# Improving Goddard Riverside's Options Center Access Program Intake Process

A Major Qualifying Project

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# Abstract

Through the DMAIC framework, we assisted Goddard Riverside's Options Center Access Program, a New York City nonprofit student counseling service, in identifying operational inefficiencies in their intake process impacting student retention and counselor workloads. We addressed these by (1) revising the program's intake form; (2) implementing Calendly – a scheduling app; and (3), validating solutions through simulation and discussions with our sponsors. Following implementation, Access Program counselors are more accessible to students and streamlined the scheduling process for the Options Center.

# Executive Summary


***Goals and Objectives***

A college education can bring socioeconomic security and increased opportunities. College access programs (CAPs) are nonprofit organizations that offer free college counseling and other services to help high school students of all backgrounds find and enroll in their best fit universities. CAP intake systems must quickly process potential applicants without overloading counselor schedule capacity. Goddard Riverside's Options Center Access Program is a CAP in New York City that sought to improve its intake process. In this MQP, we worked with Goddard Riverside's Options Center Access Program to improve their intake form and integrate the Calendly scheduling tool within their intake process.

***Proposed Solutions***

To carry out these improvements, we followed the DMAIC continuous improvement framework. We defined the problem by interviewing key staff at the Access Program to ascertain the present state of the intake process. We mapped the process and determined that key metrics to measure intake process efficiency would be:

- student throughput
- average number of contact points per student
- student retention rate

The intake process's student throughput rate and the percent of students moved to reengagement measure how effective the intake process is, while the average number of contact points per student measures the amount of back-and-forth between students and Access Program staff. Student retention rate also illustrates how efficiently the system moves students from intake to the Access Program. With these metrics, we analyzed past and present intake data for trends and patterns to inform our simulations used to validate our proposed solutions. Any proposed solutions were shown to Access Program staff for approval and feedback.

***Results***

From our research, simulation, and data analysis we created an improved intake form with Google Forms and determined that Calendly would be an effective scheduling tool for Goddard Riverside. Calendly allows for round robin style event assignment, which allocate meetings amongst a subset of hosts, a process not found in many other services. This service is crucial to

the Options Center as caseload balancing greatly effects the efficiency of the intake process. We also found through simulation that, in a pessimistic scenario where only 50% of students accept their given appointment times, if Calendly is implanted and used by only 40% of students, then student retention rate would increase by an average of 15.7%.

Additionally, we outlined a methodology for mapping and analyzing case trajectories across students to evaluate the different types of contact they had with the Access Program. Specifically, we investigated the difference between cancellations and no-shows, finding that no-shows correlated with a lower student retention rate. This analysis can be repeated in the future and extended to compare the impact of other contact types. A custom intake form and scheduling tool could be constructed for the Access Program to meet assignment constraints and fully integrate with each other. Additionally, future student cohorts could be analyzed using more complex methods to create further forecasts and predictions. This project is therefore not only a one-time process improvement effort, but a framework for future operational improvements at the Options Center and similar nonprofit organizations.

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# Authorship

All four team members contributed equally to this project. McKenna headed the intake form modifications, Mason was the lead on researching, introducing, and implementing Calendly, Reagan took the initiative on developing the simulation model to validate our recommendations, and Adam created the Python script and performed the case data analysis. We split the work equally to accomplish our goals, implement our deliverables, and develop this final report.

# Table of Contents

**Abstract** i
**Executive Summary** ii
**Acknowledgements** iv
**Authorship** v
**List of Figures** viii
**List of Tables** x
**Table of Abbreviations** xi

**1 Introduction** 1
**2 Background** 3
2.1 Higher Education Accessibility Challenges 3
2.2 Access Programs 7
2.3 Goddard Riverside's Options Center Access Program 7
2.4 Scheduling Tools 8
*2.4.1 Popular Scheduling Tools* *9*
*2.4.2 Applications of Scheduling Tools* *10*
2.5 DMAIC Process Overview 10
2.6 Discrete Event Simulation 11
2.7 The Access Program Intake Process and Associated Challenges 12
**3 Methodology Overview and Timeline** 15
3.1 Define: Understand the Intake Process and Relevant Stakeholders 15
3.2 Measure: Historical Case Data and Developed Metrics 16
3.3 Analyze: Evaluate the Current and Future States 17
*3.3.1 Data Analysis* *17*
*3.3.2 Discrete Event Simulation* *20*
3.4 Improve: Develop Process Improvements 21
3.5 Control: Facilitate Long-Term Adoption of Solutions 23
**4 Results and Findings** **24**
4.1 Overview of the Access Program Intake Process 24
4.2 Improved Intake Form 25
4.3 Calendly 26
4.4 Discrete Event Simulation 29
*4.4.1 Intake Process DES Model* *29*
*4.4.2 DES Model Results* *32*
4.5 Analysis of Historical Case Trajectories 35
*4.5.1 Analysis of Average Case Trajectories* *36*

*4.5.2 Analysis of Granular Case Trajectories* *40*

**5 Conclusion and Recommendations** **47**

5.1 Conclusion 47

5.2 Future Work 48

**6 Reflection** **50**

**Works Cited** **52**

**Appendix A: Revised Intake Form** **57**

**Appendix B: Guided Discussion Questions** **65**

**Appendix C: Historical Case Trajectory Figures** **67**

**Appendix D: Regex Search Strings** **73**

**Appendix E: DES Model Inputs** **79**

**Appendix F: Simulation Scenarios** **80**

# List of Figures

**Figure 1:** The objectives of this project, following a standard DMAIC framework ..... 2
**Figure 2**: Median annual income of American householders with various levels of educational attainment..... 3
**Figure 3**: Comparison of undermatching in students of different academic qualifications and socio-economic statuses..... 5
**Figure 4**: Overview of the 5 step DMAIC Process ..... 11
**Figure 5:** Flowchart of the Access Program intake process..... 13
**Figure 6:** Demonstration using contrived data showing how case trajectories were created. ..... 18
**Figure 7:** Demonstration using contrived data showing how trajectories were converted into strings of letters..... 19
**Figure 8 :** Demonstration using contrived data showing how regular expressions were used to search sequences. ..... 19
**Figure 9:** Organization chart of Goddard Riverside's Options Center. ..... 24
**Figure 10:** Access Program intake process value stream map, revised using discussions and feedback from the Director of Counseling and Administrative Coordinator ..... 25
**Figure 11:** Screenshot of the Calendly booking page as it appears when a user clicks on the event link ..... 27
**Figure 12:** The five modules used in Arena DES software to create our models and descriptions of each..... 29
**Figure 13:** Our Arena DES model of the current Access Program intake process. ..... 30
**Figure 14:** Our Arena DES model of the proposed intake process integrating Calendly. ..... 32
**Figure 15:** A bar chart of the average number of students successfully entering the Access Program after 50 replications across the twelve scenarios. ..... 34
**Figure 16:** A bar chart of the average number of students entering re-engagement after 50 replications across the 12 scenarios. ..... 35
**Figure 17:** Relative frequency of the fourteen contact types across the 2,963 recorded contact points..... 36
**Figure 18:** The relative frequency of the fourteen contact types among the five current student designations..... 37
**Figure 19:** Graphical representation of a random sample of fifteen case trajectories. ..... 38

