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8. A SYSTEM DYNAMICS APPROACH TO IMPROVING AN ADVISING SYSTEM FOR BUSINESS SCHOOL UNDERGRADUATES

INTRODUCTION

A School of Business located in the northeast United States annually administered the AACSB/EBI Undergraduate Business Exit Survey to all its graduating seniors. Students evaluated various aspects of their educational experience, and the School of Business took the results very seriously in its efforts to improve its programs. One area that consistently received low marks was advising. The Associate Dean of the Business School wanted to address the situation and see how to improve the system. Through interviews with the Associate Dean and the advising staff, a consulting team compiled information about the School's advising program, and analyzed it using systems thinking and system dynamics. Between the survey results shared and the staff interviews done with the team, the information painted a very clear picture of the systemic nature of the problem.

STATEMENT OF THE PROBLEM

There were two advisors for eight hundred undergraduate business students, with each advisor responsible for advising four hundred students. The School of Business required some students to seek advising services to register for classes each semester, based on meeting any one of three criteria:

- the student has fewer than 53 credit hours;
- the student has not met the computer proficiency requirement;
- the student has a GPA of less than 2.33.

The students using advising services fell into three categories: those who were required to get advice based on the above requirements, those students who voluntarily sought advice about what courses would best meet their needs, and those transferring in from other departments or universities. According to the advisors, very few students sought them out during the school year, to talk about graduation requirements or to receive other advising support. While the advisors did have other duties, such as generating a newsletter, planning events and other outreach efforts, during most of the semester the advisors had ample time to spend with students. The busiest times for advising services were in the first few

G. Bell, J. Warwick and P. Galbraith (Eds.), Higher Education Management and Operational Research: Demonstrating New Practices and Metaphors, 125–152.

days of the semester (for incoming first year students, add/drop, and transfer students) and at the end of the semester. This later period was dramatically busier because this was when all the students had to register for the next semester.

During the middle of the semester, when few students thought about using advising services, the advisors felt they were able to give good quality advice to the students by spending plenty of time with them and thereby developing personal relationships. They felt that a half hour was the most effective amount of time to spend with a student. In addition to half an hour spent talking with students, they also needed some time before the meeting to prepare by gathering the student's grades and records. The preparation process included manually checking a student's file for records of past visits and checking the information system for what limited information was available there. At the end of the semester, students flocked to the advisors' offices, resulting in long lines that forced many students to come back to the office repeatedly until an opening was available. When the line was too long, the students were unhappy and the advisors experienced high stress. When the end of semester deadline neared, the advisors often had no choice but to spend only about seven minutes with each student. Part of the reason so many students waited until the last four weeks to meet with an advisor were the established procedures in place within the School of Business. The window for the registration period was four weeks because the Registrar issued Personal Identification Numbers (PINs) only four weeks in advance of the deadline for registration. Students were not able to register for classes without a PIN, and the system forced those students who failed to meet the criteria listed earlier to meet with an advisor to receive a PIN.

Many other departments at the university used automated advising tools that were available on the university's "Campus Solutions Enterprise Portal" (CSEP) (Lieberman, 1996). Some examples of these were Prerequisite Check and Degree Audit. In many other departments, students were able to self-advise by using these tools and other materials, such as catalogues and simplified graduation plans. The School of Business advisors considered the curriculum requirements for their school to be relatively complex. It had been their mindset for many years that students were not capable of self-advising, so the School of Business had a policy that ensured most students had to see an advisor to register. Furthermore, in all other departments at the university, faculty members were responsible for advising, and they relied only to a limited extent on staff advisors. The non-faculty staff advisors had a long history with the School of Business, and it was not clear why faculty members were not involved in advising.

Based on the information the consulting team gathered, it determined the problem to be the way the advising system was structured. Although the use of staff advisors and lack of faculty involvement had a long history in the School of Business, the team thought that a solution was possible. It confined its analysis to just one semester, which allowed it to look at the entire advising cycle and see the impact of the system on all parties.

KEY VARIABLES

Based on the team's interviews, its members identified the key variables in the system.

Advisors:
- total workload;
- advising workload;
- time spent with students;
- quality of advising;
- communications process;
- number of advisors.

Students:
- wait time;
- queue length;
- student expectations;
- students satisfaction;
- number of students seeking advising;
- non-traditional students;
- transfer students.

Faculty:
- faculty involvement;
- complexity of curriculum;
- guidance requirements.

Other:
- time frame;
- automated advising;
- budget.

REFERENCE MODES

Working with the advisors, the consulting team clarified the relationships among the variables by drawing some of the most important as "reference modes", or graphs of "behavior over time". Its members determined that the five variables shown in figure 1 would act consistently from semester to semester. The team sketched these graphs with its expectations of their behavior against the x-axis of time (18 weeks of a semester). The reference modes highlight the last four weeks of the semester because that is when the largest volume of students entered the system.

Figure 1 shows the graphs that represent the research team's expectations for the dynamics of the most important variables in its model during the 18-week semester.

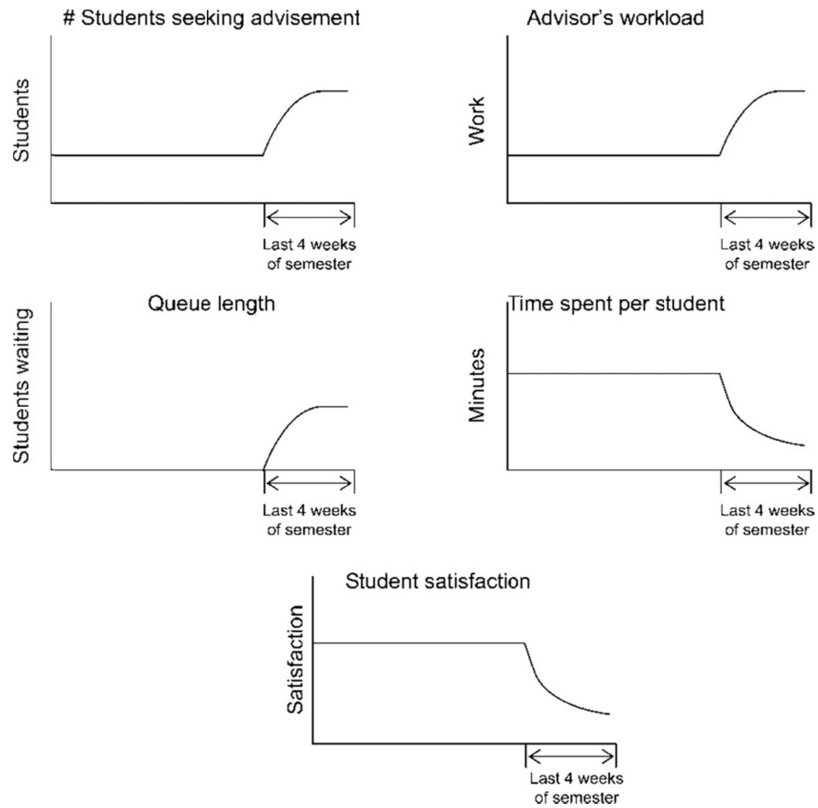

Figure 1. Reference modes.

DYNAMIC HYPOTHESIS

Before forming a dynamic hypothesis, the team listed all the potential issues to be resolved. A portion of this list follows:

- understaffing (advisors had too many students to advise);
- not enough time;
- students could not get a PIN early enough;
- faculty members were not knowledgeable about the advising system (and out of that ignorance established curricular policies and practices that made the situation worse);
- students waited until the last minute;
- students were purportedly immature;
- students were looking for parenting, not advising;
- student expectations were wrong (based on high school or prior experience);
- the term "Advising" did not have the same meaning for each constituency—students, advisors, and faculty;

– there was not a good method for communicating the message of advising to students (who, what, where, how, when);
– advising was not spread out enough; advisors could not do it in four weeks.

