# AN AUTOMATED ADVISING SYSTEM FOR COURSE

# SELECTION AND SCHEDULING[*]

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## ABSTRACT

Less than ¾ of freshmen at four-year institutions return for a second year; the percentage is even lower for students at two-year institutions. While the causes for such attrition are complex, inaccurate advising is clearly a contributing factor. The first author developed an expert system for advising freshmen several years ago that did not address scheduling, an important factor in advising students. In this updated version of the program, the issue of scheduling is addressed and the re-engineered system is specified. The authors described two versions, built to meet the advising criteria of two different undergraduate institutions as well as discussing the design of a general model that can be customized for the needs of other schools.

## INTRODUCTION

Too many of the nation's students do not finish college. Statistics compiled by ACT[1] showed that only 51% of four-year college students graduated within five years of high school graduation. Only 42% of students attending the public institutions surveyed by ACT graduated within the timeframe. While many of these students may have graduated eventually, a large number do not. These figures are even worse for students in two-year institutions, where only 36% earn a degree within three years. This attrition starts in the freshman year. In 2001, only 74% returned to their four-year institution for a second year. Among freshmen in two-year institutions, only 54% returned for a second year.

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This implies that the students in public two-year colleges are far less likely to finish their studies. Yet the nation's community colleges are important because they play a vital role in providing quality employees. According to a study by the American Association of Community Colleges and ACT[2], over half of community college students are first-generation students and are more likely to be older and minority students.

While there are many reasons that students are dissatisfied with their original choice of college, inadequate academic advising is clearly one of the reasons. Academic advisors are either administrators specializing in this area who frequently lack the expertise in the various disciplines in which they advise students or they are college faculty who lack the expertise in advising students regarding academic concerns outside their own disciplines. In either case, the broad number of majors from which students may choose as well as the many special cases that advisors encounter exacerbates the problem. These special cases include students interested in double majors that may or may not be related and students who have been unable to choose a major.

There are many factors involved in student attrition and while the student's poor academic performance is frequently a factor, it is only one of several. Generally, students tend to leave colleges to which they do not feel a personal connection. Poor academic advising plays a role in this. If students do not feel that they have received good advice from whatever counselors they have, this undermines a sense of connection to the institution as well as hurting their academic performance.

Better academic advising increases the probability of the student staying in school. It improves the chance that students will feel that the institution cares about them, it improves the likelihood that they will succeed in their classes and that they will continue to make progress in the field of study that the student chose. Given that student-professor interactions are more positive when the student is performing better academically, it leads to better interactions with professors as well as with peers. This leads to better retention, improved morale and a better educational experience overall.

## PRIOR WORK

It was for these reasons that the first author developed FROSH when he taught at Saint Peter's College[3]. The diversity of the student body together with the twenty-nine different majors available for incoming freshmen made the freshman advisor's job difficult and invariably led to errors in advising. FROSH was developed as a tool that could be used as an automated consultant or as a training tool for freshman advisors.

FROSH was written using the expert system development tool VP-Expert and helped the freshman advisor select a set of courses for the first-semester freshman. It first determined the maximum number of courses that a student should take, then chose the appropriate composition and math classes for the student. After determining the student's choice of major, it selected the appropriate beginning course in that major for the student (or advised the student to wait until certain prerequisites were taken) and then helped the student choose additional courses until his or her program was complete.

FROSH had several shortcomings. It did not take course scheduling into account nor did it consider the possibility of course conflicts or closed course sections. These deficiencies were to be dealt with in subsequent versions.

## THE ADVISING PROCESS

The process of advising incoming freshmen has many similarities regardless of the college or university. There are certain basic decisions that are made either by freshmen or their advisors. These include:

- ! The number of credits or courses that the incoming freshman will take in the first semester.
- ! The courses that the student will take as part of the common curriculum taken by all incoming freshmen.
- ! The courses that the student will take to begin a major field of study.
- ! The other courses that fill the remainder of the student's courseload.