**Figure 20:** Absolute and relative contact counts across chronological contact steps for all students, color-coded according to contact type ..... 39
**Figure 21:** Count of students with one or more cancellation or no-show, grouped by designation. ..... 42
**Figure 22:** Counts of the number of students with different numbers of cancellations or no-shows in their trajectories, grouped by current designation. ..... 43
**Figure 23:** Count of students whose first cancellation or no-show occurred at different step numbers, grouped by current designation. ..... 45
**Figure 24:** Count of students with a given number of remaining sequence steps following their first cancellation or no-show. ..... 46

# List of Tables

**Table 1:** Summary of the three student record datasheets provided by the Access Program. ..... 16

**Table 2:** Summary of our key performance metrics for evaluating the intake process. ..... 17

**Table 3:** The twelve scenarios run with Process Analyzer, including a baseline with no Calendly, and pessimistic, likely, and optimistic estimates for acceptance and Calendly usage rates. ..... 21

**Table 4:** The average number of students that successfully entered the Access Program over 50 replications of each scenario. ..... 33

**Table 5:** Table summarizing historical trajectory uniqueness ..... 39

**Table 6:** Summary of how many students of each designation had a cancellation or no-show in their case trajectory ..... 42

**Table 7:** Trajectory length summary statistics across current designations and students with one or more cancellation and or no-show. ..... 44

# Table of Abbreviations

| Abbreviation | Definition |
|---|---|
| CAP | College Access Program |
| CPS | Chicago Public Schools |
| DES | Discrete Event Simulation |
| DMAIC | Define, Measure, Analyze, Improve, Control; a five-step process improvement framework |
| ED | The US Department of Education |
| FAFSA | Free Application for Student Federal Aid |
| NCPS | North Carolina Public Schools |

# 1 Introduction

Higher education provides opportunities for greater socio-economic status. Completing a higher education degree can translate into higher job security, better salaries, and more industry connections (Jensen & Jetten, 2015, US Census Bureau, 2020). While higher education enables vertical socio-economic movement, lower socio-economic status correlates with lower college attendance. For instance, first-generation and low-income students often find applying to college difficult because they lack resources and family members who understand the college application process (Smith et al., 2013). This problem is exacerbated by the fact that most public schools have limited counseling resources, with the median student-to-guidance-counselor ratio of US school districts at 411:1 compared to the 250:1 maximum recommended by the American School Counselor Association (Gagnon & Mattingly, 2016).

In response, counseling services known as college access programs (CAPs) have been created to bridge the gap and give disadvantaged students the full-time help they need in the application process. CAPs are typically run by non-profit organizations operating independently from public schools. Such programs pair students with counselors who help them develop the skills necessary to be accepted into suitable college programs and earn scholarships. CAPs aim to not only guide students into higher education, but also find the institutions where they would best grow as academics and adults.

Our project focuses on Goddard Riverside's Options Center Access Program. Goddard Riverside is a community outreach organization located in New York City founded in 1959 that serves over 22,000 people annually. The organization's services span 27 programs across five areas of outreach for families at every stage of life. Under Goddard Riverside's Options Center, the Access Program is a CAP that specializes in advising low-income and first-generation college students through the college application process. The program offers one-on-one advising, workshops, financial aid counseling, college trips, recruiter visits, and support through college graduation. Through these efforts, the Access Program has helped over 7,000 students enroll in higher education (Goddard Riverside, 2021b).

Public school counseling resources are particularly limited in New York, with a student to counselor ratio of 635:1 (S1409, 2019). It is therefore imperative that the Access Program can

efficiently take in a high volume of students. As a result, the Options Center desired to improve the Access Program student intake process. Currently, some applicants are unable to book initial counseling appointments for several weeks, deterring them from pursuing guidance and potentially jeopardizing their opportunities for higher education. Furthermore, the intake process handles counselor caseloads independently and relies on text and email chains to coordinate student appointments with Access Program counselors. This has resulted in uneven utilization of counselor time and discouraged students from pursuing further counseling. Our project addresses these initial appointment booking delays and caseload imbalances through industrial engineering techniques. Specifically, we sought to identify and apply operational changes, including a scheduling tool, to improve the intake process's efficiency. To accomplish this, we applied the DMAIC process improvement framework with the following objectives (**Figure 1**):

| | |
|---|---|
| **1. Define** | ***Assess*** the Access Program's student intake and scheduling processes to understand their operational challenges |
| **2. Measure** | ***Develop*** metrics to gauge the current system's counselor caseload distribution and predict appointment capacity requirements for future student cases |
| **3. Analyze** | ***Isolate*** key process facets that negatively impact initial appointment scheduling lead time and counselor caseload balance |
| **4. Improve** | ***Adjust*** the intake process to minimize the target metrics, using simulation to validate improvements |
| **5. Control** | ***Integrate*** final deliverables, acquire feedback from Access Program staff on the revised intake process and provide user-friendly directions if needed |

**Figure 1:** The objectives of this project, following a standard DMAIC framework (American Society for Quality, 2017).

We begin by contextualizing the intake process challenge within the larger issue of expanding higher education access. We discuss potential technical tools as well as the DMAIC framework we will use to achieve our goal. We outline our proposed methods for evaluating the current intake process capabilities, developing improvements, and implementing them as long-term solutions. From there, we present the results of improvements and final recommendations. We conclude with a project reflection from an industrial engineering perspective.

## 2 Background

Improving the Access Program's intake process can be contextualized within the larger goal of making higher education more accessible. In this section we discuss higher education accessibility challenges and how college access programs (CAPs) work to resolve them. We discuss the history and goals of Goddard Riverside's Options Center Access Program and provide an overview of frequently used client appointment scheduling tools. We then overview the DMAIC framework and detail the methodology used to achieve each of the five DMAIC objectives. We introduce discrete event simulation (DES) as an effective tool for modeling service systems such as CAPs, providing examples of similar DES applications in the service industry. We conclude by reviewing the scheduling tools already in use by the Access Program and its existing challenges.

### *2.1 Higher Education Accessibility Challenges*

Higher education often represents an opportunity to attain higher socio-economic status. For instance, the median salary of Americans increases with higher levels of educational attainment as seen in **Figure 2**: Median annual income of American householders with various levels of educational attainment. Data taken from the 2020 Current Population Survey (US Census Bureau, 2020). Students enrolled in college also build connections with professors and members of their respective industries that can lead to better job security post-graduation (Jensen & Jetten, 2015).