Most of these theories seemed to blame outside forces (exogenous variables), other people, or factors that were outside the control of the School of Business. The theories arose from mental models that each staff person held. Mental models can sometimes help to find answers, but, more often, they create barriers to learning and to new ways of thinking. In this case, the relatively long history of the system and the staff's traditional roles in the system seemed to limit everyone's ability to examine it in an objective way. Furthermore, the structure of the School of Business did not appear to encourage a lot of interaction among the faculty, the Dean's Office and the advisors in terms of sharing information and solving problems. These structural characteristics would certainly be factors when implementing policy changes and they would cause resistance to change. After considering this list of theories, which were products of team meetings with the advising and administrative staff, the team formed a dynamic hypothesis.

This hypothesis holds that "Student Satisfaction" is dependent on the amount of time students spend with their advisor, a hypothesis supported in the literature (Abernathy & Engelland, 2001). The students should be there because they want to talk to their advisor, not because someone forces them to. In general, if the amount of time spent with the advisor is a half hour or more, the student is satisfied; if it is less, the student is not satisfied. Therefore, "Queue Length" should be the primary indicator to see how much time advisors would spend with a student. If the "Queue Lengths" are short, the students will have plenty of time, at least a half hour with the advisor, and will be satisfied. If the "Queue Length" is too long, they will have less than a half hour, and will be dissatisfied with their advising experience. The most effective way to reduce "Queue Length" would be through a significant change in the requirements that dictate how many students would be in the queue.

CAUSAL LOOP DESCRIPTION

The Advising Causal Loop diagram (shown in figure 2) has three exogenous inputs and eight loops. The diagram attempts to show how the relationships in the problematic School of Business advising system interconnected and how they interacted. Following are descriptions of the three exogenous inputs and the eight causal loops.

Exogenous Inputs

Under the School of Business advising policies in effect at the time of this project, a significant portion of the student body was required to pass through the advising system to register for classes. The causal loop diagram represents this with the variable "Students Requiring PINs". This variable is the sum of the four groups of students who make up this pool, which we represent with the following variable names: “# Students with <53 Credits”, “# Students with GPA < 2.33”, “# Students Lacking Computer Proficiency”, and “# of Transfer Students”. This input, which had a positive relationship with the variable “# of Students Requiring Advising”, appeared to the advising staff to be exogenous, but in reality it was a policy choice that they, and their faculty colleagues, had made. No one imposed this policy on them.

A second exogenous input showed the effect of time passing during the semester, to measure the effect on the causal relationships. This input started with two variables, “Calendar Time” and “Start of Next Semester Date”. Both of these variables fed into “Time Remaining”, which was calculated as the difference between “Start of Next Semester Date” and “Calendar Time”. This variable started out high at the beginning of the semester and decreased as time approached the start of the next semester. The variable “Time Remaining” had a negative relationship with “Schedule Pressure”, showing that as the semester progressed “Time Remaining” decreased while “Schedule Pressure” increased. “Schedule Pressure” had a direct positive relationship with “Queue Length”.

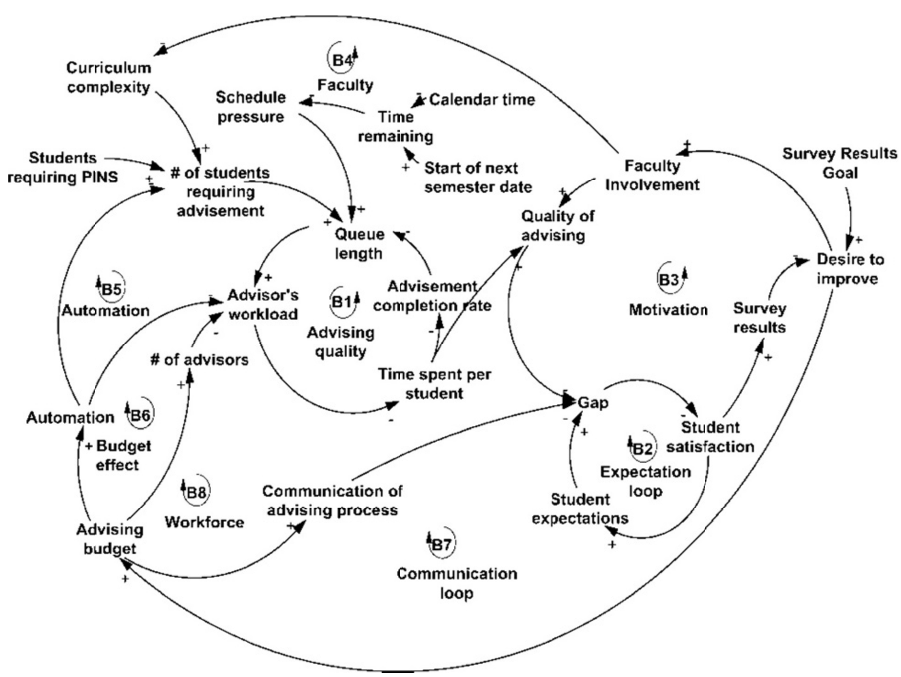

Figure 2. Causal loop diagram.

The final exogenous input came in the form of “Survey Results Goal”, which was a benchmark target set by the School of Business for results on future exit surveys.

Advising Quality Loop (B1)

This balancing loop illustrated that as workload increased, advisors sacrificed the quality of advising to increase throughput and reduce the length of the queue. “Queue Length” increased with increases in “Schedule Pressure” and with increases in the “# of Students Requiring Advising”. As “Queue Length” increased, it caused an increase in “Advisors’ Workload”, which represented the total workload per advisor. Increases in “Advisors’ Workload” resulted in decreases in the variable “Time Spent per Student”. This variable represents the average time spent per student, at any given point in time during the semester. As “Time Spent per Student” went down, the “Advising Completion Rate” went up. This shows that as advisors spent less time per student, their student throughput increased. Finally, to complete the loop, as “Advising Completion Rate” increased, “Queue Length” decreased. This is a result of an increase in the outflow from the queue. Completing this loop shows that it was a balancing loop—an initial increase in “Queue Length” led to an ultimate decrease in “Queue Length”.

Expectations Loop (B2)

This loop represented the dynamics of student expectations relative to student satisfaction in the advising experience at the School of Business during the time of the study. The variable “Student Expectations” represents the student expectation coming into the semester. This variable was the cumulative result of experiences with advising, including any high school experiences as well as any advising experiences from previous years at the university. “Student Expectations” feeds into a variable labelled “Expectations Gap” with a positive relationship. As “Student Expectations” increased, so too did the “Expectations Gap”—the difference between students’ expectations and their advising experiences. “Expectations Gap” took into account two different types of inputs. One was the gap between expectations from students regarding communication of the advising process; the other was the gap between the quality of advising expected and the quality received. “Expectations Gap” linked negatively into “Student Satisfaction”, showing that as the gap between expectations and experience widened, satisfaction decreased. Finally, to complete the loop, “Student Satisfaction” fed positively into “Student Expectations”, showing that as satisfaction increased (or decreased), so too did expectations regarding future advising. This was a classic balancing loop of expectations versus satisfaction.

Motivation Loop (B3)

This loop captured how the results of the student exit survey motivated the School of Business to improve the advising process. As “Desire to Improve” increased, so too did “Faculty Involvement” (albeit slowly). In the course of interviewing the advisors about this project, the consulting team learned that historically there had been very little faculty involvement in the advising process, but after the “Desire to Improve” increased, there had been some initial involvement by the School of Business administration to seek a solution. The School hoped that this increased “Faculty Involvement” would result in an increase in “Quality of Advising”, a hope borne out by previous studies (Swanson, 2006). This variable reflects the overall quality of the advising students received. Continuing around the loop, as “Quality of Advising” increased the “Expectations Gap” already discussed decreased, resulting in greater “Student Satisfaction” and ultimately in better “Survey Results”. The variable “Survey Results” fed back into “Desire to Improve”, closing this balancing loop.