The first author's experience in advising students at Saint Peter's College and subsequently at Adelphi University provided an interesting contrast. At Saint Peter's College, virtually all courses are three credits, with an extremely small number of four-credit and one-credit courses. While most courses at Adelphi University are three credits, there is a significant number of courses that are one, two and three credits that might be taken by the typical incoming freshman. While it made sense to count courses for Saint Peter's freshmen, this does not work in the Adelphi model where it is essential to count credits. While both schools require all incoming freshmen to take a composition and orientation seminar, Saint Peter's requires a math course and Adelphi requires a Freshman Seminar whose subject varies section to section. At Saint Peter's the Orientation Seminar was noncredit; at Adelphi, it is a one-credit course that runs for half the semester.

### Core Curriculum at Saint Peter's

The core curriculum at Saint Peter's College is shown in Table 1. There are ten separate categories of requirements that undergraduate must fulfill and within several of these categories, the exact courses that must be taken will vary depending on the student's major. Students are expected to complete the composition and math requirements no later than the end of their second year.

Table 1 – Core Curriculum Requirements at Saint Peter's College

| Composition<br>Cm 104-115 or Cm 105-116 or<br>Cm 106-117 or Cm 108-119 or<br>Cm 120 | Composition sequence determined by placement test |
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| Literature<br>El 123 Poetry and Drama and<br>El 134 Prose Fiction | Generally taken after completing composition requirements |
| Modern Languages and Literature<br>6 credits | Level is determined by previous language study and a placement test. |
| Fine Arts<br>Ar127 Introduction to Visual Arts or<br>Ar128 Introduction to Music | |
| History<br>Hs111-112 Western Civilization I and II | |
| Social Sciences<br>Po100 Perspectives on Politics and<br>So121 Introductory Sociology | Students not majoring in business may substitute Economics for either course |
| Mathematics<br>Ma102-103 Mathematics for the Humanities, I and II or<br><br>Ma105-106 Finite Mathematics, I and II or<br><br>Ma123-124 Elementary Calculus, I and II or<br><br>Ma143-144 Differential and Integral Calculus | Science majors must take calculus; exact requirements vary with major. |
| Natural Sciences<br><br>Ns110 Scientific Literacy and<br><br>One course in Biology, Chemistry, or Physics and<br><br>One course in Psychology, Computer Science,  Biology, Chemistry, or Physics | Higher level courses in biology, chemistry or physics can be substituted for Ns 110 and the third course cannot be in the student's major. |
| Philosophy<br><br>Pl100-101 Introduction to Philosophy I and II | Usually  taken after the freshman year |
| Theology<br><br>Th110 Religious Faith in the Modern World and<br><br>Th120 Christianity in the Contemporary Era | |

**General Education at Adelphi**

The general education requirements of Adelphi University are listed in Table 2.  It is assumed all freshmen will take GEN 100, GEN 110 and ENG 107 and whatever courses needed to begin their major.  Additionally they will begin fulfilling their second competency and

distribution requirements. Not all courses in the departments below fulfill the distribution requirements; generally, these are entry-level courses taken by majors in their fields of study.

Table 2 – General Education Requirements at Adelphi University

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|---|---|
| Freshmen Courses<br>GEN 100 Freshman Orientation Experience (1 credit)<br>GEN 110 Freshman Seminar (3 credits) | |
| Competency Courses<br>ENG 107 The Art and Craft of Writing (3 credits)<br>Second competency course | Second competency refers to other skills necessary for success in college such as writing, public speaking, computer literacy, statistics and critical thinking. |

Distribution courses (6 credits each) in

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| Arts<br>    Art, Art History, Communications, Performing Arts, and Music |
| Humanities and Languages<br>    English, History, International Studies, and Philosophy |
| Natural Sciences and Mathematics<br>    Biology, Biochemistry, Chemistry, Computer Science,  Mathematics, and Physics |
| Social Sciences<br>    Anthropology, Economics, Political Science, Psychology, and Sociology |

