A System Dynamics Approach to Improving An Advising System for Business School Undergraduates

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Abstract

A School of Business located in the northeast United States annually administers the AACSB/EBI Undergraduate Business Exit Survey to all its graduating seniors. One area that has consistently received low marks has been advising. The Associate Dean of the Business School wanted to address the situation and see how the system could be improved. Through interviews with the Associate Dean and the advising staff, a consulting team compiled information about the system and identified the major problem as congestion in the system. Recommendations included changing the criteria for students required to use the system, simplifying the curriculum, better promoting the advising function to students, increasing the use of automated advising tools, expanding the length of the advising period, and adding advising staff or having faculty do advising. So far, the School of Business has adopted only one of these recommendations—curricular simplification—which may improve the situation as time passes. The School is currently examining other options, especially changing the criteria for required advising and having the faculty get involved in advising.

Introduction

A School of Business located in the northeast United States annually administers the AACSB/EBI Undergraduate Business Exit Survey to all its graduating seniors. Students evaluate various aspects of their educational experience, and the School of Business takes the results very seriously in its efforts to improve its programs. One area that has consistently received low marks has been advising. The Associate Dean of the Business School wanted to address the situation and see how the system could be improved. Through interviews with the Associate Dean and the advising staff, the consulting team compiled information about the system. Between the survey results shared, and the staff interviews done, with the team, the information painted a very clear picture of the problem.

Statement of the Problem

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

1. Student has fewer than 53 credit hours,
2. Student has not met the computer proficiency requirement
3. Student has a GPA of less than 2.33.

The students using advising services fall into three categories: those who are required to get advising based on the above requirements, those students who voluntarily seek advising about what courses would best meet their needs, and those transferring in from other departments or universities. According to the advisors, very few students seek them out during the school year, to talk about graduation requirements or to receive other advising support. While the advisors do have other duties, such as generating a newsletter, planning events and other outreach efforts, during most of the semester the advisors have ample time to spend with students. The busiest times for advising are in the first few days of the semester (incoming first year students, add/drop, transfer students) and at the end of the semester. This later period is dramatically busier because this is when all the students must register for the next semester.

During the middle of the semester, when few students think about advising, the advisors feel they are able to give good quality advising to the students by spending plenty of time with them and thereby developing personal relationships. They feel that a half hour is the most effective amount of time to spend with a student. In addition to half an hour spent talking with students, they also need some time before the meeting to prepare by gathering the student's grades and records. The preparation process includes manually checking a student's file for records of past visits and checking the information system for what limited information is available there. At the end of the semester, students flock to the advisors' offices, resulting in long lines that force many students to come back to the office repeatedly until an opening is available. When the line is too long, the students are unhappy and the advisors are stressed. When the end of semester deadline nears, the advisors are often forced to spend only about seven minutes with each student. Part of the reason so many students wait until the last four weeks to meet with an advisor are the established procedures in place within the School of Business. The window for the registration period is four weeks because Registration Access Numbers (RANs) are issued only four weeks in advance of the deadline for registration. Students are not able to register for classes without a RAN, and those students who fail to meet the criteria listed earlier are forced to meet with an advisor to receive a RAN.

Many other departments at the university use automated advising tools that can be found on the university's "Distributed Student Information System" (DSIS). Some examples of these are *Prerequisite Check* and *Degree Audit*. In many other departments students are able to self-advise by using these tools and other materials, such as catalogs and simplified graduation plans. The School of Business advisors consider the curriculum requirements for their school to be relatively complex. It has been their mindset for many years that students are not capable of self-

advising, so the School of Business has a policy that ensures most students must see an advisor to register. Furthermore, in all other departments at the university, faculty members are responsible for advising, and they rely only to a limited extent on staff advisors. The non-faculty staff advisors have a long history with the School of Business, and it is not clear why faculty members are not involved in advising.

Based on the information the consulting team gathered, it determined the problem to be the way the advising system is structured. Although the use of staff advisors and lack of faculty involvement have had along 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 this 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 selecting some of the most important to be drawn as reference modes. It determined that it would expect the five variables shown in Figure 1 to act in a consistent way from semester to semester. These are the graphs the team sketched with its expectations of their behavior against the x axis of time (18 weeks of a semester). The last four weeks of the semester are highlighted because that is when the largest volume of students enters the system. Figure 1 shows the graphs that represent the research team's expectations for the dynamics of the most important variables in our model during the 18 week semester.