Faculty Loop (B4)

This balancing loop includes parts of the Advising Quality, Expectations, and the Motivation Loops. It represents the effect that “Faculty Involvement” had on “Student Satisfaction” and ultimately on the success in reaching the desired survey results goal. Starting with “Faculty Involvement”, the loop shows that increases in this variable resulted in decreases in “Curriculum Complexity”. As the team examined this topic, it found that one of the explanations given for the need to require many students to receive advising was the complexity of the curriculum. The rationale was that if faculty had greater involvement in the whole advising process they would see more clearly the complexity of the curriculum and would work to simplify it, thus reducing the need for students to be required to meet with an advisor. A decrease in curriculum complexity would decrease the “# of Students Requiring Advising”. With fewer students needing advising, “Queue Length” would decrease. On the same path as described in the Advising Quality Loop (B1), “Advisors’ Workload” would decrease, followed by an increase in “Time Spent per Student”. With an increase in “Time Spent per Student” there would be an increase in the “Quality of Advising” and we could follow the Motivation Loop around to an increase in “Student Satisfaction” and ultimately to a decrease in “Faculty Involvement”. Since an initial increase in “Faculty Involvement” resulted in an eventual decrease in “Faculty Involvement”, this was a balancing loop.

Automation (B5) and Budget Effect (B6) Loops

These loops were closely related and captured the effects of “Automation and Budget” on the advising process. The consulting team learned that very little of the advising process had been updated to take advantage of the computing power available to the School of Business. Advisors still used a manual paper system to track student progress. Other departments at the university used automated advising tools, such as Prerequisite Check and Degree Audit, both of which enabled significant levels of student self-advising. The lack of an automated system for School of Business students to verify their path toward graduation forced them to seek advising, as shown in the Automation Loop. With decreases in "Automation" it followed that there would be an increase in "# of Students Requiring Advising" for the reasons just discussed. Increases in the "# of Students Requiring Advising" resulted in greater "Advisor Workload", which led to a reduction in "Time Spent Per Student". With a reduction in "Time Spent per Student", the "Quality of Advising" decreased, and the students' "Expectations Gap" increased. As "Expectations Gap" increased, "Student Satisfaction" decreased, followed by poorer "Survey Results". As "Survey Results" decreased, "Desire to Improve" increased; this led to more financial resources being allocated toward advising or to an increase in "Advising Budget". Because "Automation" of the advising process would require budget spending, a positive link existed between the "Advising Budget" and "Automation" variables in the model. Finally, increases in "Advising Budget" resulted in more "Automation", closing the balancing loop.

Although the Budget Effect Loop and the previously described Automation Loop have much in common, the consulting team decided to split them because the "Automation" of the advising process had another aspect directly related to the "Advisor's Workload" other than to the "# of Students Requiring Advising". The key distinction between the two is that increased "Automation" not only reduces "# of Students Requiring Advising" but also directly reduces "Advisors Workload". A significant part of the advisor's work consisted of the manual search for individual student records and information about curriculum requirements for the School of Business. During the busy final four weeks of the semester, the advisors often spend several minutes of the seven-minute advising meeting pulling and reviewing paper records. This decreased the "Time Spent Per Student" and ultimately the "Quality of Advising". The remainder of this loop overlaps with the Automation Loop, described in detail in the previous paragraph. This loop was also a balancing loop, since an initial increase in "Advising Budget" ultimately resulted in a decrease in this variable after completing the loop.

Communication Loop (B7)

The balancing Communication Loop reflected the ability of advisors to communicate important aspects of the university requirements to students effectively. Effective "Communication of Advising Process" reduced the gap between "Students Expectations" and "Quality of Advising", thereby increasing "Student Satisfaction". An increase in student satisfaction positively affected "Survey Results" which, in turn, had a negative effect on "Desire to Improve", a variable that also reflected the advisor's willingness or motivation to improve her/his work if the goal for such an improvement was perceived and taken seriously. We show “Desire to Improve” with a positive link to “Advising Budget”, since most of the improvements required budget spending. An increase in “Advising Budget” increased the capability of advisors to communicate the advising process to students more efficiently. The interview process revealed that many schools used direct mailing or even phone campaigns to remind students of important deadlines and to prompt them to seek advising. At the very least, administrators can use these tools to inform students of the advising options available to them, and to help set their expectations about what advising resources are available. All of these communication methods required money and this loop showed the positive effect that investment in communication can have on “Student Satisfaction”.

Workforce Loop (B8)

A final loop was the Workforce Loop, another loop very closely related to the Automation Loop. However, it differed because it showed the effect that increases in the number of full or even part time advisors would have on the system. This balancing loop captured the link between “Advising Budget” and “# of Advisors”. An increase in the “Advising Budget” allowed recruiting of more advisors which, in turn, reduced the “Advisor’s Workload”. As “Advisor’s Workload” went down, “Time Spent per Student” increased. An increase of the latter resulted in improved “Quality of Advising”, which caused “Student Satisfaction” to rise. Student satisfaction was the main factor driving “Survey Results”. These, through “Desire to Improve”, fed into “Advising Spending” as described in the previous section. Although included in the causal loop for completeness, the likelihood of hiring a new advisor was slim, and therefore this loop did not play a significant role in the analysis and policy recommendations to follow.

SYSTEM DYNAMICS MODEL

After creating the complete causal loop diagram, the consulting team chose to create a system dynamics model from a section of the diagram that was significant in showing the behavior of the system relative to the dynamic hypothesis. Because the dynamic hypothesis revolves around the idea that the most significant change that administrators could make to improve the system would be a reduction in “# of Students Requiring Advising”, the team chose to build a simulation model (figure 3) around this variable and to show the effect on “Student Satisfaction”. Most of the data about the dynamics of the system were qualitative, so it was necessary to use lookup tables to model the nonlinear behavior of the system. The model includes two stocks and their respective flows, with each controlled by the various input variables and lookup table functions. The Technical Appendix at the end of this paper discusses the issues related to the use of the table functions.

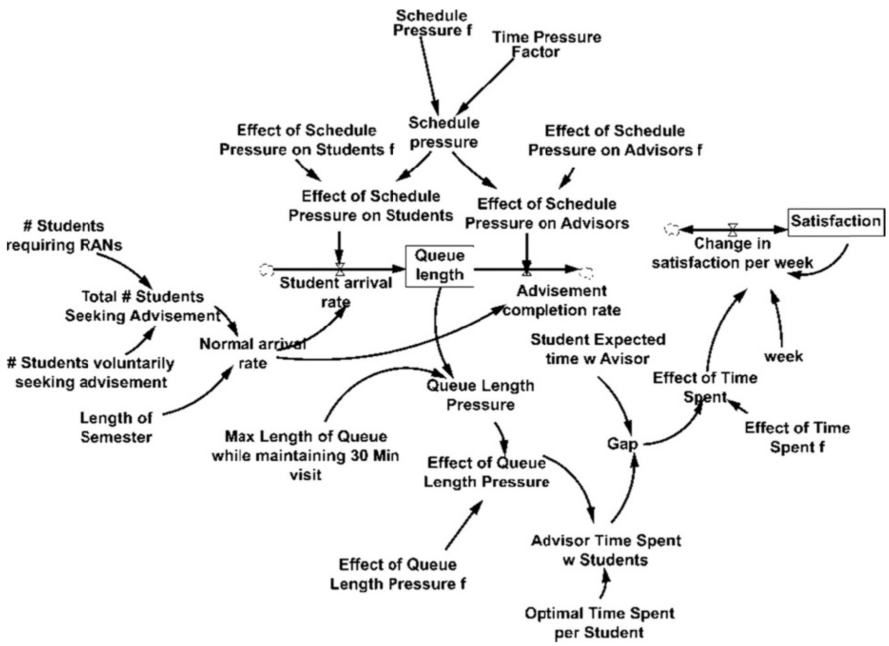

Figure 3. Simulation model queue length and satisfaction stocks.

POLICY DESIGN AND EVALUATION

The environment in which this system operated was static. The causal loop diagram contains several balancing loops, but no reinforcing loops. The system had been in equilibrium for a long time, resting in a state of dissatisfaction among students towards the advising process. Given the nature of the system, the only way to bring the system out of its rut was to make changes to some of the variables that are exogenous to the model, but certainly within the control of the School of Business. This was a fixable problem, but the first step had to be to expand the recognition of the problem beyond a few administrators and the advising staff. The problem needed to be clarified for all administrators and certainly for all faculty members.