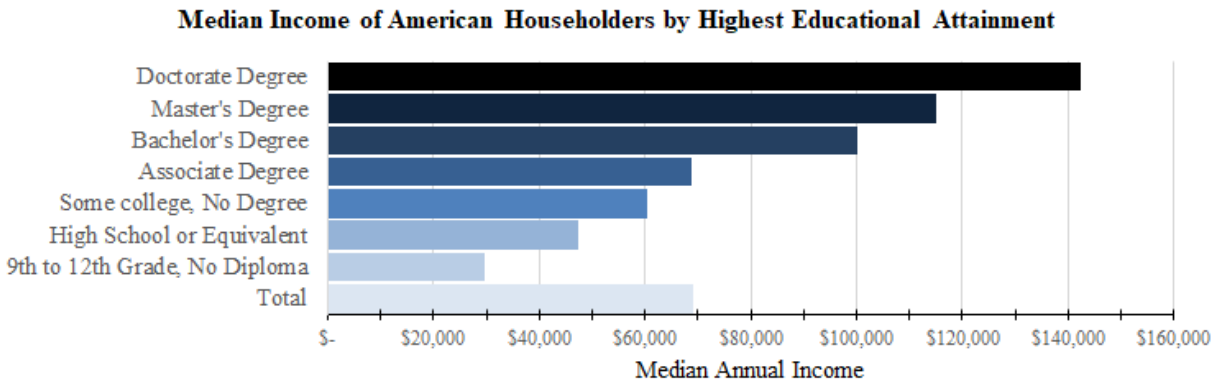


**Figure 2**: Median annual income of American householders with various levels of educational attainment. Data taken from the 2020 Current Population Survey (US Census Bureau, 2020)

Due to its impact on socio-economic status, pedagogy researchers have investigated how to improve access to higher education. The US Department of Education (ED) defines **access** as the "accessibility of an education to a student, including access to appropriate educational institutions, materials, and personnel" (Department of Education, 1977). Two basic measures to evaluate college access are enrollment and dropout rates. By these metrics access has improved in the US over the last decade, as evidenced by increasing enrollment rates and decreasing dropout rates. ED records from 2010 to 2019 show the immediate enrollment rate of students leaving high school has remained stable as the total dropout rate has gradually declined (Department of Education, 2021a, 2021b). However, access encompasses most aspects of the long and complicated college admissions process, beyond just getting into college itself. Even students accepted into college may have still had limited access to financial aid advising, standardized test preparation, and campus visits. Therefore, while an increasing proportion of students are getting into, and staying in, higher education, they may not be getting into their best-fit institutions at the best price.

> **Access:** *"accessibility of an education to a student, including access to appropriate educational institutions, materials, and personnel"*
> *(Department of Education, 1977)*

> **Undermatching:** *"When a student's academic credentials permit them access to a college or university that is more selective than the postsecondary alternative they actually choose"*
> *(Smith et al., 2013)*

In fact, access can vary between students with different socio-economic conditions but comparable academic ability. Research over the past two decades has identified an apparent sorting pattern in American higher education, where disadvantaged students tend to enroll in less competitive institutions than they qualify for (Simmons, 2011). This phenomenon, termed "**undermatching**," is prevalent among students of all levels of academic credentials, though more common in low-income, first-generation, and low-credential students (Smith et al., 2013), illustrated in **Figure 3**.

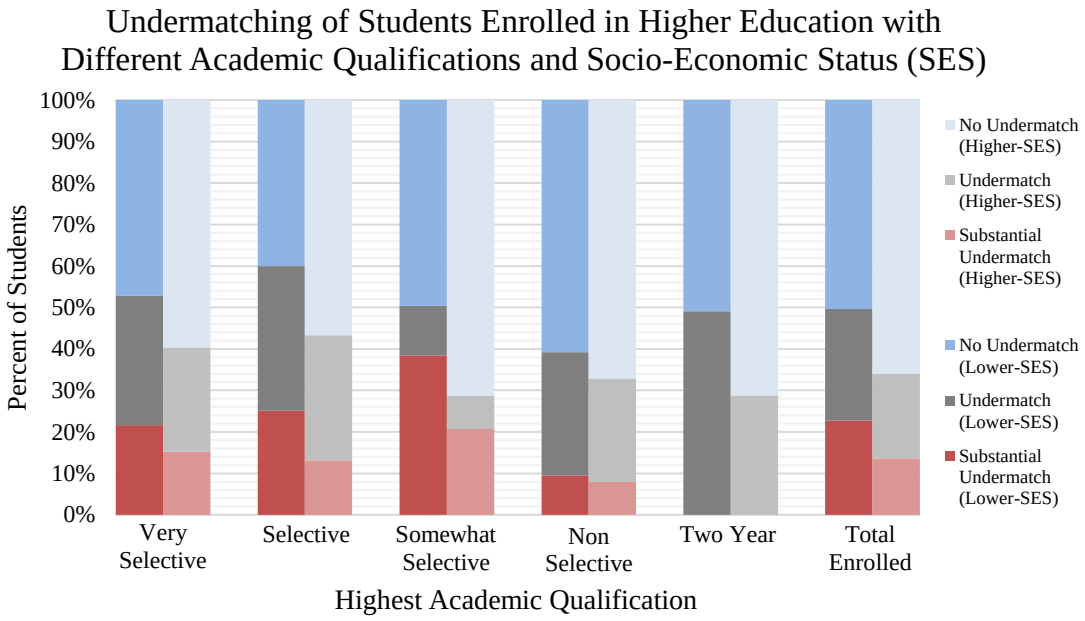


**Figure 3**: Comparison of undermatching in students of different academic qualifications and socio-economic statuses (SES). The dataset used is a nationally representative sample of the 2004 US graduating class (see Smith et al., 2013). Students designated as Lower-SES are below the median SES, based off a National Center for Education Statistics (NCES) index of parental income, education, and occupation. Academic Qualification is the highest level of institution selectivity a student qualifies for, based on applicant and enrollee GPAs, SAT scores, and acceptance rates. Undermatch means enrollment in an institution one level below highest qualification (*i.e.*, qualified for Two Year but not enrolled), while Substantial Undermatch is enrollment in an institution two or more levels below highest qualification (*i.e.*, qualified for Non-Selective but not enrolled).

Two studies have guided modern undermatching research in the US: a Chicago Public Schools (CPS) analysis of the 2005 Chicago senior class (Roderick et al., 2008), and a North Carolina Public Schools (NCPS) analysis of the 1999 North Carolina senior class (Bowen et al., 2009). The CPS study found that only 41% of CPS students aspiring to attend a four-year institution completed the full application process. Of CPS students that ultimately attended a four-year institution, 62% chose a school below their qualifications. The NCPS study had similar findings, further noting that students from high schools with lower matriculation rates, or with parents of lower income and education levels, were more likely to undermatch. For instance, 64% of students with non-college educated parents were found to be undermatched, compared to 41% and 31% of students with parents with any college and graduate degrees, respectively. Though a study of 1992 and 2004 seniors indicates undermatching has decreased over time, the same study

found that the proportion of students declining their acceptance to more selective colleges has simultaneously increased (Smith et al., 2013). While a student's success after college is not completely determined by their college's selectiveness, selective institutions with strong alumni networks can still provide better financial aid, industry connections, and starting salaries (Simmons, 2011). These represent opportunities for vertical socio-economic movement.