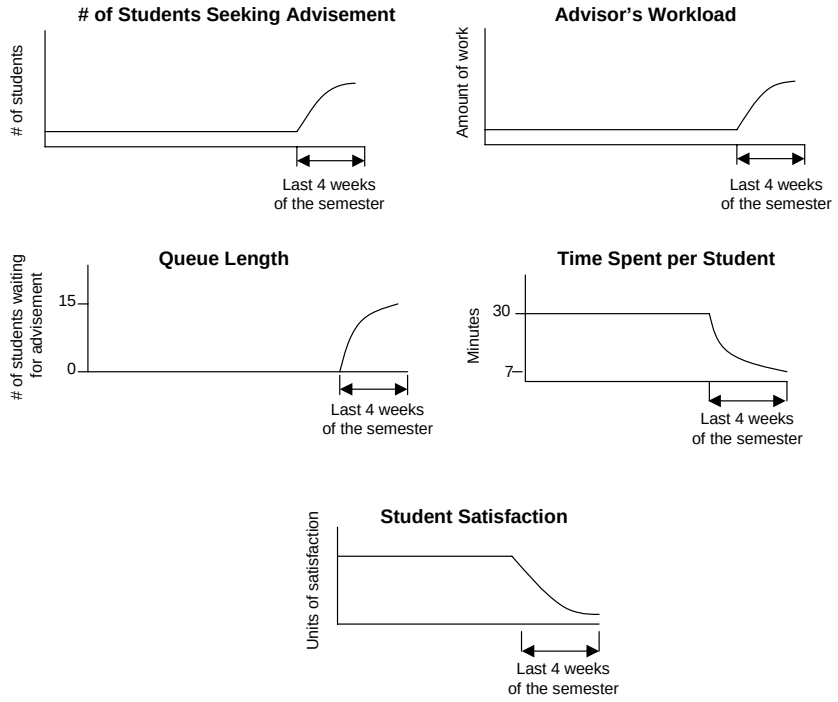


Figure 1 Reference Modes

Dynamic Hypothesis

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

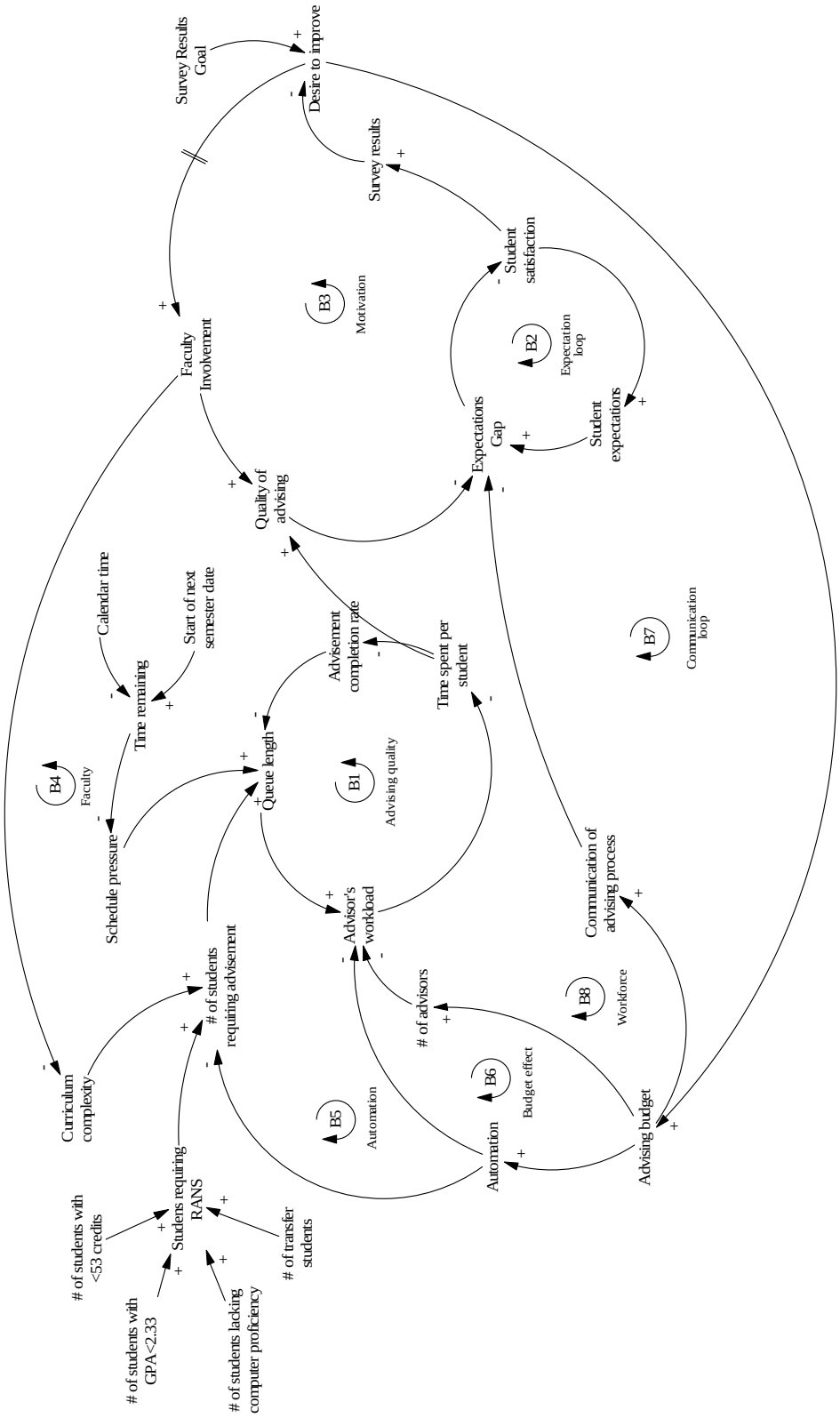
- Understaffing (advisors have too many students to advise)
- Not enough time
- Students can not get RAN early enough
- Faculty members are not knowledgeable about advising system (and out of that ignorance establish curricular policies and practices that make the situation worse)
- Students wait until the last minute
- Students are purportedly immature
- Students are looking for parenting, not advising

- Student expectations are wrong (based on high school or prior experience)
- The term "Advising" does not have the same meaning for each constituency: students, advisors, and faculty
- There is not a good method for communicating the message of advising to students (who, what, where, how, when)
- Advising not spread out enough, can not do it in four weeks

Most of these theories seemed to blame outside forces (exogenous variables), other people, or factors that are 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 look at 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.

"Student Satisfaction" is dependent on the amount of time students spend with their advisor. The students should be there because they *want* to talk to their advisor, not because they are forced 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.

Figure 2 Causal Loop Diagram



Causal Loop Description

The Advising Causal Loop diagram (shown in Figure 2 on page 5) has three exogenous inputs and eight loops. The diagram attempts to show the interconnected relationships in the current School of Business advising system and how they interact. Following are descriptions of the three exogenous inputs as well as 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 RANs." This variable is the sum of the four groups of students who make up this pool, which are represented with the following variable names: "# Students with <53 Credits," "# Students with GPA < 2.33," "# Students Lacking Computer Proficiency," and "# of Transfer Students." This exogenous input has a positive relationship with the variable "# of Students Requiring Advising."

A second exogenous input shows the effect of time passing during the semester, to measure the effect on the causal relationships. This input starts with two variables, "Calendar Time" and "Start of Next Semester Date." Both of these variables feed into "Time Remaining," which is calculated as the difference between "Start of Next Semester Date" and "Calendar Time." This variable will start out high at the beginning of the semester and decrease as time approaches the start of the next semester. The variable "Time Remaining" has a negative relationship with "Schedule Pressure," showing that as the semester progresses "Time Remaining" decreases while "Schedule Pressure" increases. "Schedule Pressure" has a direct positive relationship with its input "Queue Length."

The final exogenous input comes in the form of "Survey Results Goal" which is a benchmark target set by the School of Business for future exit survey results.

Advising Quality Loop (B1)

This balancing loop illustrates that as workload increases, the quality of advising is sacrificed to increase throughput and reduce the length of the queue. "Queue Length" increases with increases in "Schedule Pressure" and with increases in the "# of Students Requiring Advising." As "Queue Length" increases it causes an increase in "Advisors' Workload," which represents the total workload per advisor. Increases in "Advisors' Workload" results in decreases in the variable "Time Spent per Student." This variable represents the average time spend per student, at any given point in time during the semester. As "Time Spent per Student" goes down the "Advising Completion Rate" goes up. This shows that as advisors spent less time per student their student throughput increases. Finally, to complete the loop, as "Advising Completion Rate" increases, "Queue Length" decreases. This is a result of an increase in the outflow from the queue. Completing this loop shows that it is a balancing loop, since an initial increase in "Queue Length" results in an ultimate decrease in "Queue Length."

Expectations Loop (B2)

This loop represents the dynamics of student expectations relative to student satisfaction in the advising experience at the School of Business. The variable "Student Expectations" represents the student expectation coming into the current semester. This variable is the cumulative result of past 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 labeled "Expectations Gap" with a positive relationship. As "Student Expectations" increase so to will the variable "Expectations Gap," the difference between student expectations and their current advising experiences. "Expectations Gap" takes into account two different types of inputs. One is the gap between expectations from students regarding communication of the advising process; the other is the gap between the quality of advising expected and the quality received. "Expectations Gap" links negatively into "Student Satisfaction," showing that as the gap between expectations and experience widens, satisfaction will decrease. Finally, to complete the loop, "Student Satisfaction" feeds positively into "Student Expectations," showing that as satisfaction increases (or decreases), so too will expectations regarding future advising. This is a classic balancing loop of expectations versus satisfaction.