The recommendations were designed to have the greatest amount of leverage throughout the system, and many involved altering the main exogenous variable affecting satisfaction, the number of students requiring advising. That this system was well entrenched in the School of Business was the largest obstacle to making these changes. The advisors were closest to the problem and felt the most pressure. Their area of work received low scores, but they worked hard and got little recognition for the work that they did. Most of the suggested policy changes were changes that someone needed to make, at either the administrative or the faculty level.

This presented a problem because the faculty was not dissatisfied with the system as it was currently structured—in fact, they were not involved in the system at all. As mentioned earlier, the School of Business was the only school in the university that did not utilize its faculty as advisors. As articulated quite clearly by the advising team, there had been strong resistance in the past to suggestions that faculty become more involved in the process. This created a difficult situation for the advisors. They clearly wanted the system to be changed, yet they were not the ones who needed to act and were not in positions of power over the faculty to compel them to act. Faculty would obviously resist becoming more involved because it would mean more work for them. Although in the end the proposed changes would benefit everyone involved (faculty, advisors and most importantly the students), in the short term it is likely that faculty would continue to resist what they would see as the administration piling more tasks on their already full plates. It would be a tough package to sell to the faculty, but the benefits would probably warrant the sacrifices required of them.

The problem with the old system was obvious: a clogged pipeline created student dissatisfaction. Either there needed to be fewer students in the pipeline, or the School had to modify the system to accommodate more students. There were several areas of opportunity for change; one was to decrease the number of students in the system or to increase the number of advisor-hours by adding staff. Another was to change the structure of the advising process to spread the bulk of the advising over the semester rather than all occurring in the last several weeks.

The consultants thought that several approaches might ease system congestion. The following list of policy recommendations outlined only those that the team thought were most significant in their potential effects. Within the scope of this project, the consulting team chose to model the portion of the causal loop diagram that related most closely to the dynamic hypothesis and that offered the best potential for solving the problem. We list the recommendations in order of strength of recommendation from highest to lowest.

POLICY RECOMMENDATIONS

The most obvious and easiest way to increase student satisfaction with advising would be to remove some of the students from the system, by loosening or eliminating the requirements for students who need advising prior to registration. This puts more responsibility on the shoulders of the students. The School could do this by decreasing the requirements gradually, or by eliminating a requirement. It could lower the GPA requirement to 2.0, or eliminate it. It could reduce the number of credits to fewer than 25, instead of 53. It could eliminate the computer proficiency requirement. These changes would reduce the number of students in the queue, which would eventually increase student satisfaction with advising. The idea here is to change the work of the advisors from a compulsory and inconveniently timed meeting with the student to a meeting where advisors have more time to work on serious problems or issues and get to know the students better. This way they would be better able to provide real advising rather than a hurried review of a course list and adding a signature at the bottom of a slip of paper. The consulting team felt that many students would prefer to self-advise if given the choice.

If a student's only experience with his or her advisor was rushing through a crowded system at the end of the semester to receive a PIN, then it should come as no surprise that the survey results were as low as they were. This was not a reflection of the quality of the advisors—it was a reflection of a poorly designed system. The system forced students into their advisor's office under the guise of helping them to plan their academic careers properly. Yet when they arrived, they received hurried and unsatisfactory service that amounted to little more than a rubber stamp in the form of a quick look at their schedule, the handing out of a PIN and a final push out the door so the next student could enter. For this reason, we felt that one sure way to raise satisfaction levels among the students was to remove the compulsory aspect of advising and make it instead a resource that students could use when they felt the need. The consulting team ran several policies in its model, to compare the implications of changes in the number of students requiring advising. The team tried to model the change in one advisor's workload. Each advisor had 400 students assigned to her. Of those 400 students, the assumption was that half required advising, based on the four criteria listed in the Statement of the Problem. That would be a modelled policy of two hundred students in the system. Figure 4 shows that the resulting the queue length headed up at about Week 13, and rose to a high of around seventeen at Week 18, the end of the semester. The team ran alternate policies—with one hundred students needing advising, fifty students requiring advising, and finally zero students requiring advising. In the last policy run there were still a few remaining students who voluntarily wish to be advised which accounts for the short queue length. As shown in figure 4, the fewer students in the system, the shorter the queue length becomes. Even with one hundred students still requiring advising, the queue length is only eight or nine at the most, and the increase is much more gradual than at two hundred students.

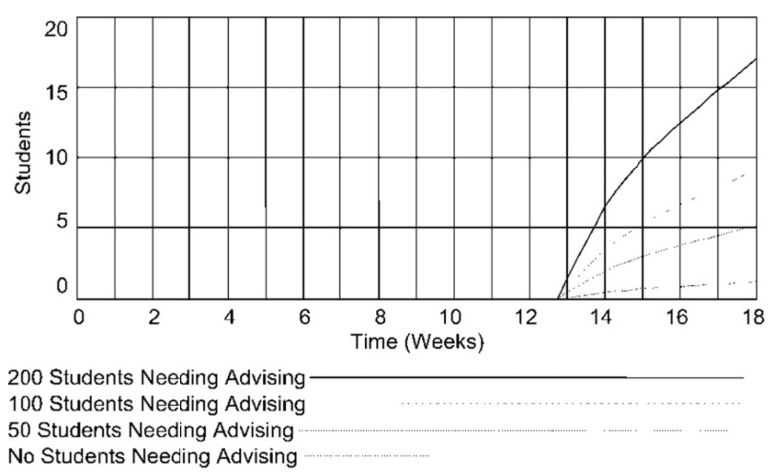

Figure 4. Simulation results of queue length by policy scenario.

The consulting team then ran the same policies, this time measuring Student Satisfaction. The result: as queue length increases, student satisfaction drops markedly. Testing the hypothesis that Queue Length has a direct effect on Student Satisfaction gives the results shown in figure 5—the fewer students requiring advising, the more likely students are to be satisfied with advising, because a short queue length means they will have at least a half hour with the advisor, which we have defined as being satisfactory. Complete satisfaction equals 1, i.e. students are 100% satisfied. Anything less than 1 indicates a level of dissatisfaction; the lower the number, the more dissatisfied the students are. When two hundred students are in the system, satisfaction levels drop more quickly and more dramatically. Far more students are dissatisfied at current assumed levels than at the reduced levels of students in the system.

A second policy recommendation was to simplify the curriculum for the School of Business. One of the problems that prevented increased automation and made the use of temporary help during peak times more difficult was that the curriculum was so complex. As shared by advisors, not only were the requirements for a given year sometimes difficult to follow, there were also several versions of the curriculum in play at any given time, depending on when the students started the program. The causal loop diagram shows a negative relationship shown between "Faculty Involvement" and "Curriculum Complexity". This indicates that as the faculty becomes more involved in the advising process, the curriculum becomes less complex.

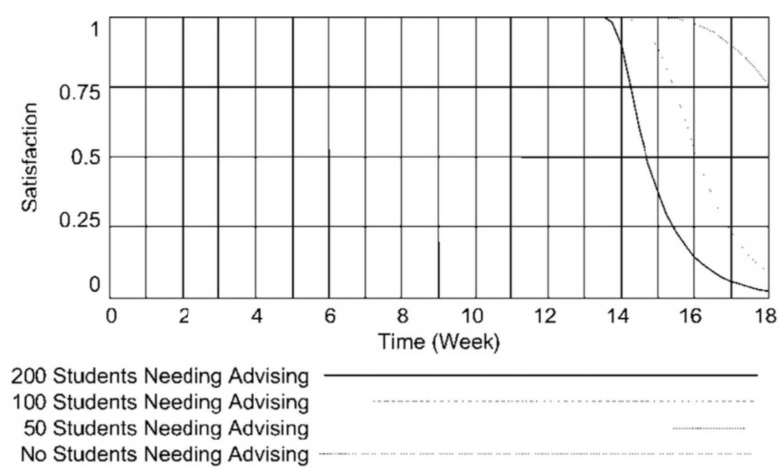

Figure 5. Simulation Results of Satisfaction by Policy Scenario.