Lower socio-economic status is therefore both a cause and effect of undermatching. This relationship can be understood using a social capital lens. Social capital is the goodwill available to an individual through social connections that gives them access to "information, influence, or solidarity" (Adler & Kwon, 2002). Recent studies indicate that lower income, minority, and first-generation college applicants have a difficult time accruing social capital to help them succeed in the application process and beyond (Jensen & Jetten, 2015). The CPS study further indicated a knowledge deficit on how to navigate the application process amongst low-income and first-generation students (Roderick et al., 2009). This deficit is due to their limited social capital with others who have navigated the process themselves. Fortunately, the socioeconomic barriers preventing the growth of social capital are surmountable (Kim & Schneider, 2005). Social media is one avenue through which students can independently build connections and improve their access. For instance, a 2013 survey found that first-generation college students who sought information regarding the application process or connected with college graduates on Facebook improved their application efficacy and expectation of success (Wohn et al., 2013). Nevertheless, seeking guidance can be difficult for students if they do not know where to start. Furthermore, the scale of the higher education access problem and complexity of the application process both warrant more structured support systems with professional counselors.

Unfortunately, while most high schools employ guidance counselors to share higher education information with students, not all high schools can provide one-on-one counseling to all their students; there are simply not enough counselors. While the American School Counselor Association recommends a maximum student to counselor ratio of 250:1, the median ratio across all US school districts is 411:1 (Gagnon & Mattingly, 2016). In New York, this ratio is even higher at 635:1 (S1409, 2019). Nevertheless, counseling is not limited to schools, as external organizations are equally capable of guiding students through the application process. This niche is served by college access programs in most cities across the United States.

### *2.2 Access Programs*

**College access programs (CAPs)** are programs that guide individuals from underrepresented groups through the college application process. Students are referred to these programs by their high school or hear about them through friends, family, counselors, and community members. CAPs are generally run by either non-profit organizations or government agencies and can take several forms. However, all CAPs seek to rectify unequal higher education access (King, 2009). CAPs primarily provide college application information and tools to low-income and first-generation students that would otherwise have difficulty utilizing these tools on their own. CAPs provide information to students through several delivery methods, including one-on-one counseling and workshops. Some programs also help students in other related areas such as scholarships, social and academic enrichment, and counseling (County Health Rankings and Roadmaps, 2016). The main goal of a CAP is to help students become aware of, and act on, opportunities available to them after high school.

**College Access Programs (CAPs):** *Programs "which aim to reconcile inequitable higher education access through services such as career guidance, tutoring, academic and financial counseling, test preparation, mentorship, college visits, and scholarships" (King, 2009)*

There are over 5,000 CAPs across the US, with 36 in New York City alone (National Association for College Admissions Counseling, 2021). All these programs offer the same basic services, with some additionally specializing in social awareness assistance or academic guidance. New York's CAPs play an important role by providing one-on-one counseling to students who would otherwise be unable to get it, improving their access to higher education.

### *2.3 Goddard Riverside's Options Center Access Program*

Goddard Riverside is a New York City based nonprofit that works to improve the lives of individuals and families from childhood to retirement (Goddard Riverside, 2021a). Their outreach spans 27 programs, including the Goddard Riverside Options Center. The Options Center has two main departments: the Options Institute and Counseling Team. The Options Institute provides training to professionals in the college counseling field, while the Counseling Team assists New York students with applying to, paying for, and graduating from higher education institutions. The

Counseling Team is further divided into the Success Program and Access Program. The Success Program helps students already in higher education graduate with regular check-ins, need based aid, and assistance when transferring schools. The focus of our project is the Access Program, a CAP that helps New Yorkers enter higher education.

Like other CAPs, the Access Program specializes in bridging the knowledge and resource gaps disadvantaged New Yorkers face in the college application process. Students are typically directed to the Access Program by their school's counseling department, though all New Yorkers are eligible to apply, free of charge, starting the spring of their junior year in high school.

The Access Program primarily serves students through one-on-one counseling sessions. Students are assigned to counselors after filling out an intake form and submitting test scores, transcripts, and extra-curricular information. An initial counseling appointment is then made, during which the student meets their assigned counselor and discusses the amount of assistance they require to complete the college application process. Counselors provide this assistance at subsequent one-hour appointments. This can include developing specific skills, like navigating the Common Application or other similar forms, writing essays, and completing the Free Application for Student Federal Aid (FAFSA). Alternatively, assistance can be more exploratory. For instance, counselors also help students build lists of potential colleges, explore different academic environments through campus visits, and discover the true breadth of their college opportunities. Both types of assistance help students find and apply to the schools that best suit them so that they are well positioned to succeed. Given each student's unique needs and circumstances, the number of subsequent appointments and the duration of student participation in the Access Program can vary. Nevertheless, students are paired with one counselor throughout their time at the Access Program to provide them with long-term, personalized support.

### *2.4 Scheduling Tools*

For this project, we define a scheduling tool as a program or application that facilitates the calendaring and appointment booking process. Scheduling tools automatically fill a digital calendar with appointments according to user input or display open blocks of availability to clients which can be selected to create appointments. These tools come in a variety of forms, such as mobile applications, websites, or proprietary programs, and can fill a diverse range of roles within an organization. The effectiveness of scheduling tools has been demonstrated for some time. For

instance, a 1997 study explored the uses of Meeting Maker, an early scheduling app that supported multiple user calendars, automatically detected open times between multiple users, and allowed for group scheduling (Mosier & Tammaro, 1997). Users of the app found that it facilitated the creation of meetings, with 88% of study participants reporting they would continue using it and 92% saying they would recommend it to someone else. Scheduling tools have risen in popularity in recent years. The next sections discuss popular scheduling tools on the market today and how several industries use them.

### *2.4.1 Popular Scheduling Tools*

Many scheduling tools exist on the market. According to an article from PR Newswire, the top appointment scheduling calendar applications ranked by market share of 2021 are as follows: AppointmentPlus, Calendly, JRNI, and ScheduleOnce (PR Newswire, 2021). AppointmentPlus markets itself as a cloud-based scheduling tool that allows clients to easily make, change, and cancel appointments, thereby streamlining the appointment creation process (AppointmentPlus, 2021). This application allows clients to receive email and calendar notifications, tracks all transactions performed within the app, and allows for mass data export to excel (Software Advice, 2021). Calendly markets itself as a hub for scheduling that removes the back and forth of email and call exchanges (Calendly, 2021). Calendly allows users to place several constraints on a calendar, such as availability increments, maximum event time, maximum event count, and minimum scheduling notice. Calendly can also be embedded within websites or emails and automatically generates virtual meeting links over zoom or similar platforms (Calendly, 2021).

Several less established tools are also available. PR Newswire also lists BookedIn, Genbook, and others as up-and-coming calendar apps (PR Newswire, 2021). BookedIn advertises itself as an “easy to use appointment booking software with great features like appointment reminders and payment processing (BookedIn, 2022).” The app places great emphasis on ease of use and simplicity and is accompanied by a mobile app and 24/7 support team (BookedIn, 2022). Genbook focuses on growing small businesses, by providing a calendar framework that integrates with social media and review sites (Genbook, 2021). Scheduling rules can be set like in Calendly, and preformulated texts and emails allow client communication to be automated (Genbook, 2021).