Motivation Loop (B3)

This loop captures the effect of the student exit survey results relative to a target score and how it affects the motivation of the School of Business to improve the advising process. As "Desire to Improve" increases, so too will "Faculty Involvement" (albeit slowly). In the course of interviewing the advisors about this project, the consulting team learned that up until recently there has been very little faculty involvement in the advising process but now that the "Desire to Improve" has increased there has been some initial involvement by the School of Business administration to seek a solution. It is hoped that this increased "Faculty Involvement" will result in an increase in "Quality of Advising." This variable is meant to reflect overall quality of the advising students receive. Continuing around the loop, as "Quality of Advising" increases the "Expectations Gap" already discussed will decrease, resulting in greater "Student Satisfaction" and ultimately in better "Survey Results." The variable "Survey Results" feeds 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" has on "Student Satisfaction" and ultimately the success in reaching the desired survey results goal. Starting with "Faculty Involvement" shows that increases in this variable result 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 is the complexity of the curriculum. The rationale is 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 decreases the "# of Students Requiring Advising." With fewer students needing advising,

"Queue Length" will decrease. On the same path as described in the "Advising Quality" loop B1, "Advisors' Workload" will decrease followed by an increase in "Time Spent per Student." With an increase in "Time Spent per Student" there will be an increase in the "Quality of Advising" and we follow the Motivation loop around to an increase in "Student Satisfaction" and ultimately in a decrease in "Faculty Involvement." Since an initial increase in "Faculty Involvement" resulted in an eventual decrease in "Faculty Involvement," this is a balancing loop.

Automation (B5) and Budget Effect (B6) Loops

These loops are closely related and capture the effects of "Automation and Budget" on the advising process. The consulting team learned that very little of the advising process has been updated to take advantage of the computing power available to the School of Business. Advisors still use a manual paper system to track student progress. Other departments at the University use automated advising tools, such as *Prerequisite Check* and *Degree Audit*, both of which enable significant levels of student self-advising. Because there is no automated system for School of Business students to verify their path toward graduation, they are forced to seek advising as shown in the "Automation" Loop. With decreases in "Automation" it follows that there will be an increase in "# of Students Requiring Advising" for the reasons just discussed. Increases in "# of Students Requiring Advising" results in greater "Advisor Workload" which leads to a reduction in "Time Spent Per Student." With a reduction in "Time Spent per Student" the "Quality of Advising" decreases and "Expectations Gap" increases. As "Expectations Gap" increases "Student Satisfaction" decreases followed by poorer "Survey Results." As "Survey Results" decrease, "Desire to Improve" increases, which leads to more financial resources being allocated toward advising or an increase in "Advising Budget." Because "Automation" of the advising process will require budget spending, a positive link exists between the "Advising Budget" and "Automation" variables in the model. Finally, increases in "Advising Budget" will result 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 has 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 consists of the manual search for individual student records and information about curriculum requirements for the School of Business. During the busy four weeks of the semester the advisors often spend several minutes of the seven minute advising meeting pulling and reviewing paper records. This decreases the "Time Spent Per Student" and ultimately the "Quality of Advising." The remainder of this loop overlaps with the Automation loop and a detailed description can be found the in the previous paragraph. This loop is also a balancing loop, since an initial increase in "Advising Budget" ultimately results in a decrease in this variable after completing the loop.

Communication Loop (B7)

The balancing Communication Loop reflects the ability of advisors to communicate effectively important aspects of the university requirements to students. Effective

"Communication of Advising Process" will reduce the gap between "Students Expectations" and "Quality of Advising," thereby increasing "Student Satisfaction." According to the causal loop diagram, an increase in student satisfaction will positively affect "Survey Results" which, in turn, will have a negative effect on "Desire to Improve," a variable that also reflects the advisor's willingness or motivation to improve her/his work if the goal for such an improvement is perceived and taken seriously. "Desire to Improve" is shown with a positive link to "Advising Budget" since most of the improvements require budget spending. An increase in "Advising Budget" will increase the capability of advisors to communicate the advising process to students more efficiently. The interview process revealed that many schools use direct mailing or even phone campaigns to remind students of important deadlines and to prompt them to seek advising. At the very least these tools are used 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 require money and this loop shows the positive effect that investment in communication can have on "Student Satisfaction."

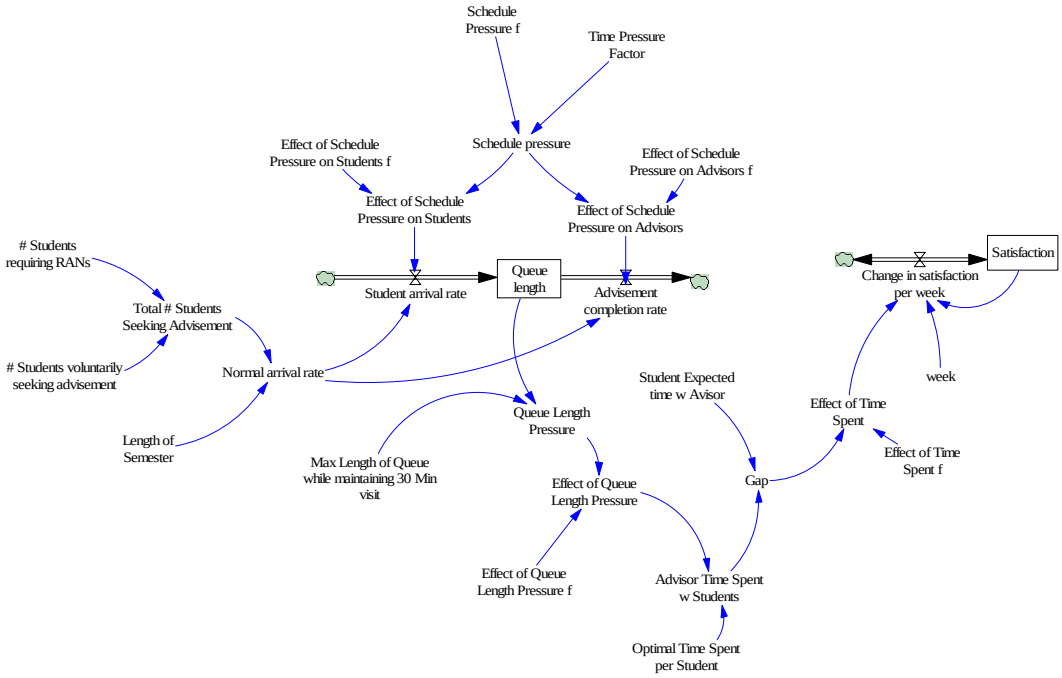
Workforce Loop (B8)

A final loop is the Workforce Loop which also is very closely related to the Automation Loop. However, it differs because it shows the effect that increases in the number of full or even part time advisors would have on the system. This balancing loop captures the link between "Advising Budget" and "# of Advisors." An increase in the "Advising Budget" will allow recruiting of more advisors which, in turn, will reduce the "Advisor's Workload." As "Advisor's Workload" goes down, "Time Spent per Student" increases. An increase of the latter will result in improving of "Quality of Advising," which will cause "Student Satisfaction" to rise. Student satisfaction is the main factor driving "Survey Results." "Survey Results," through "Desire to Improve," feeds into "Advising Spending" as described in the previous section. Although included in the causal loop for completeness, the likelihood of hiring a new advisor is slim, and therefore this loop does 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 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 can be made to improve the system is 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 as the team understood it to be. The model includes two stocks and their respective flows, where each is controlled by the various input variables and lookup table functions. The issues related to the use of all the table functions are included in a Technical Appendix at the end of this paper.