This relationship is a valid and important one. A large part of the problem with advising at the School of Business was that the faculty were simply not aware of the implications of their curriculum decisions on the advising process. This is because they were not involved in the process at all, so advising was likely not a consideration when new course offerings were being considered. A good first step to improving the system would simply be to make faculty aware of the advising process and show them the complexities involved in figuring out a schedule that will successfully meet all of the requirements. Exposing the faculty to these complexities would also help in another area that exacerbates the problem—the lack of long-term course scheduling that the administration does in its undergraduate program. One of the frustrations that the advisors expressed is that it was difficult to recommend schedule choices to students when it was unclear when faculty would offer certain courses again, and in which order.

Ultimately, the team felt that simply exposing the faculty to the current situation would not solve the problems. Ideally, the faculty will become involved in the advising process themselves. This could involve everything from opening up class time for the advisors to come in and talk to students, to taking on a caseload of advisees to help guide them through their academic program. Not only would it be easier for the students to understand the rationale behind the curriculum design from the designers themselves, this would also open the faculty up to seeing more clearly some of the logistical effects that their curricular and scheduling decisions have on students. The faculty saw portions of the student body every day in their classes, but seeing this other side of the student experience would help to broaden their horizons and in the end will make the curriculum less complex.

One fear of letting more students self-advise expressed by the advisors was that the students could misinterpret the curriculum and not graduate on time as a result. This would certainly not raise the satisfaction level of students. They would likely feel that the advisors really let them down in permitting them to miss needed classes and would rank them even lower on the senior exit surveys. Although the consulting team understood this fear and saw that the advisors were genuinely concerned about this, it did not feel that this would play out in reality. As the system was structured, most juniors and seniors were able to follow their respective curricula and graduate on time without being forced to seek the assistance of an advisor. The team felt that the same was true for the first and second year students. The advisors would still be available for the students to seek out, but the ball would be in their court. The reduced complexity of the curriculum, along with improved communication about the advisors and their availability, would also help to alleviate these problems.

The result of this policy recommendation would be to reduce the number of students seeking advising. Figure 4 already showed the effect of this (see policy suggestion 1). This policy change would not directly affect the number of students requiring advising, but would be an important step to take if the faculty loosened or eliminated those requirements. The School of Business wanted students to have success without forcing them into a frustrating advising process. Therefore, reducing the complexity of the program should go hand in hand with dropping the advising requirements so that students do not run into problems as they try to navigate the curriculum waters.

One of the jobs of the advisors was to communicate to students what advising was and how to get access to it. The advisors had an opportunity at first year student orientation to address this message with the students, and then follow it up with the advisors' newsletter and other communications. The advisors felt that their message got lost at orientation because the students were being overwhelmed with so much information at that point that they were not able to retain important facts about the advising process. The consulting team asked the advisors if they could identify one required course that might present an opportunity to institute a regular half hour mini-seminar on advising, during class time. They said that most students took Accounting 110, but that there would be resistance among faculty to permit them to take class time for such a project. Were the faculty to allow such a change, it would get the students to understand and use the advising resources better, with the goal of spreading out the time for demand on advising services.

The consulting team felt that this change should occur regardless of whether or not staff made any other changes. There is no cost to this suggestion and would help to adjust student expectations, a leading contributor to their level of satisfaction. The causal loop diagram shows that "Communication of the Advising Process" led directly to reducing the "Expectations Gap" between "Student Expectations" and the "Quality of Advising". One of the problems that the advisors experienced during the rush of scheduling time was that the students had expectations that do not match what the advisors are able to provide, especially during this busy time of the semester. Students are looking for advice and help in a wide range of areas at a time when advisors are not able to give it. Expectations not being met leads to lower satisfaction with the advising process. Taking time to explain when, and for what, they are available would help to alleviate this source of dissatisfaction.

Increasing the amount of automation would reduce "Advisors' Workload" even if the rest of the system remained unchanged. One of the problems with the old system is that neither advisors nor students had the advantage of using all of the available tools to assist them in examining or creating schedules or tracking progress through the program. While others schools at the university use the degree audit and student records features available on the Campus Solutions Enterprise Portal (CSEP), the School of Business was not making full use of this resource. The consulting team was shocked to learn from the advisors how manual and paper-based the advising process was. Advisors spent much of their time pulling paper files and charting student progress on paper copies of the curriculum that was in effect at the time a particular student began the program. Automation would help to reduce the number of manual tasks performed by the advisors and would help to ease the pressure on the system by increasing the "Advising Completion Rate".

Additionally, increased automation could go hand in hand with the first policy recommendation of reducing the number of students requiring advising. As the university opens up more resources to students through the incorporation of automated records systems, students would be better able to track their own progress (Murray et al., 2000). This will help to ease the fear, discussed earlier, that students will make mistakes that will wind up affecting their scheduled graduation dates. As the university makes available tools such as the degree audit, the complexity of the curriculum will decrease even further.

Also on the student side, if students were able to communicate with the advisors, either by e-mail, phone, or fax rather than a face-to-face meeting, it might be more convenient (especially for non-traditional students) or more time-effective. Student services staff would have to address security issues with regard to giving out PINs, but others have done this, and it certainly could help to increase satisfaction rates at the university. Advisors could respond to e-mails when the queue length was short or non-existent (early, late, during class time), which would give the system much more flexibility. Students could contact advisors at any time that is convenient for them, as long as they understood the delay in response. E-mail blasts to students of reminders to come in for advisement might be helpful in improving the communication process, but now the budget and technology needed to do this are not in place.

Exploring the idea of expanding the length of the advising period yielded several ideas. If the university issued PINs earlier than four weeks before the registration deadline, it could extend the process over a longer period. Staff would have to test this because it is possible that many students would continue to wait until the last minute to register, even if they had an extra six weeks at the beginning of the period, making this intervention not as helpful as hoped.

One solution to the "wait until the last minute" problem would be to establish rolling registration periods, spread throughout the semester. For example, allow seniors to register between ten and nine weeks remaining in the semester, juniors between eight and seven weeks left in the semester and so forth. This would prevent students from waiting until the last minute because of the fear that their desired classes would fill if they waited too long.

As depicted in the causal loop diagram, this policy change would reduce "Schedule Pressure". Because this would increase the window for registration, the schedule pressure would be less intense and spread over a longer period, so there would be a reduction of the queue length at the end of the semester. Additionally, the queue would never reach the unmanageably high levels that it currently does. We are uncertain as to how difficult it would be to get the PINs earlier.

One of the largest limitations to this system was the number of hours that advisors had in their workday. The School could alleviate this by either adding another advisor or involving the faculty directly in advising. Examining the Budget Effect Loop shows that an increase in the "Advising Budget" could create an increase in "Number of Advisors", reducing the "Advisors' Workload", increasing the "Time Spent with Students" and ultimately increasing "Student Satisfaction". Although this would improve the situation, it is not without a significant cost to the School of Business and consequently does not yield the best cost/benefit ratio.

CONCLUSIONS

The above suggestions for policy change came directly from discussions with the advising team. Although there was a lot of ambiguity about how to solve the problem at the time of these discussions, a couple of points nevertheless clearly came to the surface. The first is that there definitely was a problem with the undergraduate advising in the School of Business. The advisors clearly described the chaotic situation that they experienced at the end of the semester. They were frustrated that no matter how fast they rushed through appointments with students, they looked out to see the lines growing as students rushed to get the PIN needed to register for classes. Either the students did not want to be there in the first place and the staff rushed them through, or they did want to be there, but the staff did not allot sufficient time to address their real questions or problems. Either way, they were leaving the advising office upset and frustrated. The survey results reflected this, but the stories that they told of this unfortunate situation illustrated it even better.

The second point that rose to the surface is that this was a systemic problem. It was not the result of one unqualified or poorly performing advisor. That would have been a relatively easy problem to solve. This was a deeper problem involving the entire system. There did not appear to be any “quick fixes” for the advising problem.

