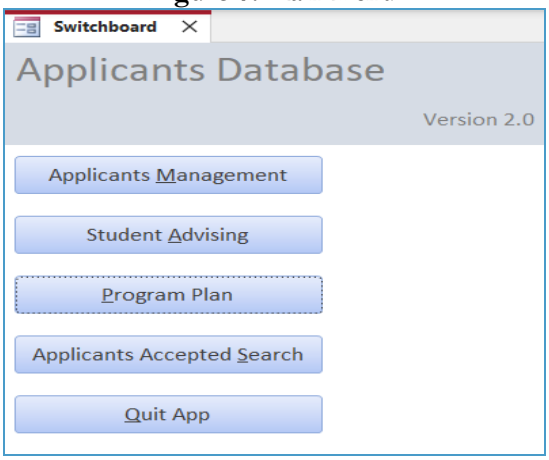
Plan ID	First Name	Last Name	Conditional Requirements
113	Mike	Allen	

			Completed	Transferred In
BUS 535 Cost Accounting and Financial Analysis	FA 2 (First Half of Fall)	2022	☑	☐
BUS 520 Organizational Behavior and Ethical Decision Making	FA 2 (First Half of Fall)	2022	☑	☐
BUS 550 Managerial Economics and Corporate Profitability	FA 3 (Second Half of Fall)	2022	☑	☐
BUS 540 Quantitative Analytics for Business	FA 3 (Second Half of Fall)	2022	☑	☐
BUS 580 International Business	FA 2 (First Half of Fall)	2023	☐	☐
BUS 571 Procurement and Material Management	SP 2 (First Half of Spring)	2023	☑	☐
BUS 565 Foundations of Logistics and Supply Chain Management	SP 2 (First Half of Spring)	2023	☑	☐
BUS 574 Management and Distribution of Inventory	SP 3 (Second Half of Spring)	2023	☑	☐
BUS 573 Case Studies in Logistics and Supply Chain Management	SP 3 (Second Half of Spring)	2023	☑	☐
BUS 599 Business Strategy, Policy, and Stewardship	SP 3 (Second Half of Spring)	2023	☐	☐

The data in the Degree Plan Table also helps in course scheduling once all the degree plans have been entered into the system, because the director can run a report that shows the number of students that need a particular class in any given semester. Being able to offer the correct number of sections of each course and to offer only courses that are likely to make, reduces the time it takes to develop and maintain course schedules each semester and helps ensure students graduate in the semester noted in their plan of study. If only a few students need a course each semester, the director may not offer the course and instead will offer the course when more students need it. The director can easily identify those students that were planning to take it and adjust their degree plans accordingly. The director can then generate a new degree plan for those students.

To ensure the system is user friendly, a graphical user interface with a main menu was developed with buttons to allow the user to access the three forms described above and shown in Figures 2, 3, and 5. The main menu for the system is depicted in Figure 7.

Figure 7: Main menu.



5. Limitations

The Graduate Students Management and Advising System described in this paper has some limitations worth noting. The system was designed as a desktop application for a single person's use but can be structured to allow for multiple users over a shared network. The tables would have to be placed in a separate database from the remaining database objects (forms, queries, and report) and links would need to be established between the two databases. The link table management wizard in Access® can be used to establish the links between the two databases. The database containing the tables would serve as the back-end portion of the system that would be housed on a shared server, while the other database with the remaining objects would serve as the front-end portion of the system on separate desktop computers. This structure allows multiple users to interact with the same set of data maintained in the back-end database. Such a shared network setup would be limited to about 10 or fewer users to avoid record locking errors and other Microsoft Access® limitations.

Another limitation of the system is that it is not a web-based system. Although Access® databases can serve as web-based back-end systems, other database management systems such as MySQL are more secure and scalable options. A web-based user interface connected to a back-end database built in MySQL would enable numerous simultaneous users. Although this system has been carefully designed, tested, and used since 2017, it was used only in one department in a small college. Additional implementation of this solution would further validate its usefulness in managing the graduate student admission and advising process.

6. Suggested Future Revisions of the System

The second version of the Graduate Students Management and Advising system described above has undergone numerous changes from the previous version. Regardless, additional revisions to the system should expand the capabilities of the system. One possible change to the system is the migration of the system to MySQL since it is a more secure and web capable database management system. Development of a web-based version of the system would allow the director to use the system from any location with an Internet connection. Also, simultaneous user connections would no longer be a limitation of the system.

Additional features of the systems should also allow current graduate students to access advising and degree planning screens using web-based forms that allow them to interact with the system. They would be able to update their degree plans as their situations change and print copies anytime. They would also be able to review previous advice they received. These features should improve communications between students and advisors. An additional feature should be added that allows students nearing completion of their degree programs to submit an online intent to graduate form. This task is currently done manually, where a student completes a paper-based form that is signed and emailed to the director for their signature about four months before the student is expected to graduate. After the director signs the intent to graduate form, it is sent to the registrar's office for processing.

Automating this task by integrating it into a web-based version of the system would reduce paperwork and confusion when determining if a student nearing graduation submitted their intent to graduate form. The system should also prompt students that are nearing completion of their program of study to complete the intent to graduate form directly in the new version of the system.

Advanced reporting that generates the course schedules for each semester would also be useful and reduce the time it takes to develop course schedules. Since all the graduate classes in the program are online classes, the assignment of rooms and meeting times is not necessarily. The only additional data needed in the system would be the assigned instructors' names and the semesters they are teaching the classes. A table called Assigned Instructors could be added to the system with a relationship established with the Courses Table depicted in Figure 1. The relationship should be a one-to-many relationship, where one record in the Courses Table is related to many records in the Assigned Instructor table. A field called Course ID would be included in the Assigned Instructors table, which will serve as the foreign key in the Assigned Instructors Table. A foreign key is a field that is associated to a primary key field in another table. Each table usually has a primary key field that uniquely identifies each record in the table. The primary keys of each of the tables in the current version of the system are shown in Figure 1 with a key symbol next to them.

7. Conclusion

In summary, this paper presents an automated solution to a common academic task not addressed in the literature by presenting a database solution that was initially developed in 2017 and underwent several changes that resulted in the current version of the system. This system with its useful features can be replicated by other academic institutions with graduate programs that are looking for a similar solution to address their graduate admission review and advising needs. Since the fall of 2017, over 430 student records were entered and managed by the Graduate Students Management and Advising System. The system reduced countless hours manually creating acceptance letters, advising students, and managing degree plans. The system also aided in the development and modification of graduate class schedules. The accumulated data also allowed the director to assess target marketing efforts in real-time. Furthermore, the system aided in student retention and led to improved graduation rates, since the director had a more holistic view of students' progress throughout their programs of study.

Although the current version of the Graduate Students Management and Advising system has some limitations as outlined above, future versions can address those limitations and add additional features beyond those discussed in this paper. Future studies should assess the usefulness of those versions and identify necessary changes needed to improve them.

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