Figure 3 Simulation Model Queue Length and Satisfaction Stocks



Policy Design and Evaluation

The environment in which this system operates is fairly static. The causal loop diagram contains several balancing loops, but no reinforcing loops. The system has 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 is 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 is a fixable problem, but the first step has to be to expand the recognition of the problem beyond a few administrators and the advising staff. The problem needs to be made clear to all administrators and certainly all faculty members.

The recommendations are designed to have the greatest amount of leverage throughout the system and many involve altering the main exogenous variable affecting satisfaction, the number of students requiring advising. That this system is well entrenched in the School of Business is the largest obstacle to making these changes. The advisors are closest to the problem and feel the most pressure. It is their area of work that has received low scores; however they work hard and get little recognition for the work that they do. Most of the suggested policy changes are be changes that will need to be made at either the administrative or faculty level.

This presents a problem because the faculty is not dissatisfied with the system as it is currently structured—in fact they are not involved in the system at all. As mentioned earlier, the School of Business is the only school in the University that does not utilize its faculty as advisors. As articulated quite clearly by the advising team there has been strong resistance in the past to suggestions that faculty become more involved in the process. This creates a difficult

situation for the advisors. They clearly want the system to be changed, yet they are not the ones who need to act and are not in positions of power over the faculty to compel them to act. Faculty will obviously resist becoming more involved because it will mean more work for them. Although in the end the proposed changes will benefit everyone involved (faculty, advisors and most importantly the students), in the short term it is likely that faculty will continue to resist what they see as more tasks being piled on their already full plates. It will be a tough package to sell to the faculty, but the benefits probably warrant the sacrifices that are being asked of them.

The problem with the current system is obvious: a clogged pipeline creates student dissatisfaction. Either there need to be fewer students in the pipeline or the system has to be modified to accommodate more students. There are several areas of opportunity for change; one is to decrease the number of students in the system or to increase the number of advisor-hours by adding staff. Another is to change the structure of the advising process so the bulk of the advising can be spread out over the semester rather than all occurring in the last several weeks.

Several approaches might ease system congestion. The following list of policy recommendations outlines only those that are most significant in their potential effects. Within the scope of this project the consulting team chose to model the portion of the loop diagram that was most closely related to the dynamic hypothesis and offered the best potential for solving the problem. The recommendations are listed in order of strength of recommendation from highest to lowest.

Policy Recommendations

1. 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 must be advised prior to registration. This puts more responsibility on the shoulders of the students. This could be done by decreasing the requirements gradually or by eliminating a requirement completely. The GPA requirement could be lowered to 2.0, or eliminated completely. The number of credits could be lowered to fewer than 25 instead of 53. The computer proficiency requirement could be eliminated. 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 will be better able 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 is being rushed through a crowded system at the end of the semester to receive a RAN, then it should come as no surprise that the survey results are as low as they are. This is not a reflection of the quality of the advisors—it is a reflection of a poorly designed system. The system is forcing students into their advisor's office under the guise of helping them to plan their academic careers properly. Yet when they arrive they receive hurried and unsatisfactory service that amounts to little more than a rubber stamp in the form of a quick look at their schedule, the handing out of a RAN and a final push out the

door so the next student may enter. For this reason, we feel that one sure way to raise satisfaction levels among the students is to remove the compulsory aspect of advising and make it instead a resource that students can use when they feel the need. The consulting team created several datasets and ran them to compare the changes in number of students to be advised and the impact these changes had on the model. The team tried to model the change in one advisor's workload. Each advisor has 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 base run 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 re-ran it with only one hundred students required to be advised, and fifty students requiring advising, and finally zero students requiring advising. In the last run there are still a few remaining students who voluntarily wish to be advised which accounts for the short queue length. As shown in Figure 16, 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.

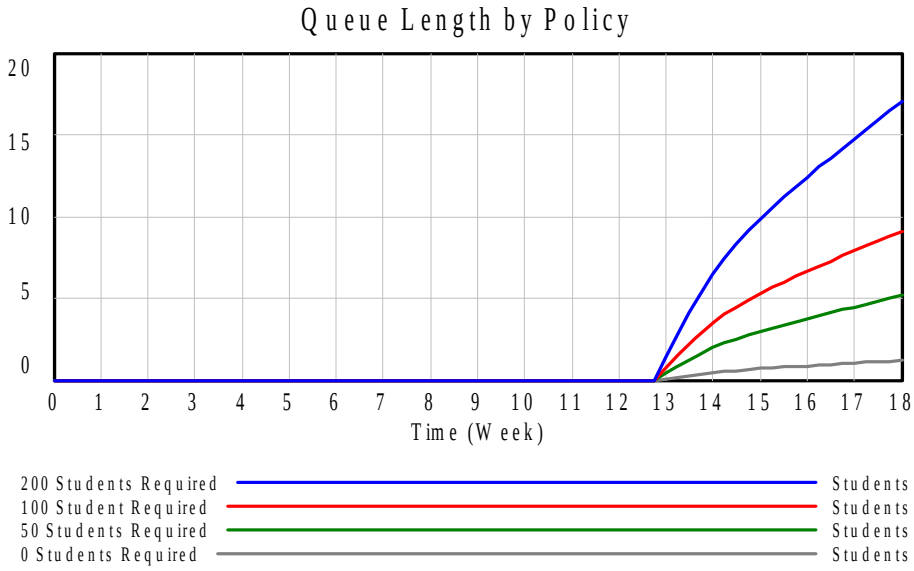


Figure 4 Simulation Results of Queue Length by Policy Scenario

The consulting team then ran the same data sets, 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. Satisfaction equals 1 when 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.

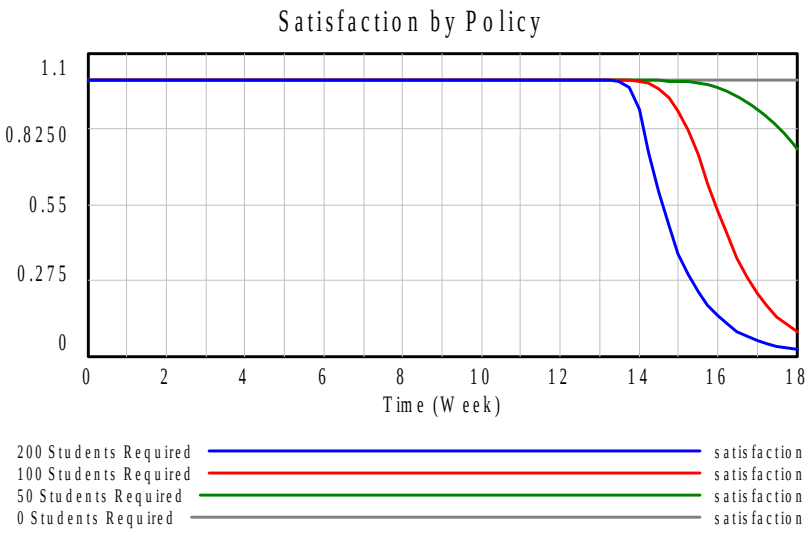


Figure 5 Simulation Results of Satisfaction by Policy Scenario

2. A second policy recommendation is to simplify the curriculum for the School of Business. One of the problems that prevents increased automation and makes the use of temporary help during peak times more difficult is that the curriculum is so complex. As shared by advisors, not only are the requirements for a given year sometimes difficult to follow, there are also several versions of the curriculum in play at any given time, depending on when the students started the program. On the casual loop diagram, there is 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.