## DESIGN OF FROSH VERSION 2

FROSH version 2 was written in Visual BASIC for three reasons: it made it easier to create an interface that was graphical and therefore easier to use; Visual BASIC's popularity makes it easier for other schools to modify FROSH for their own use; and it uses databases
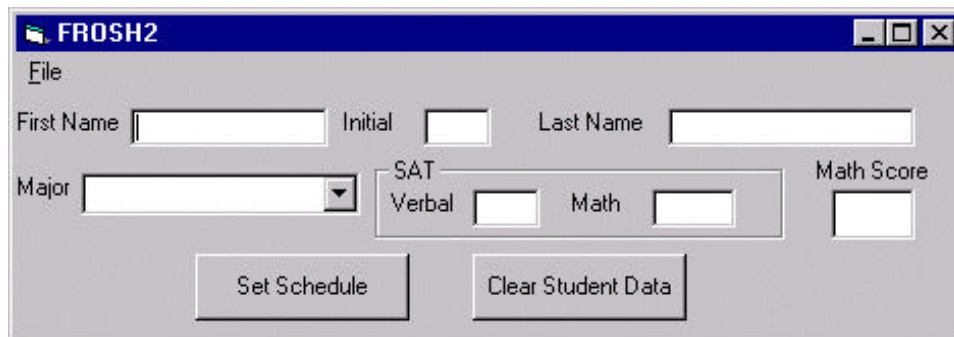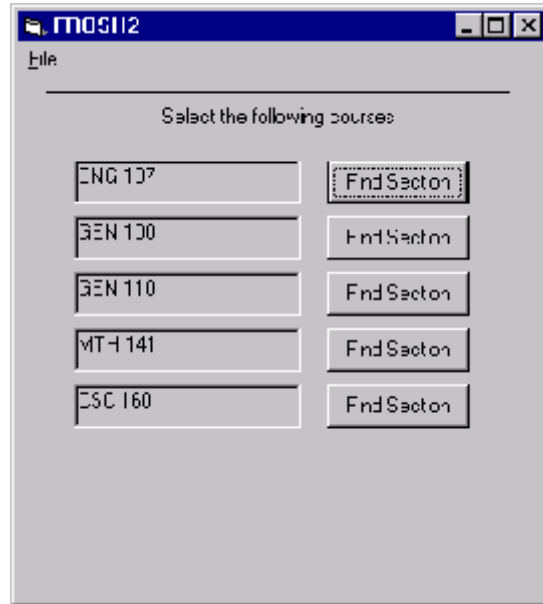


Figure 1 - the Data Entry Window

Figure 2Course Selection Window

written in Microsoft Access, which simplifies the development process. Figure 1 shows the input window of the Adelphi version. After entering the basic data, the user clicks the "Set Schedule" button and course selections for general freshman courses and courses for the major will appear in the Course Selection frame (see figure 2). Section selections are made using a separate window (see Figure 3).

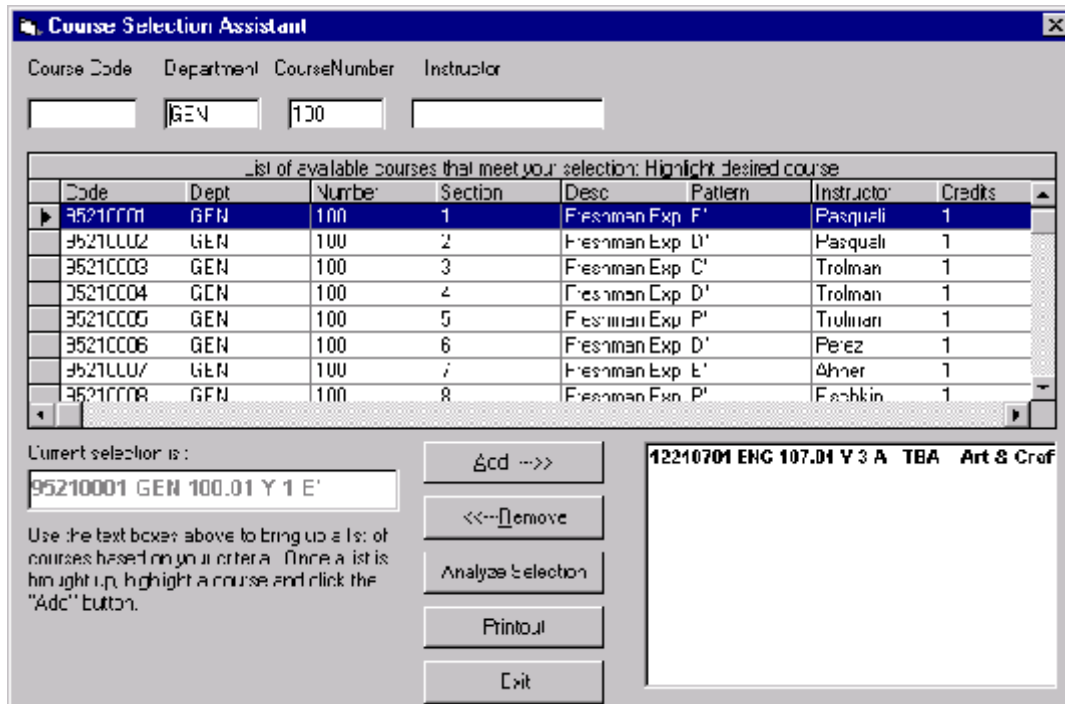While two separate versions of FROSH 2 were written, one for Saint Peter's and one for