The third point that became clear is that this problem had been around for a long time. One of the advisors had been at the university for eighteen years, and looking back over that time, she could not remember a time when things had been better. This problem had been around the School of Business for years. It was unclear if the administration and staff had attempted to correct the problem, but it was clearly not a new one. This chronic aspect of the problem was an indication of its deep, systemic nature.

These three aspects of the situation made it an ideal problem to model using causal loop diagrams and system dynamics modelling. The model discussed in this paper does a good job of showing how the causes of low student satisfaction rest with the advising process. The implications of the model and most of the proposed policy recommendations are clear—the number of students requiring advising is simply too high, given the system’s capacity. Although not all of the suggestions include this variable, it is probably the most important one. This is a variable with much leverage. Decreasing the number of students who are required to see advisors to register for classes has dramatic effects on the other key variables, most importantly student satisfaction. In conclusion, it is worth repeating the first recommendation—to alter or eliminate the requirements that compel students to seek advising as the best way to improve overall student satisfaction with the system.

EPILOGUE

So far, the School of Business has adopted two of these recommendations—curricular simplification and faculty advising. The faculty have gone through a detailed restructuring of the School’s undergraduate curriculum, placing most courses in a “core” and adding simply defined majors and concentrations to it. They hope that this will improve the advising situation as time passes.

About two years after this simplification effort, an advisor left and, for budgetary reasons, the School could not replace him. This led, for the first time, to faculty advising. The faculty were very pleased that they had earlier instituted a simplified curriculum, as it eased the burden of their new advising task. Faculty advising has also had the predicted effect of keeping curricular complexity in check. In the context of the present chapter, the Faculty Loop (B4) has operated as described earlier.

Students were apparently pleased as well—the exit survey results after the first year of faculty advising showed great improvement in student satisfaction, with School of Business graduating seniors rating their advising experience the best of any at the university. Those results have been stable ever since.

The School is currently examining the other suggested options, especially changing the criteria for required advising and having students do a greater amount of automated advising. As this chapter showed, both of these options would require fewer students to see the advising staff and faculty advisors, improving the experience for all concerned.

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TECHNICAL APPENDIX

A Detailed Examination of the System Dynamics Model

As mentioned earlier, most of the data about the dynamics of the system were qualitative, so it was necessary to use many lookup tables to model the nonlinear behavior of the system as the consulting team understood it to be. The model includes two stocks and their respective flows, with various input variables and lookup table functions controlling the flows. This Technical Appendix includes a discussion of the issues related to the use of all these table functions.

The first bit of stock and flow structure in the system dynamics model has "Queue Length" as the stock (defined as the number of people waiting in line to see an advisor). The inflow to this stock is the "Student Arrival Rate" (number of students entering per week), and the outflow from the stock is the "Advising Departure Rate" (number of students leaving the system per week after being advised). An interesting question was how to determine these arrival and departure rates. If there were no factors influencing when students wanted (or were able) to see their advisor, then the number of students seeing advisors would be evenly distributed across the eighteen week ("Length of Semester") time period. Each advisor in the system advised four hundred students, so an assumption in the model is that the number of students who meet any of the four criteria that required them to meet with an advisor to obtain a PIN was equal to half of the assigned student load, or two hundred students per advisor. Additionally, throughout the course of the semester, relatively few students came into the advising office to see their advisor voluntarily, so the assumption in the model is that this number was fifteen students for each advisor. With nothing else influencing their decision, both groups of students would come in to see their advisor at the rate of roughly eleven students per week (the "Normal Arrival Rate" equals the "# of Students Seeking Advising" divided by the "Length of semester").

At this rate, the advising office could easily handle the inflow without accumulating a backlog in the "Queue length", meaning that the "Advising departure rate" would also equal eleven students per week and the system would remain in equilibrium. If that were the case, there would have been no problem, so something else must have been influencing the arrival and departure rates. That something else was "Schedule Pressure", and we represented it by the sets of equations above the "Queue Length" stock in figure 3.

"Schedule Pressure" was a function of two variables. The first was a dimensionless time pressure factor. This was simply a representation of the time remaining in the semester, 18 at week 0, 17 at week 1, down to 0 at week 18 (see figure 6).

The other variable was the "Schedule Pressure" look-up table that provided values for the range of time pressure values (0 to 18). "Schedule Pressure", therefore, took the "Time Pressure Factor" and related it to the correlated values provided by the "Schedule Pressure Function". In arriving at the values for the "Schedule Pressure f" graph (see figure 7), the consulting team considered what it had learned from its interview with the advising team.

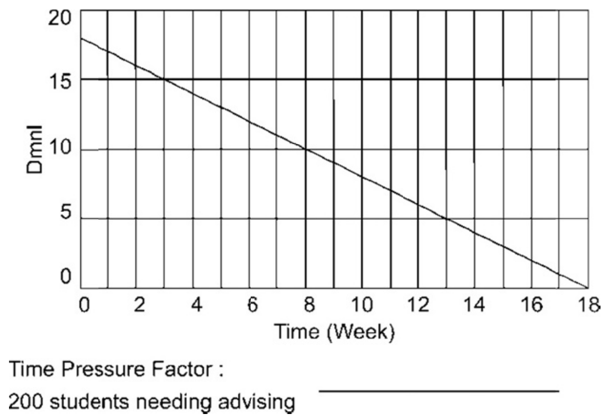

Figure 6. Time pressure factor.

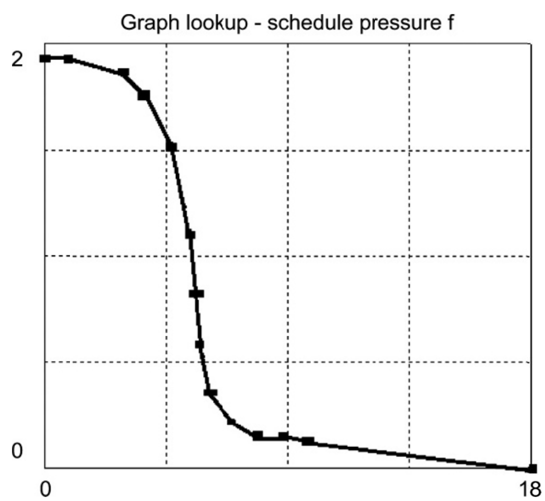

Figure 7. Schedule pressure function.

At the beginning of the semester, with 18 weeks remaining, there was little "Schedule Pressure". Similarly, the first 14 weeks of the semester also went by with very little "Schedule Pressure". Then, with 4 weeks remaining in the semester, a sharp increase in the pressure began and continued until it leveled off at the new elevated rate. The team formulated the shape this way because, when it spoke to the advisors, it found that students went through most of the semester without thinking too much about their schedule or without feeling the need to see an advisor. Then, with around four weeks remaining, the registration period began and suddenly a large number of students needed to speak with their advisor and they began to rush into the advisors' offices. This rush intensified as the deadline to register for classes (and the end of the semester) approached. "Schedule Pressure" acted on both students and advisors, but they reacted in different ways. The model represents this by the two arrows leaving "Schedule Pressure", one to "Effect of Schedule Pressure on Students" (figure 8) and the other to the "Effect of Schedule Pressure on Advisors" (figure 9).

The two were different because, although both experience pressure—student pressure came as the window to register closed and advisor pressure came as students began to flow through their doors—they differed in how they were able to react to the situation. As soon as the window opened and students were able to register (around week 14), they began to flow into the advisors' offices. When the amount of pressure on students was between 0 and 1 (below normal to normal), students' reactions were normal. They went to see their advisors at the normal rate

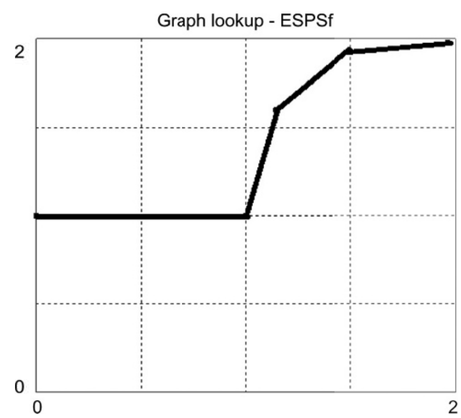

Figure 8. Effect of schedule pressure on students.