This relationship is a valid and important one. A large part of the current problem is that the faculty are simply not aware of the implications their curriculum decisions have on the advising process. This is because they are not involved in the process at all right now, so advising is likely not a consideration when new course offerings are 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 is done at the undergraduate level. One of the frustrations that the advisors expressed is that it is difficult to recommend schedule choices to students when it is unclear when certain courses will be offered again and in which order.

Ultimately, simply exposing the faculty to the current situation will 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 sees portions of the student body every day in their classes, but seeing this other side of the student experience will help to broaden their horizons and in the long run will make the curriculum less complex.

One fear of letting more students self-advise expressed by the advisors is that the students could misinterpret the curriculum and not graduate on time as a result. This would certainly not help 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 surveys taken their senior year. Although the consulting 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 is currently structured, most juniors and seniors are able to follow their respective curriculum and graduate on time without being forced to seek the assistance of an advisor. The team felt that the same is 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 and improved communication about the advisors and their availability would also help to alleviate these problems.

The end result of this policy recommendation would be to reduce the number of students seeking advising. The effect of this is already shown in Figure 14 (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 those requirements were loosened or eliminated. The School of Business wants students to be able 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 don't run into problems as they try to navigate the curriculum waters.

3. One of the jobs of the advisors is to communicate to students what advising is and how to get access to it. The advisors have 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 feel that their message gets lost at orientation because the students are being overwhelmed with so much information at that point that they will not retain important facts about the advising process. The consulting team asked the advisors if there was one course that all the students had to take, to see if there was an opportunity to institute a regular half hour mini-seminar on advising during class time. They said that most students have to take Accounting 110, but that there would be resistance among faculty to permitting them to take class time for such a project. If such a change could be made, it would get the students to better understand and better use the advising resources, 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 any other changes are made. There is no cost to this suggestion and would help to adjust student expectations, a leading contributor to their level of satisfaction. Examining the Causal Loop Diagram shows that "Communication of the Advising Process" leads directly to reducing the "Expectations Gap" between "Student Expectations" and the "Quality of Advising." One of the problems that the advisors experience during the rush of scheduling time is that the students have 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. This expectation's 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.

4. Increasing the amount of automation would reduce "Advisors' Workload" even if the rest of the system remained unchanged. One of the problems currently is that neither advisors nor students have 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 Distributed Student Information System (DSIS), the School of Business is 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 still is. Much of the advisors' current time is spent 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 more resources are opened up to students through the incorporation of automated records systems, students would be better able to track their own progress. This will help to ease the fear, discussed earlier, that students will make mistakes that will wind up affecting their scheduled graduation dates. As tools such as the degree audit are made available, 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. Security issues would have to be addressed with regard to giving out RANs, but this is something that has been done elsewhere and 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 the delay in response was understood. E-mail blasts to students of reminders to come in to get advised might be helpful in improving the communication process, but right now the budget and technology needed to do this are not in place.

5. Exploring the idea of expanding the length of the advising period yielded several ideas. If the RANs could be issued earlier than four weeks before the registration deadline, the process could be extended over a longer period of time. This would have to be tested 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 be filled if they waited too long.

Looking at the Causal Loop Diagram, this policy change would reduce "Schedule Pressure." Because the window for registration would be increased, the schedule pressure would be less intense and spread over a longer period of time, 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 RANs earlier.

6. One of the largest limitations to this system is the number of hours that advisors have in their workday. This could be alleviated 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

Conclusion

The above suggestions for policy change come 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 is a problem with the undergraduate advising in the School of Business at the university. The advisors clearly described the chaotic situation that they experience at the end of the semester. They are frustrated that no matter how fast they rush through appointments with students, they look out and see the lines growing as students rush to get the RAN needed to register for classes. The students either do not want to be there in the first place and are rushed through, or they *do* want to be there and no time is allotted to address their real questions or problems. Either way they are leaving the advising office upset and frustrated. This is reflected in the survey results, but is even better illustrated by the stories that they told of this unfortunate situation.

The second point that rose to the surface is that this is a systemic problem. It is not the result of one bad advisor who is performing poorly or is unqualified. That would be a relatively easy problem to solve. This is a much deeper, more involved problem that involves the entire system. There do not appear to be any "quick fixes" for the advising problem.

The third point that became clear is that this is a problem that has been around for a long time. One of the advisors has been at the university for eighteen years and looking back over that time she could not remember a time when things were better. This has been a problem that has been around the School of Business for years. It is unclear if any attempts have been made in the past to correct the problem, but it is clearly not a new one.

These three aspects of the situation make it an ideal problem to model using causal loop

diagrams and system dynamics modeling. 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. Although not all of the suggestions include this variable, it is probably the most important one. This is a variable with a great deal of 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 only one of these recommendations—curricular simplification. The faculty went 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. It is hoped that this will improve the advising situation as time passes. The School is currently examining other options, especially changing the criteria for required advising and having the faculty get involved in advising. As this paper showed, both of these options would *require* fewer students to see the current advising staff, improving the experience for all concerned. It remains to be seen whether or not the faculty might be induced to do *some* advising so as to reduce the overall burden and perhaps, in other ways, improve the experience for students.

Technical Appendix

A Walk Through 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, where each is controlled by the various input variables and lookup table functions. The issues related to the use of all the table functions are included in this Technical Appendix.

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 to 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 is charged with advising four hundred students, so an assumption in the model is that the number of students who meet any of the four criteria that requires them to meet with an advisor to obtain a RAN is equal to half of the assigned student load, or two hundred students per advisor. Additionally, throughout the course of the semester there are relatively few students who come into the advising office to see their advisor voluntarily, so the assumption in the model is that this number is 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 be no problem, so something else must be influencing the arrival and departure rates. That something else is "Schedule Pressure," and it is represented by the sets of equations above the "Queue Length" stock in Figure 3.