Figure 3 - Section Selection Window

Adelphi, the basic algorithm was the same for both:

- **!** Make sure that all necessary data was entered. If not, display the appropriate error message.

- **!** Determine the maximum number of credits/courses that the student may take.

- **!** Determine the general freshman courses to be taken by the student.

- **!** Determine the courses that the student should take for the chosen major.

- **!** Allow the student or advisor to choose sections for these courses.

- **!** Allow the student or advisor to choose other courses with which to complete the schedule.

- **!** Make sure that there are no time conflicts and that the student is not taking multiple sections of the same course.

### Determining Maximum workload

Saint Peter's students would normally take five courses unless their combined SAT scores were 800 or below or they were taking more than one "developmental" course. These courses included the lower-level composition courses, lower-level math courses and Reading Dynamics, a course designed to improve the reading skills of students whose reading scores did not indicate that they were reading at the level of high school graduates.

Adelphi students normally take 15-16 credits. A student might be allowed to take a total of 17 credits based on several criteria including SAT score.

### Determining General Courses

All Saint Peter's students take a composition course, a math course and Orientation Seminar. The composition course is determined by the writing test given during the Freshman Orientation that the student attends. The math course depends on the student's choice of major and placement test score. Students either take Finite Math or Math for the Humanities (if their major does not require calculus) or either College Algebra or calculus, depending on their placement score if their major requires calculus. Some students may take Introductory Algebra, a non-credit developmental math course regardless of their major if their placement scores indicates that it is needed.

Adelphi students all take Freshman Orientation Seminar, The Art and Craft of Writing and a Freshman Seminar. The topics of the seminars vary with each instructor and students are free to take whichever seminar has available seats and in which the student is interested.

### Determining Courses for the Major

The courses that the students take at both institutions depends on the major and in some cases may depend on the student's academic preparation. For example, both schools have

computer-programming courses for students whose math skills do not place them in calculus. In general, this varies by department and is more common at Saint Peter's.

**Determining the Rest of the Workload**

At both schools, students are generally encouraged to take courses that meet general degree requirements for two reasons: it allows the students to finish these requirements earlier so they can concentrate on their major studies later and to expose them to a wider array of disciplines. For this reason, the first version of FROSH did not allow students to take classes that did not meet major or Core Curriculum requirements; the second version will allow students to take such courses as long as they are on a list of courses open to freshmen.

**Time Conflicts and Multiple Sections**

After choosing a set of courses, FROSH checks to make sure that there are no time conflicts or multiple sections of the same course chosen. The time patterns are stored in the Access database and FROSH uses this data to ensure that there are no overlaps.

**WHAT'S NEXT?**

The current version of FROSH was hard-coded, i.e., the advising actions appear as Visual BASIC procedures and there are two distinctly different versions of the program, one for each of the two schools. This was done to verify that the advising done by FROSH is comparable to that which is done by experienced advisors at both schools. While this design approach made it easy to ensure that both versions are accurate in advising students, it makes the customizing of FROSH for other schools more difficult.

The next step is to create a "general framework" for FROSH that is easily customized for other schools. This will be done by the use of database tables where feasible and by different versions of code "commented-out", where the person customizing the code chooses the version to "de-commented."

Anyone interested in a copy of the source code should contact the first author at the above address.

**REFERENCES**

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