### *2.4.2 Applications of Scheduling Tools*

Since their inception, scheduling tools have been applied in a variety of service industries. They are commonplace in hospitals, where efficiency and patient turnover play a critical role in financial viability. One recent study found that implementing a hospital scheduling system reduced wait times, no-show rates, and physician punctuality (Habibi et al., 2019). Hospitals have been key beneficiaries of online appointment systems due to the costly ramifications of missing appointments or overbooking emergency rooms. Scheduling tools have also been used in the counseling field. For example, a 2011 study explored the implementation of a scheduling tool to facilitate students scheduling meetings with professors (Qaffas & Barker, 2011). The researchers in this study successfully developed a program that allowed students to privately book appointments with lecturers through a web app, which sent email reminders of meetings and important dates. Another successful application of a scheduling tool was at the Gemmill Library at the University of Colorado Boulder (Kuglitsch et al., 2021). The library implemented the Google Appointment Calendar app, which students found to be "convenient and unintimidating" while librarians saw a sharp decrease in no-show email back-and-forth. Scheduling tools have therefore been demonstrated to increase efficiency and decrease wasted time across multiple service industries. The challenges within the Access Program intake process are like those addressed in these applications. We hypothesize that a scheduling tool is therefore an effective way to improve the intake process.

## *2.5 DMAIC Process Overview*

DMAIC is a data-driven process improvement framework. It is an acronym for the five stages that compose it: define, measure, analyze, improve, and control (**Figure 4**). These phases build on each other to develop lasting solutions to problems (Berardinelli, 2012).

| | |
|---|---|
| **Define:** | Set the problem scope to give subsequent steps proper direction |
| **Measure:** | Create metrics and collect data relevant to the problem |
| **Analyze:** | Determine the root cause of the problem from the data |
| **Improve:** | Eliminate the identified root cause with process improvements |
| **Control:** | Develop plans of action to maintain quality and avoid foreseeable errors |

**Figure 4**: Overview of the 5 step DMAIC Process (American Society for Quality, 2017)

The steps of DMAIC form a rigorous improvement process that increases the chance a project succeeds. Nevertheless, DMAIC is not equally suited for all process improvement problems. A 2012 review of DMAIC literature categorized problems solved with DMAIC into four types: checklist, definition, science research, and people (de Mast & Lokkerbol, 2012). Checklist problems have clear goals with obvious step-by-step solutions. Definition problems focus on modeling and optimization variables to create a solution. Science research focuses on using empirical fact finding to discover underlying problems. People problems are subjective and rely on personal values and opinions. The DMAIC process has been shown to be most applicable in well-structured problems with unambiguous goals such as checklist problems (de Mast & Lokkerbol, 2012). Our project has the clear-cut goals of balancing counselor caseloads and reducing intake lead time. DMAIC's step-by-step formula is therefore suitable for this project and will provide a useful problem-solving framework moving forward.

### *2.6 Discrete Event Simulation*

Experimenting with process changes in actual systems is often costly, time consuming, or otherwise impractical. However, simulation allows systems to be modeled and process changes to be analyzed before they are implemented in real life. Discrete event simulation (DES) is a common simulation technique which is typically executed using specialty software packages to model operations and measure system performance (Rockwell Automation, 2021).

The use of DES is well documented in academic applications and organizations, including Fortune 100 firms, across a variety of industries. A significant portion of DES applications are

applications in improving human services within healthcare. One 2010 review of healthcare simulation literature found that, between 1970 and 2007 alone, fifty-one papers were published applying DES as a decision support tool to improve healthcare systems (Mustafee et al., 2010). Another 2006 review of healthcare simulation literature found such DES applications typically measured model performance using patient throughput and wait times as well as system resource utilization (Jacobson et al., 2006).

Other DES service systems can also model passenger flows in airport terminals (Beck, 2011) and customer orders at fast food restaurants (Hueter & Swart, 1998). The behavior of service systems typically follows a stochastic process (e.g., uncertain arrival times of customers), making quantification difficult. Due to the humanistic element of service systems, behavior of people within the system can be unpredictable making it difficult to measure (Raid, 2010). With DES software, this stochastic nature of service systems can be analytically represented to reflect real-world behavior. In this context, DES software is used to summarize system behavior across different system states so that resources and time are used efficiently (Raid, 2010). These measurements that can be collected are applicable to the previous examples of patients being cared for in a hospital, passengers in an airport terminal, and customers ordering fast food.

Our hypothesis is that DES is also effective for modeling human service systems like the Access Program's intake process. The Access Program operates using set appointment times across counselor calendars, similar to how check-ups and surgeries are scheduled in a doctor's office. Furthermore, the Access Program seeks to design its intake process to limit student scheduling delays and balance counselor utilization (M. Stockton, personal communication, August 31, 2021). DES is therefore an appropriate tool for improving the Access Program intake process as part of a larger operations improvement framework.

### *2.7 The Access Program Intake Process and Associated Challenges*

The Options Center tasked our team with streamlining the Access Program's initial student intake process. This process currently involves repetitive correspondence between the intake counselor and students, resulting in substantial non-value-added time, as seen in **Figure 5**. The intake process begins when a student fills out the intake form, after which the Options Center Administrative Coordinator reaches out to them via email or text to schedule their first counseling appointment. The Administrative Coordinator waits for the student to respond with their

availability. Once the student responds, the coordinator checks their counselors' availability and responds to the student with potential times. If no times work for the student, the Administrative Coordinator provides alternative times. This can occur for multiple students simultaneously, with appointments assigned to competing students on a first-come, first-serve basis. If a student is not first in the queue more than once, the resulting wait time may discourage the student from pursuing further assistance.

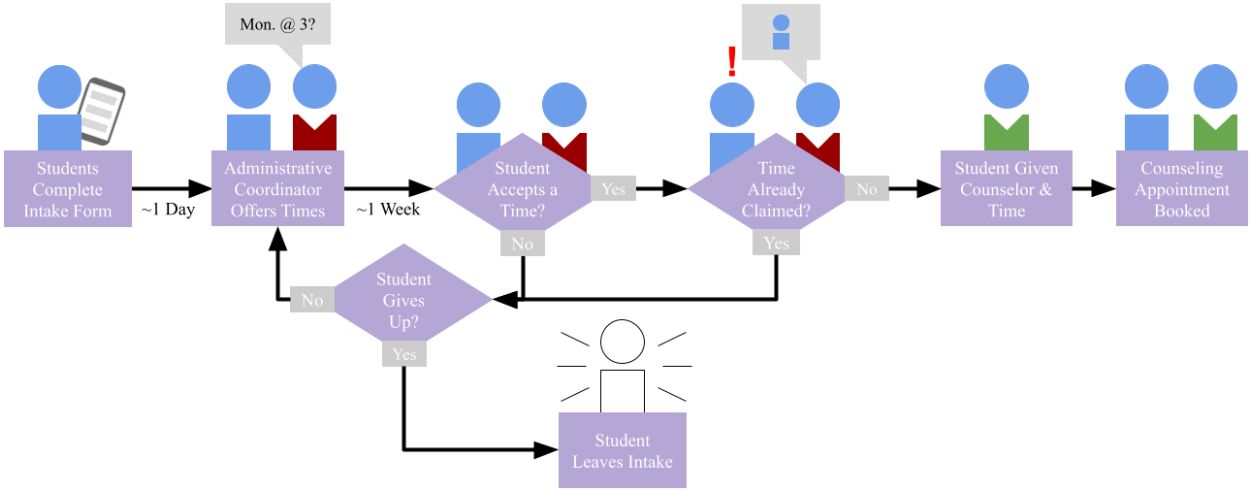


**Figure 5:** Flowchart of the Access Program intake process. Significant back and forth between the Administrative Coordinator and students can cause large lead times before counselors and times are assigned (M. Stockton, personal communication, August 31, 2021).