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

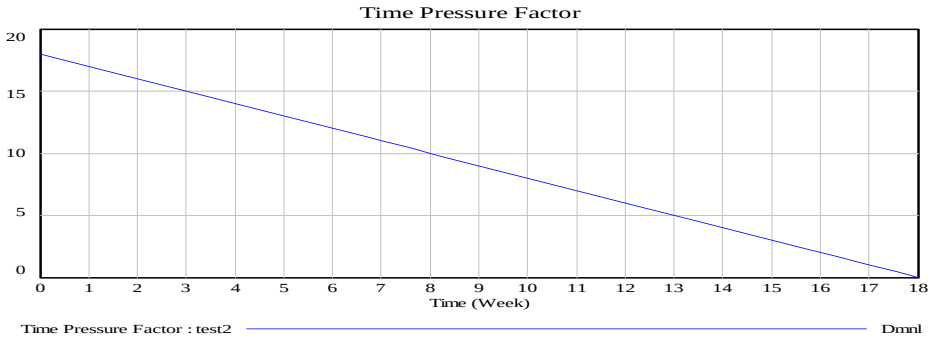


Figure 6 Time Pressure Factor

The other variable is the "Schedule Pressure" look-up table that provides values for the range of time pressure factor values (0 to 18). "Schedule Pressure," therefore, takes the "Time Pressure Factor" and relates 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. At the

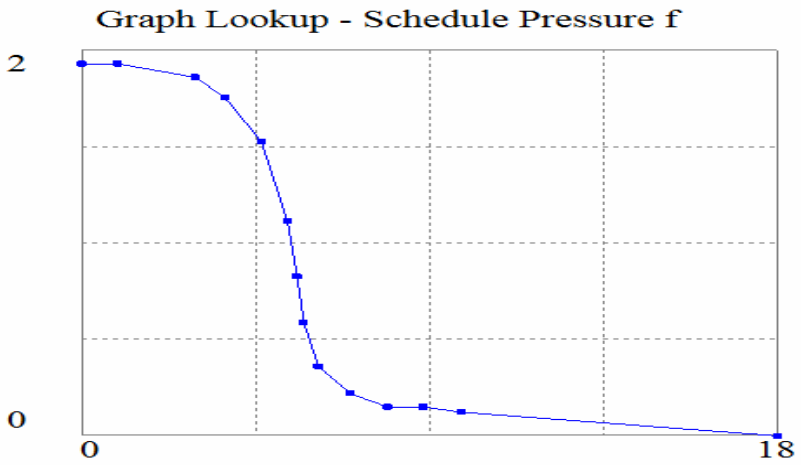


Figure 7 Schedule Pressure Function

beginning of the semester, with 18 weeks remaining, there is little "Schedule Pressure." Similarly, the first 14 weeks of the semester also go by with very little "Schedule Pressure." Then, with 4 weeks remaining in the semester, a sharp increase in the pressure begins and continues until it levels off at the new elevated rate. Why this shape? When the team spoke to the advisors, it found that students go 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 begins and suddenly a large number of students need to speak with their advisor and they begin to rush into the advisors' office. This rush intensifies as the deadline to register for classes (and the end of the semester) approaches. "Schedule Pressure" acts on both students and advisors, but they react in different ways. This is represented 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).

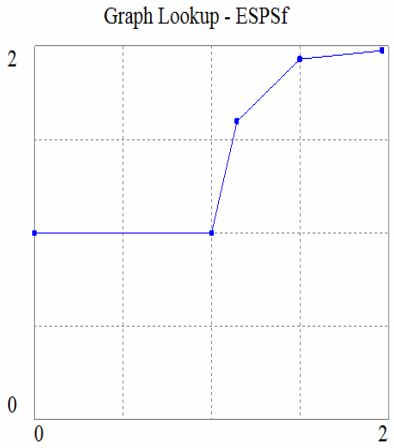


Figure 8 Effect of Schedule Pressure on Students

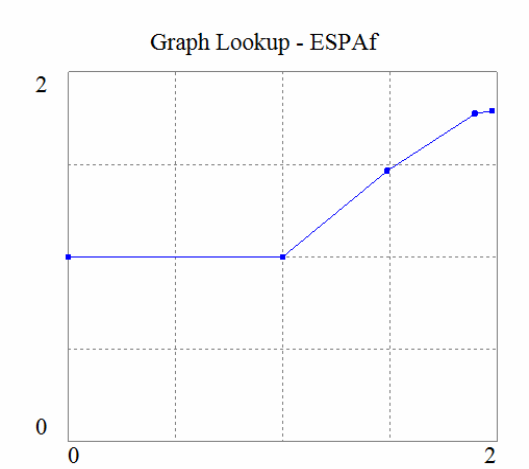


Figure 9 Effect of Schedule Pressure on Advisors

Why are the two different? Although both experience pressure—student pressure comes as the window to register closes and advisor pressure comes as students begin to flow through their doors—they also differ in how they are able to react to the situation. As soon as the window opens and students are able to register (around week 14), they begin to flow into the advisors' offices. When the amount of pressure on students is between 0 and 1 (below normal to normal), students' reactions are normal. They will go to see their advisors at the normal rate to handle all issues and questions not just schedule problems, but other services that the advisors provide. Then, the window opens and students must register for classes. Figure 6 illustrates this with the sharp upturn all the way to the maximum (2) in the "Effect of Schedule Pressure on Students" graph. Students immediately head to the advisors' office to get their RAN and along with approval for their chosen class schedule. This drives a large increase in the "Student Arrival Rate" at the point in the semester when student registration begins (Figure 10).

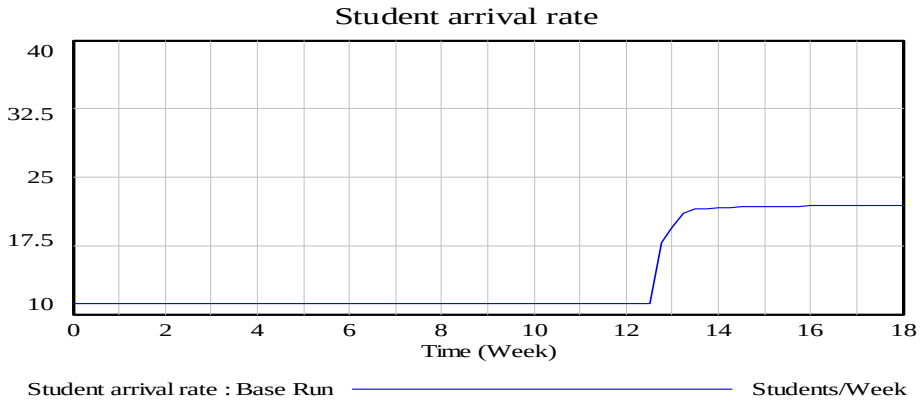


Figure 10 Student Arrival Rate over Time

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

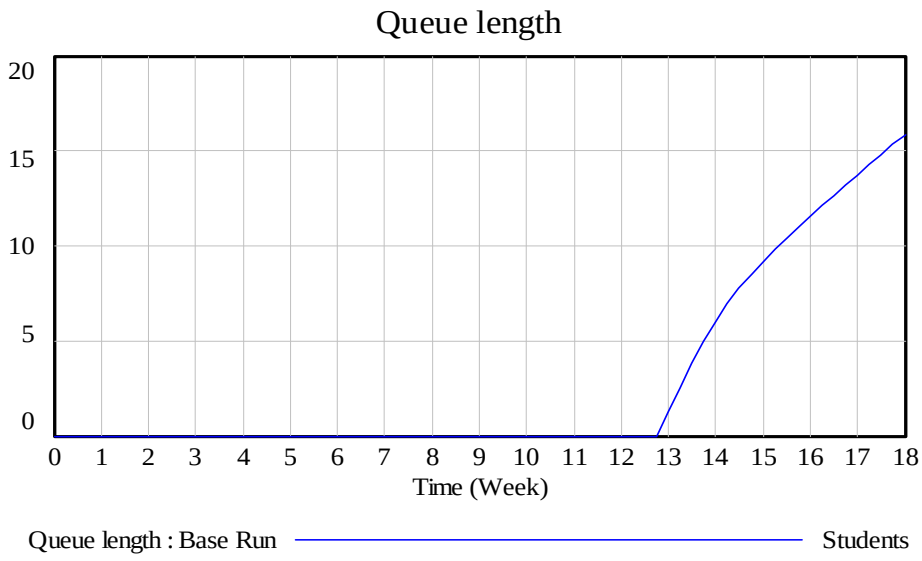


Figure 11 Advising Queue length over the semester

Then, as the window opens for students to register, they begin to flow into the advisors' offices. The difference is that advisors are unable to react immediately. Because of the manual nature of their work, the required preparation for their advising sessions with students causes 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 goes, there is a limit on how fast they can advise students. They are limited by the length of their work week and the minimum length of advising sessions. Therefore, as shown in Figure 9, the "Effect of Schedule Pressure on Advisors" line never reaches the maximum of 2. Instead it levels off at roughly 1.8. The result is that although the "Advising Departure Rate" increases sharply, the advisors are not able to keep up with the students flooding their office (see figure 12).