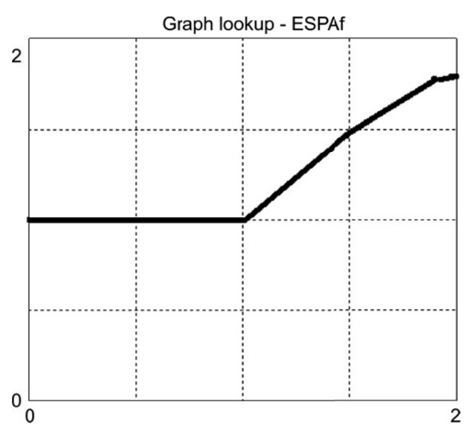

Figure 9. Effect of schedule pressure on advisors.

to handle all issues and questions—not just schedule problems, but other services that the advisors provided. Then, the window opened and students had to register for classes. Figure 8 illustrates this with the sharp upturn all the way to the maximum (2) in the "Effect of Schedule Pressure on Students" graph. Students immediately headed to the advisors' offices to get their PIN and approval for their chosen class schedule. This drove a large increase in the "Student Arrival Rate" at the point in the semester when student registration began (figure 10).

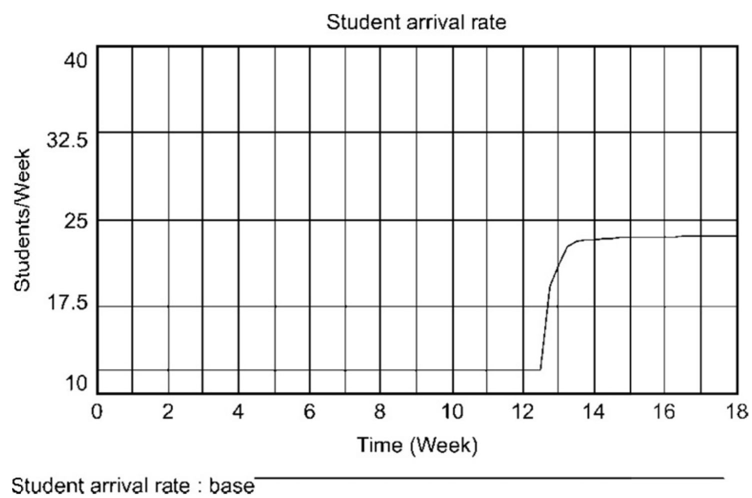

Figure 10. Student arrival rate over time.

Figure 9, on the other hand, shows the advisors' reactions to changes in the schedule pressure. Like the students, when the "Schedule Pressure" was below normal to normal (0–1), the advisors were able to advise at their normal rate and could handle the inflow as it came—and therefore no backlog in the queue developed (see figure 11).

Then, as the window opened for students to register, they began to flow into the advisors' offices. The difference is that advisors were unable to react immediately. Because of the manual nature of their work, the required preparation for their advising sessions with students caused a delay. Therefore, the curve for "Effect of Schedule Pressure on advisors" rises much more gradually once pressure goes above normal (that is, above 1). Additionally, no matter how high the "Schedule Pressure" on advisors got, there was a limit on how fast they could advise students. The length of their workweek and the minimum length of advising sessions limited them. Therefore, as shown in figure 9, the line never reaches the maximum of 2. Instead, it levels off at roughly 1.8. The result is that although the "Advising Departure Rate" increased sharply, the advisors were not able to keep up with the students flooding their office (see figure 12).

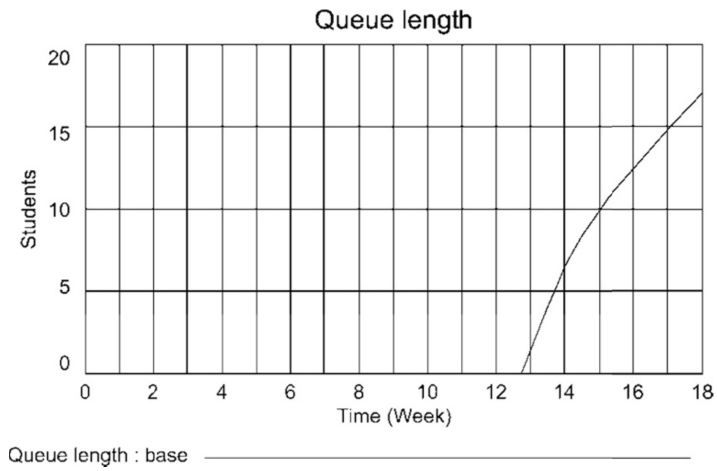

Figure 11. Advising queue length over the semester.

This model, which accurately reflects what happens in the advising office queue, allows analysis of the larger picture of Student Satisfaction.

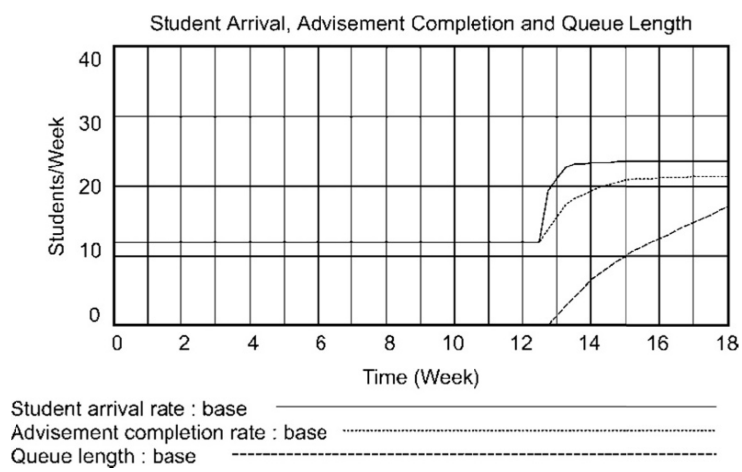

Figure 12. Student arrival rate, advising departure rate, and queue length.

The survey results indicated that many students rated the quality of the advising they receive at the School of Business as very poor, and the consulting team wanted to show the effect of the long queue on the quality of advising. Although the team does not feel that queue length itself explained the poor survey results, it may be linked directly to the chief cause of dissatisfaction—time spent with students. To link the "Queue Length" with the "Time Spent with Students", the variable "Queue Length Pressure" quantified the pressure resulting from long queues. The equation for this variable is simply the total queue length divided by two. Data showed that if the queue were two or fewer, then advisors would not feel rushed to limit appointment times below the optimal length of thirty minutes. The output of this equation is a dimensionless ratio that represents pressure put on the system by long queues. As shown by figure 13, "Queue Length Pressure" is zero for most of the semester and grows between weeks 14 and 18 to a highpoint of eight at the end of the semester. This number feeds into the "Effect of Queue Length Pressure" variable, which has a look-up table leading into it that converts that pressure score to a fraction. This represents how much time the advisors could spend with students. The shape of this curve represents the system behavior as the advisors described it to the consultants.

For most of the semester, when there was no queue, advisors were free to spend the optimal time with students. They were even able to go beyond that time and spend up to an hour with students. When there are two or fewer students in the queue and the ratio is 1, then advisors were still able to spend the full thirty minutes with each student (1 * the Optimal Time Spent = 30 minutes). However, as the number of students waiting in the queue increased, the amount of time that advisors were able to spend with students decreased, as shown in figure 14. This is a sharp drop. When the queue grew to just three, the advisors felt sufficiently pressured that they cut their time with students roughly in half to manage the increased workload. There is a minimum amount of time spent with students which the advisors estimate to be about seven minutes, which translates to 0.233 (7 ÷ 30) in the look up table. Regardless of how high "Queue Length" got, advisors could not go below this minimum amount of time spent with students.