Students are ultimately assigned to a member of the Access counseling team for counseling. The Access counseling team is composed of three full-time counselors and one Access Team Manager that acts as both a supervisor and part-time counselor. Balancing caseloads across these four individuals add another layer of complexity to first appointment scheduling. The influx and needs of students vary substantially month to month, making caseload balancing particularly important during periods of high demand like the early fall. Furthermore, no systems currently exist to objectively measure or balance the equivalent workloads of each counselor. Students are instead assigned to counselors based on the earliest available appointment. As a result, case assignments are made somewhat arbitrarily, with the Administrative Coordinator manually balancing caseloads in reaction to noticeable imbalances (M. Stockton, personal communication, August 31, 2021).

Overall, much of the Access Program intake process is administered manually. The Access Program leverages Google Forms for its initial intake form and a centralized database to handle

student case data. Nevertheless, scheduling initial appointments and assigning student cases requires the Administrative Coordinator to manually monitor the database, new forms, and counselor calendars every business day. In the following section we outline our methods for integrating additional applications to reduce this manual effort and improve the efficiency of the intake process.

# 3 Methodology Overview and Timeline

In the following sections, we outline the methods associated with each objective of our DMAIC framework.

## *3.1 Define: Understand the Intake Process and Relevant Stakeholders*

We began our investigation by assessing the Access Program's student intake and scheduling processes. This assessment was designed to provide an understanding of the Access Program's organizational structure, its operational capabilities, and the scope of its needs.

This assessment involved several meetings with stakeholders at the Options Center. Our main contact whom we consulted throughout the project was the Director of Counseling. Initial meetings with the Director of Counseling established the scope of our project, key decision makers and stakeholders, and the basic operational steps of the intake and scheduling processes. Additionally, we met with other key stakeholders, including the Access Program Administrative Coordinator and the Access Team Manager to understand their responsibilities and needs. From these meetings we identified relevant stakeholders in an organization chart (see **Figure 9** in Section 4.1) and clearly defined the scope of our project.

From data and information gathered in these meetings, we mapped the scheduling and intake processes. We organized operational steps and relevant actors in a Value Stream Map of the intake process (see **Figure 10** in Section 4.1). This Value Stream Map was reviewed by the Administrative Coordinator and Director of Counseling to identify which operational steps caused bottlenecks or could be streamlined.

Our initial assessment also involved a two-stage review of the intake form. We conducted the first stage independently of the Options Center, during which we noted questions or features that could potentially be removed or simplified. In the second stage, we discussed our suggestions with the Director of Counseling to understand their perspective and identify features that could not be modified due to the Options Center's internal requirements. For instance, government funding requires the Access Program to collect certain demographic information from participating students.

### *3.2 Measure: Historical Case Data and Developed Metrics*

We developed key performance metrics to gauge the effectiveness of the Access Program intake process. These metrics were used to isolate underperforming process facets and provide evidence for our suggested improvements.

The Access Program provided us with a large dataset of student records from June 2020 to the end of November 2021 from their central case database. Before providing us with this dataset, the Access Program replaced student names with anonymous "Workspace Numbers" to protect student privacy. The dataset contained three datasheets: student summary "headers," intake form responses, and contact point case notes. The headers datasheet gave summary information for each student, including their program designation (i.e., Access, Success, Reengagement), status (i.e., college freshman, high school senior, etc.), cohort (i.e., 2021-2022), and other information such as their high school and expected graduation year. The intake form datasheet contained individual student responses to the original Access Program intake form. The case note datasheet logged every point of contact the Access Program made with a student during the recorded period. Each case note listed the student's workspace number, the type of contact made (i.e., outreach email, one-on-one in person counseling appointment, phone call, etc.), when it occurred, and how long it lasted in minutes. See **Table 1** for a summary of the three datasheets.

**Table 1:** Summary of the three student record datasheets provided by the Access Program.

| Datasheet | Description | Data Contained |
|---|---|---|
| Summary Headers | Summary information categorizing students | • Current designated counselor<br>• Current program designation (i.e., Access, Success, Reengagement, etc.)<br>• Student type (i.e., college freshman, high school senior, not in school, etc.)<br>• Linked high school and expected graduation year |
| Intake Form Responses | Individual student intake form responses | • Academic history (i.e., SAT/ACT/GED scores, diploma type, etc.)<br>• Demographic information (i.e., gender, language spoken at home, ethnicity, etc.)<br>• Dated form response timestamp<br>• How the student heard of the program |
| Case Notes | Summary of every contact point made between the Access Program and a student | • Type of contact (i.e., email, phone call, one-on-one meeting in person, etc.)<br>• Topics covered during the contact<br>• Length of contact in minutes<br>• Date of contact |

We reviewed this dataset and our findings from initial discussions with Access Program staff (see Section 3.1) to create key performance metrics of the intake process, listed in **Table 2**.

**Table 2:** Summary of our key performance metrics for evaluating the intake process.

| Performance Metric | Description |
|---|---|
| Student Throughput | The number of students that successfully complete the intake process and enter the Access Program in a given period. This can be per week, month, or admissions season. |
| Student Retention Rate | The percentage of students that successfully complete the intake process and enter the Access Program. Alternatively, the percentage of students that fail to complete the process and enter reengagement can also be used to evaluate retention rate. |
| Contact Point Count | The number of contact points a student has on record with the Access Program, potentially categorized by contact type. This includes emails, one-on-one meetings, and all other contact types. |

These metrics and the dataset were central to our data analysis (see Section 3.3.1) as they allowed us to construct student case trajectories that chronicled time students spent with the Access Program. Both were also used to calculate parameters in our DES models that we used to gauge the efficiency of the current and proposed future intake processes (see Section 3.3.2).

### *3.3 Analyze: Evaluate the Current and Future States*

The third step the team took in improving the intake process was analyzing the data provided using the metrics developed to evaluate and compare the current intake system and the proposed future state. Using Excel and Python, we analyzed the data discussed in Section 3.2 to identify trends and patterns, and present subsequent findings in several graphs and visuals. We utilized Rockwell Arena discrete event simulation software to evaluate the current and proposed states of the Intake Process, basing our models on the intake process value stream map (see **Figure 10** in Section 4.1) and case data.