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

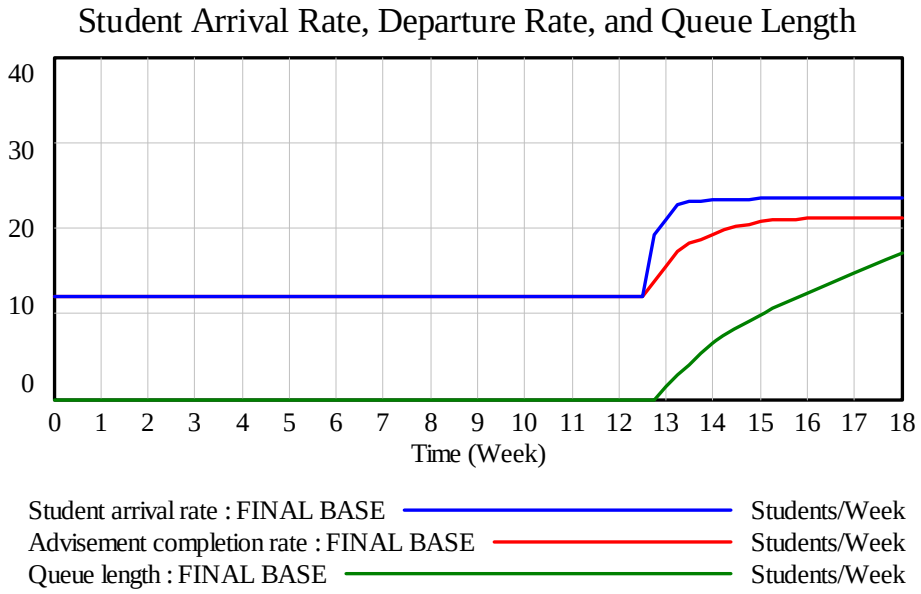


Figure 12 Student Arrival Rate, Advising Departure Rate, and Queue Length

The survey results indicate that many students rate 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 explains the poor survey results, it may be directly linked 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" quantifies 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 is two or fewer, then advisors will 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 0 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 is fed 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 are able to spend with students. The shape of this curve represents the system behavior as the advisors described it to the consultants.

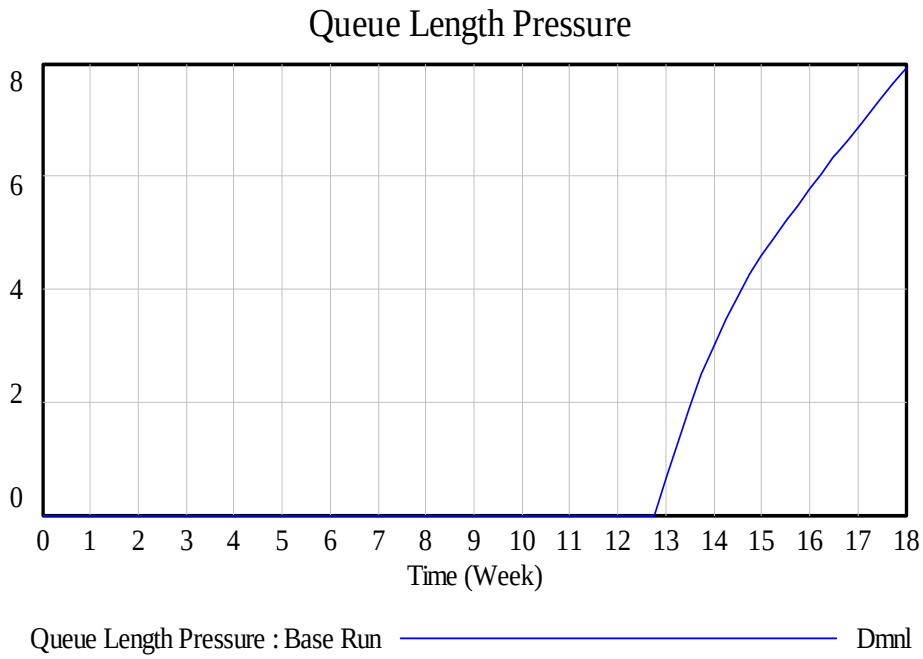


Figure 13 Queue length Pressure over Time

For most of the semester, when there is no queue, advisors are free to spend the optimal time with students. They are 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 are 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 increases, the amount of time that advisors are able to spend with students decreases, as shown in Figure 14.

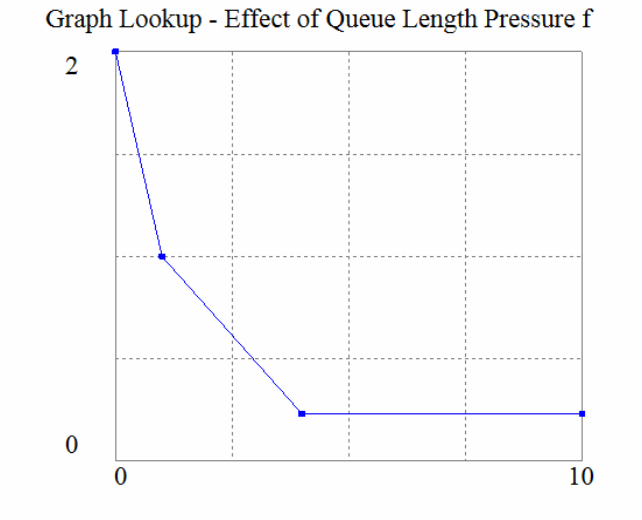


Figure 14 Effect of Queue Length Pressure

This is a fairly sharp drop. When the queue grows to just three, the advisors feel 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" gets, advisors cannot go below this minimum amount of time spent with students. The graph of "Time Spent per Student" (Figure 15) shows that over the course of the semester, advisors are able to spend up to the maximum one hour per student. It also shows that when the "Schedule Pressure" hits, the time drops sharply such that by week 15 they are going through students at the hurried pace of one every 7 minutes.