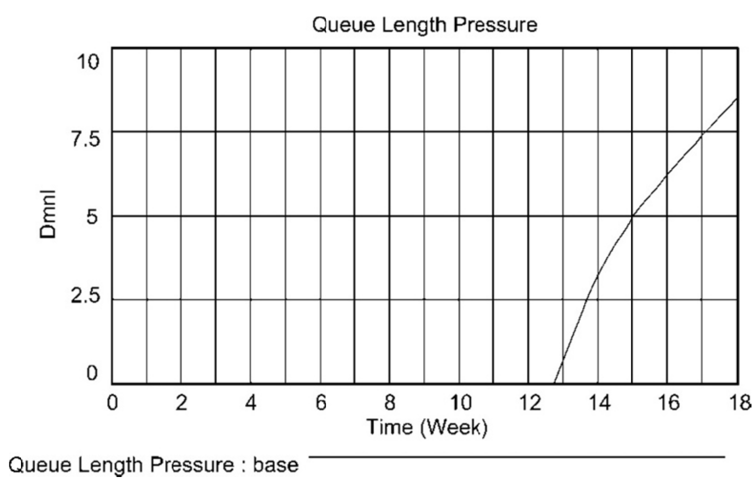

Figure 13. Queue length pressure over time.

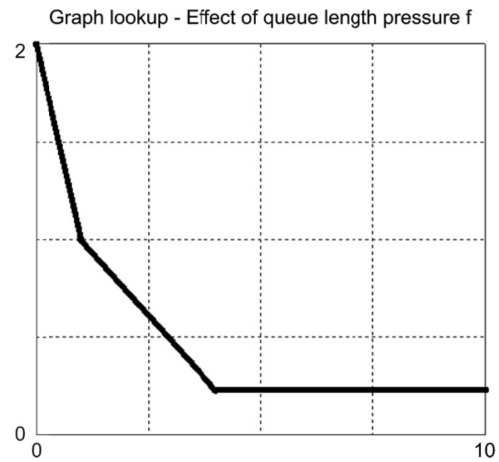

Figure 14. Effect of queue length pressure.

The graph of "Time Spent per Student" (figure 15) shows that over the course of the semester, advisors were able to spend up to the maximum one hour per student. It also shows that when the "Schedule Pressure" hit, the time dropped sharply, such that by week 15 they are going through students at the hurried pace of one every seven minutes.

To make the connection between "Time Spent per Student" and "Student Satisfaction", the consulting team started with the idea that the students had expectations about what advising should be. The assumption was that they expected to spend at least thirty minutes with their advisor discussing their schedule and any progress that they were making in their particular academic

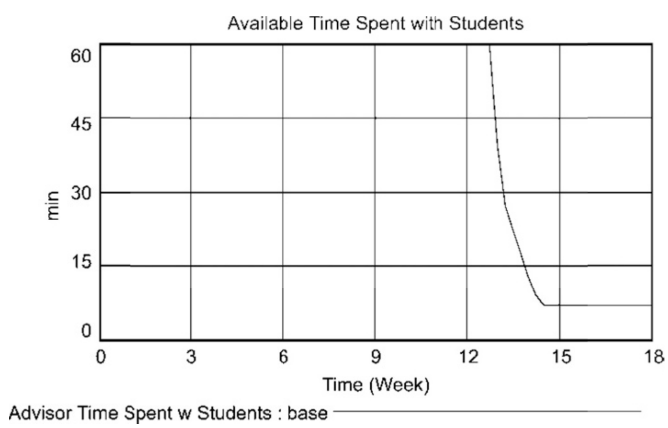

Figure 15. Time spent per student over the semester.

program. When their actual time was less than this expectation, a ratio of less than one (actual time spent/expected) was created. This "Expectations Ratio" fed into a variable called "Effect of Time Spent", which acted on the level of "Student Satisfaction". Obviously if students had to wait in line to receive required advising and they only received seven minutes of rushed advising on their proposed schedule of classes, they were not overly satisfied with the process. To show this, the "Effect of Time Spent" (figure 16) variable incorporated a look-up table to relate the size of the "Expectations Gap" (the lower the number, the higher the gap) to the level of satisfaction, a dimensionless variable that fed into the "Change in Student Satisfaction per Week". The output of this variable is a number between 0 and –1.

This number becomes a multiplier in the "Change in Satisfaction per Week" in-and-out flow. One potential weaknesses of the model is that it indicates when satisfaction declines, but is not able to indicate when satisfaction rises above the current level. Although this does limit the model's ability to mirror reality completely, it does not diminish its ability to show the important aspects of the advising process. The problem the team modeled was the decrease in student satisfaction with advising over the past several years prior to the study. For that reason, showing only the decrease in satisfaction did not limit the ability to model this particular problem. As shown in figure 16, the level of satisfaction began to fall when the amount of time the advisors spent with students fell below 30 minutes (a ratio of 1). At 25 minutes (roughly 0.85), students were still satisfied enough not to change their satisfaction level. When advisors began spending fewer than 20 minutes (roughly 0.65), student satisfaction levels began to plummet and they bottomed out at the minimum 7 minute session with a score of –0.8386. The existing "Satisfaction" stock level multiplies the figure from this look-up table and it becomes the inflow to "Satisfaction", either keeping the level stable or lowering it ("Change in Satisfaction per Week").

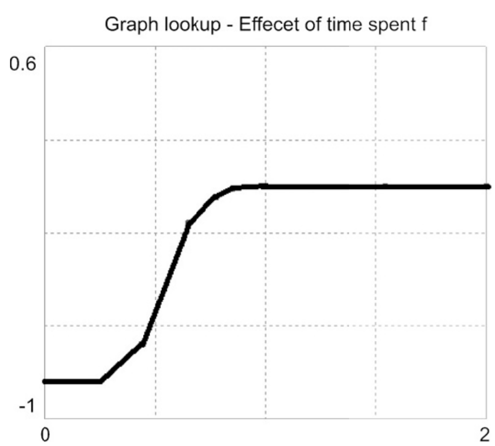

Figure 16. Effect of time spent.

The goal of this project was to help explain why some students were giving the advisors low marks for the quality of their advising experience at the university. Figure 17 and the survey results show that a number of students were satisfied.

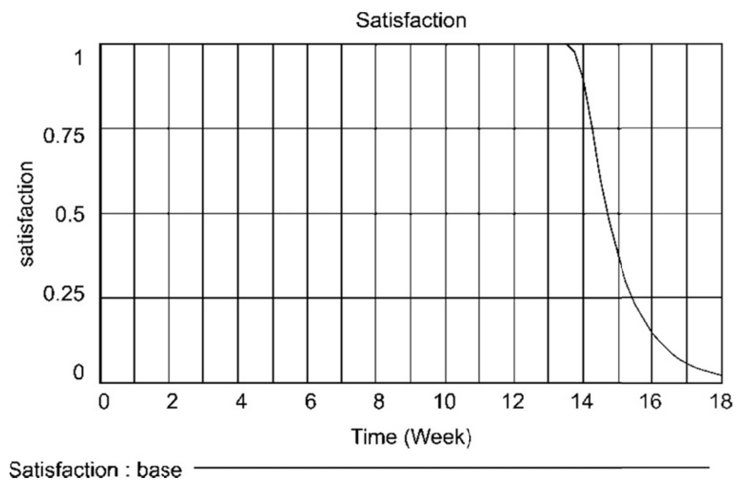

Figure 17. Satisfaction levels over time.

This group included those students who saw their advisors throughout the first two-thirds of the semester, and who therefore had the advantage of no queues and who experienced long meetings with their advisors. However, the survey results suggest that there were also a large number of students at the other extreme. These students gave their advisors very low scores on their surveys. The model suggests that these students were the ones whose only experience with their advisor was when the process forced them through the bottleneck at the end of the semester, and they consequently receive a hurried, incomplete advising session. It is important to note that figure 17 shows the satisfaction of the students receiving advising at any given point in time and does not represent an aggregate total of satisfaction. Therefore, students squeezed in during week 18, as time was running out, were not at all satisfied with the service that they received.