#### *3.3.1 Data Analysis*

Using Excel and Python, we analyzed the data provided to evaluate the intake process's performance and understand patterns in case trajectories across groups of students.

We began our analysis by connecting the three datasets and calculating cursory summary statistics. To enable us to study case patterns across different groups of students, we labeled each student's intake response and case notes with their current designation and student type. Designation was of particular interest because it represents a student's outcome from participating in Access. We constructed several pivot tables to establish the relationships between student demographics and both contact type and intake form responses. Further analyses of the intake form found the minimum, maximum, and average time between form submissions, the latter of which we used to represent student interarrival rate in the simulation (Section 3.3.2). We also calculated the average time and total count for each meeting type.

We define "case trajectory" as the ordered sequence of contacts made between the Access Program and an individual student. We created each student's case trajectory by chronologically ordering their contact summaries as shown in **Figure 6**. We analyzed both average case trajectories and patterns amongst individuals over several groups of students.

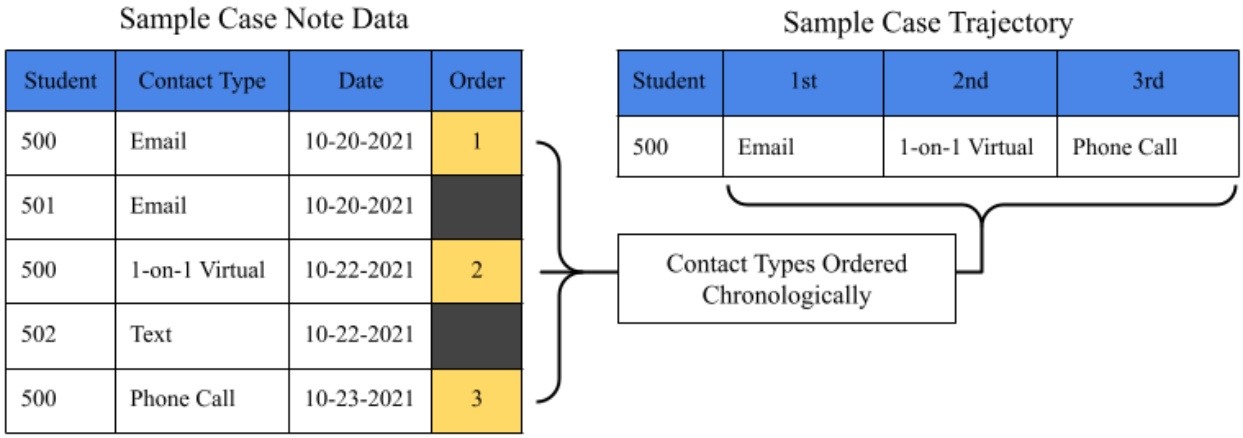


**Figure 6:** Demonstration using contrived case data showing how case trajectories were created.

Average trajectories were depicted as bar charts showing the count and percentage of students with each contact type at each sequence step. We created separate plots for all students combined, by current designation as of November 2021 (Access, Success, Re-Engagement, etc.), and by student type (high school senior, college freshman, etc.), shown in Appendix A. These charts allowed us to measure the spread of trajectory lengths, measured in sequence steps, and the relative frequency of each contact type.

Patterns amongst individual student trajectories were analyzed both visually and using regular expressions in Python. Visuals were created in Excel, with samples of student trajectories plotted against each other using color coded bars to represent different types of contact (see **Figure 19** in Section 4.5.1). These visuals highlighted patterns in the sequences, such as runs of the same contact type. To detect patterns more robustly, we converted case trajectories into multi-letter strings using Python, with each letter representing a different type of contact (**Figure 7**). We then used a search algorithm and several regular expressions to search each string for certain patterns. Regular expressions are sequences of characters that can be given to a search algorithm to find groups of characters within strings. Regular expressions allowed us to calculate things like the percentage of students that had three consecutive 1-on-1 Virtual meetings and the types of contact that preceded student cancellations. **Figure 8** shows an example of how we applied regular expressions. Appendix D contains the Python script we created, which includes several regular expression search strings.

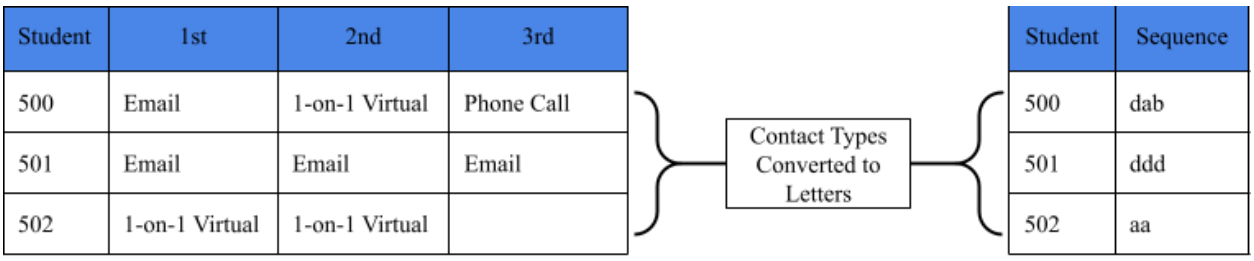


**Figure 7:** Demonstration using contrived data showing how trajectories were converted into strings of letters. In this example, "a" represents 1-on-1 Virtual, "b" represents Phone Call, and "d" represents Email.

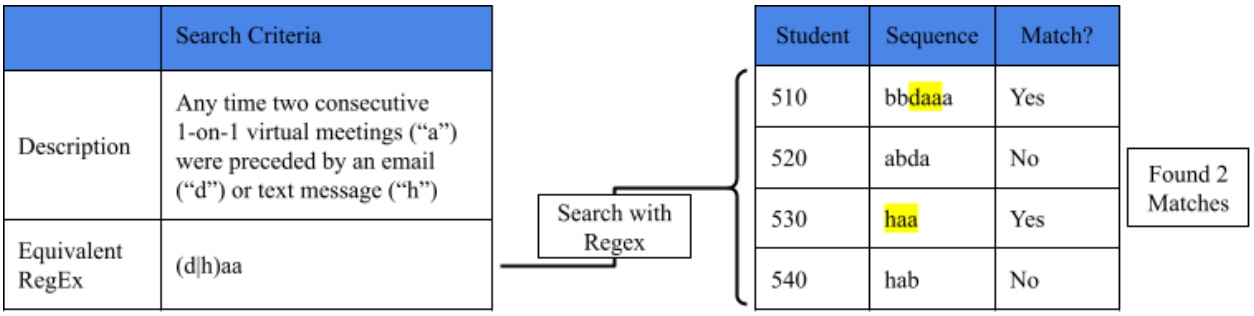


**Figure 8 :** Demonstration using contrived data showing how regular expressions were used to search sequences. In this example, "(d|h)" represents "d or h."

### *3.3.2 Discrete Event Simulation*

We applied DES to the service system at the Options Center to measure the current intake process and simulate the impact of our recommendations.[1] We used Arena Simulation Software by Rockwell Automation (Rockwell Automation, 2020) to create two DES models: (1) the current intake process and (2) the proposed intake process with Calendly and a revised intake form.