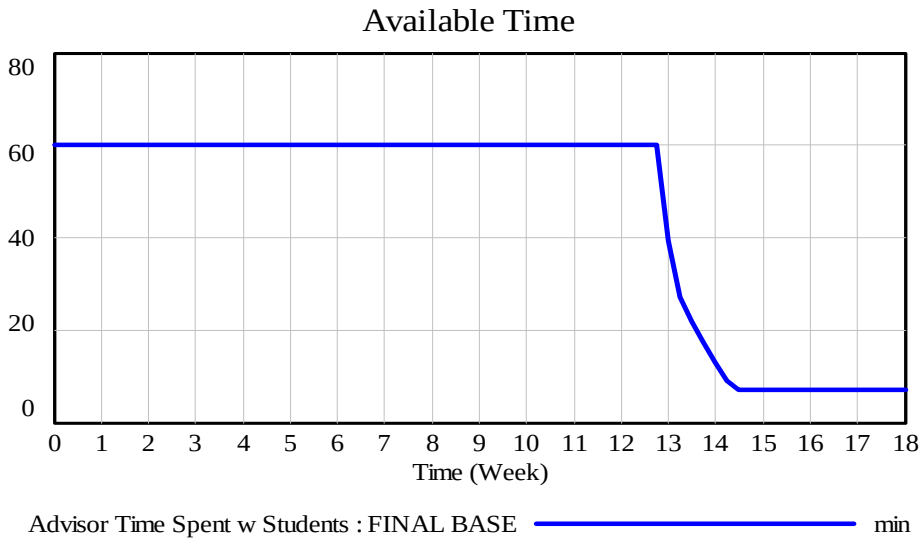


Figure 15 Time Spent Per Student Over the Semester

To make the connection between "Time Spent per Student" and "Student Satisfaction," the consulting team started with the idea that the students have expectations about what advising should be. The assumption is that they expect to spend at least thirty minutes with their advisor discussing their schedule and any progress that they are making in their particular academic program. When their actual time is less than this expectation, a ratio of less than one (actual time spent/expected) is created. This "Expectations Ratio" feeds into a variable called "Effect of Time Spent," which will act on the level of "Student Satisfaction." Obviously if students are forced to wait in line to receive required advising and they only receive seven minutes of rushed advising on their proposed schedule of classes, they will not be overly satisfied with the process. To show this, the "Effect of Time Spent" (Figure 16) variable incorporates 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 will feed into the "Change in Student Satisfaction per Week." The output of this variable is a number between 0 and -1.

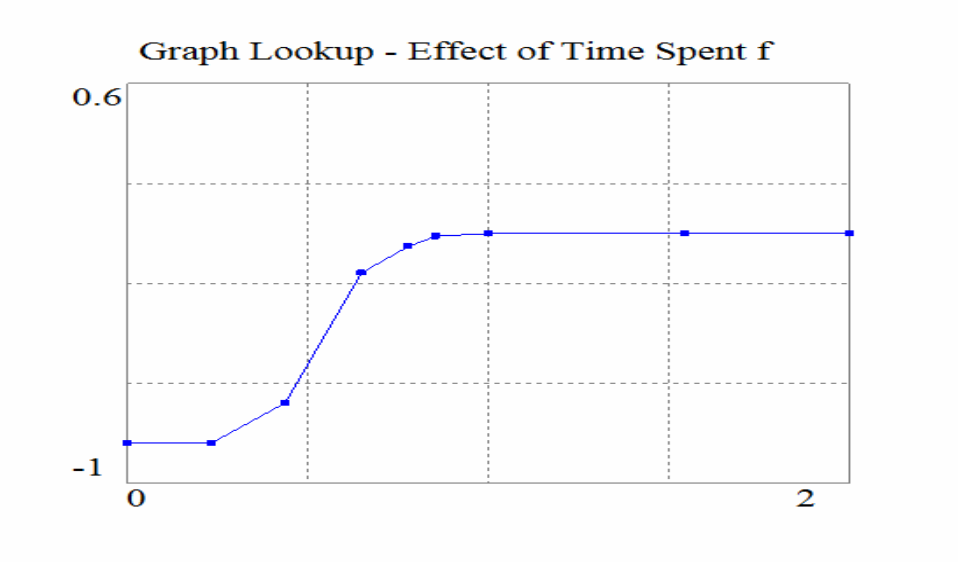


Figure 16 Effect of Time Spent

This number will be used as a multiplier in the "Change in Satisfaction per Week" in/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 being modeled is the decrease in student satisfaction with advising over the past several years. For that reason, showing only the decrease in satisfaction does not limit the ability to model this particular problem. As shown in Figure 15, the level of satisfaction will begin to fall when the amount of time the advisors spend with students falls below 30 minutes (a ratio of 1). At 25 minutes (roughly 0.85), students are still satisfied enough not to change their satisfaction level. When advisors begin spending fewer than 20 minutes (roughly 0.65) student satisfaction levels begin to plummet and they bottom out at the minimum 7 minute session with a score of -0.8386. The figure from this look-up table is multiplied by the existing "Satisfaction" stock level and becomes the inflow to "Satisfaction" either keeping the level stable or lowering it ("Change in Satisfaction per Week")*.*

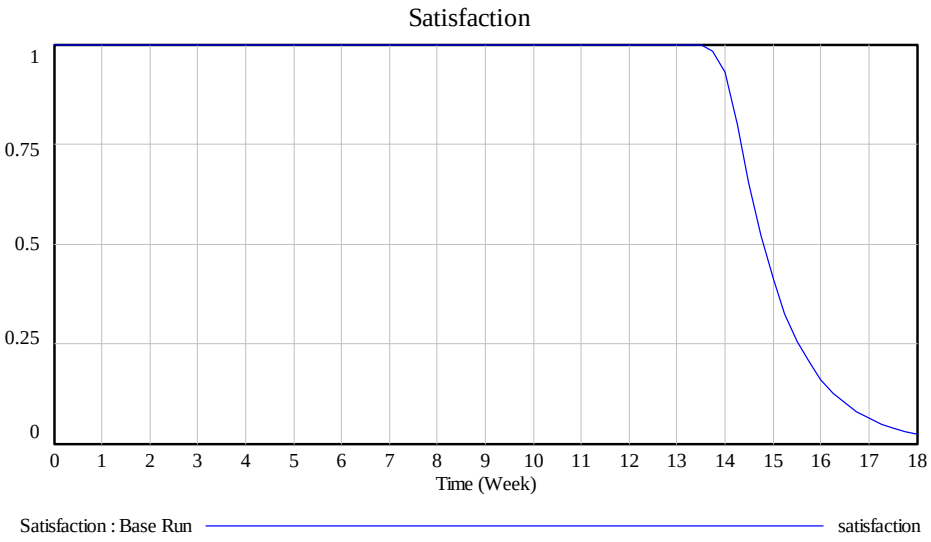


Figure 17 Satisfaction Levels over time

The goal of this project was to help explain why some students are giving the advisors low marks for the quality of their advising experience at the university. As shown in Figure 17 and reflected in the actual survey results, there are a number of students who are satisfied. This group includes those students who see their advisors throughout the first two-thirds of the semester and have the advantage of no lines and experience long meetings with their advisors. However, the survey results suggest that there are 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 are the ones whose only experience with their advisor is when they are forced through the bottleneck at the end of the semester and receive a hurried, incomplete advising session from their advisor. 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 is running out are not at all satisfied with the service that they are receiving.