The structures of these models were based on our analysis and discussions with Access Program staff. The model entities, which enter the system and become Work in Process (WIP) until exiting, represent students in the Access Program intake process. The entity flows were modeled after the value stream map created with the Administrative Coordinator and Director of Counseling (see **Figure 10** in Section 4.1). Model parameters, including student arrival rates, decision node routing percentages, and delays between responses, were obtained from the data analysis (Section 3.3.1) to reflect the real system.

Two key model parameters required estimation: the probabilities of a student accepting their appointment time and, of a student using the proposed scheduling tool. The first parameter is required because the dataset included the number and type of pre-appointment contact, but not what was discussed within them. The second was because the proposed scheduling tool did not yet exist, so no data was available. To compensate for these estimates and validate our simulation, we ran a sensitivity analysis on the Arena simulations using another tool called Process Analyzer. Process Analyzer is a child program of Arena that allows the user to create different scenarios with different values for model parameters, run multiple replications of each, and interpret scenario results. We ran twelve scenarios using three estimates for acceptance rates and four estimates for Calendly usage (**Table 3**).

[1] We refer the reader to Maria (1997) for a detailed overview of DES.

**Table 3:** The twelve scenarios run with Process Analyzer, including a baseline with no Calendly, and pessimistic, likely, and optimistic estimates for acceptance and Calendly usage rates.

| | | Probability that a Student Accepts Appointment Time | | |
|---|---|---|---|---|
| Percentage of Students using Calendly | | Pessimistic | Likely | Optimistic |
| | | 50% | 67% | 80% |
| No Calendly (Current State) | 0% | Scenario 1 | Scenario 2 | Scenario 3 |
| Pessimistic | 40% | Scenario 4 | Scenario 5 | Scenario 6 |
| Likely | 85% | Scenario 7 | Scenario 8 | Scenario 9 |
| Optimistic | 95% | Scenario 10 | Scenario 11 | Scenario 12 |

We ran each scenario with 50 replications to generate robust confidence intervals for the average number of students entering the Access Program or reengagement (Appendix F). We chose 50 replications because this number was sufficiently high to mitigate the effect of variance between replications and still allowed all twelve scenarios to finish in a reasonable timeframe. Each replication was run for 90 simulation days to represent four and a half months of 8 hour-long business days, roughly the length of time from the beginning of the school year to when most college applications are due in December.

### *3.4 Improve: Develop Process Improvements*

The fourth step of the DMAIC process is to improve. For this project we adjusted the intake process to improve target metrics, using simulation to validate the improvements.

To begin, the design of the intake form was improved. The main method to achieve improvement was communication with our sponsors. All communications with the Options Center team were held over the virtual meeting platform Zoom and prefaced with an email to find time to meet and followed with an agenda. Agendas were sent in advance as they consisted of questions to guide our discussion. These agendas were reviewed as a group and with our project advisors before being sent off to the Options Center team. In the second seven-week project span, we met with the Access Program Administrative Coordinator once and the Director of Counseling three times to understand the entire process, as well as the shortcomings of the intake forms. The

communications were less formal than an interview but comparable to a structured academic discussion. We gained an understanding of the Access Program Administrative Coordinators' perspective on her role in the intake process. Communication with the Director of Counseling was carried out through a similar procedure, and she provided insight on the specifics of the intake form. This was chosen to be our primary method to help us understand why the form was structured by the people who created it and interact with its data daily (A. Floyd, personal communication, October 29, 2021).

To assign cases to counselors, we proposed two systems: (1) a custom-built algorithm and (2) implementing an existing scheduling tool such as an app. We initially planned to implement a linear programming model or develop an algorithm to automatically sort and assign cases based on historical data. This would address counselor caseload imbalances, where students are unequally distributed between counselors, which was a problem identified during discussions with the Access Program team. We found this imbalance was typically due to unequal assignment during the intake process, as students work with the same counselor throughout their case once assigned. However, we determined implementing such a system was infeasible because it required developing a program from scratch to integrate with the centralized database, Google Forms, and other tools used by the Options Center. Such a tool would either be an application executed by the Administrative Coordinator, requiring additional administrator time, or an automatic program built into a custom web app, which we lacked the necessary programming expertise to realize. To address these identified challenges, we explored existing scheduling tools with built-in distribution capabilities. Calendly (Calendly, 2021), has a built-in distribution function installed within the round robin event type. Within Calendly, a team of individual child accounts can be organized under one administrative account that manages their events and schedules. Each of those child accounts can be added to a round robin event that can be set to distribute accounts equally, or according to availability. The availability mode prevents the booking of any counselors when they are not available, while the equal distribution mode also prevents bookings from being made with a counselor that already has many appointments. We tested these features using sample counselor calendar records provided by the Director of Counseling. We created test events using dummy accounts. We recorded each booking in an Excel spreadsheet to monitor how Calendly chronologically ordered appointments and distributed between them between accounts. Calendly also provides administrative tools to redistribute or reschedule cases if a counselor needs to change

their availability. Given the features available in Calendly and the Options Center's prior use of the application in other departments, we decided that Calendly was an appropriate tool to use in the intake process.

### *3.5 Control: Facilitate Long-Term Adoption of Solutions*

Once our improvements were finalized, we integrated them into the intake process. To do this, we sent the Director of Counseling the revised intake form with a link to their active Calendly account. We met the Access counseling team virtually in a group format to help set up their individual Calendly accounts and integrate their calendars. From there we added an initial appointment scheduling link to the intake form for students to fill out. These tools were also linked to the Options Center's centralized database to allow their data recording process to continue as usual. We held additional meetings with the Administrative Coordinator, Access Team Manager, and Access counseling team to explain the entire process and created short video tutorials for them to reference in the future. Conducting walkthroughs over the Zoom platform was beneficial, as questions could be answered in real time.

After demonstrating to the counseling team how to use the new tools, we waited a few weeks to hear feedback from the team on the positives and what challenges they had faced. Feedback was collected from counselors and administrators in an unstructured interview held over Zoom. The questions asked can be seen in Appendix B. Responses were loosely recorded for further analysis.

# 4 Results and Findings

This section discusses our key findings and deliverables and discusses their implications. We begin with an overview of the Access Program intake process, including key process owners and steps. We then discuss our improved intake form and Calendly implementation, our two main deliverables. We detail our DES models used to validate our revised intake process and discuss their outputs. We conclude with our key findings from our analysis of historical case data.

## *4.1 Overview of the Access Program Intake Process*

To improve the intake process, it was first necessary to understand the Access Program's organizational structure and individual staff responsibilities. From our interviews with the Director of Counseling and Administrative Coordinator we defined the roles and hierarchy of Access staff, from which we developed an organization chart (**Figure 9**). This allowed us to identify the Director of Counseling, Access Program counseling team, and Administrative Coordinator as key stakeholders. Though the Success Program is also part of the Options Center, we learned that it is not directly involved in the intake process and therefore fell outside the scope of our project.

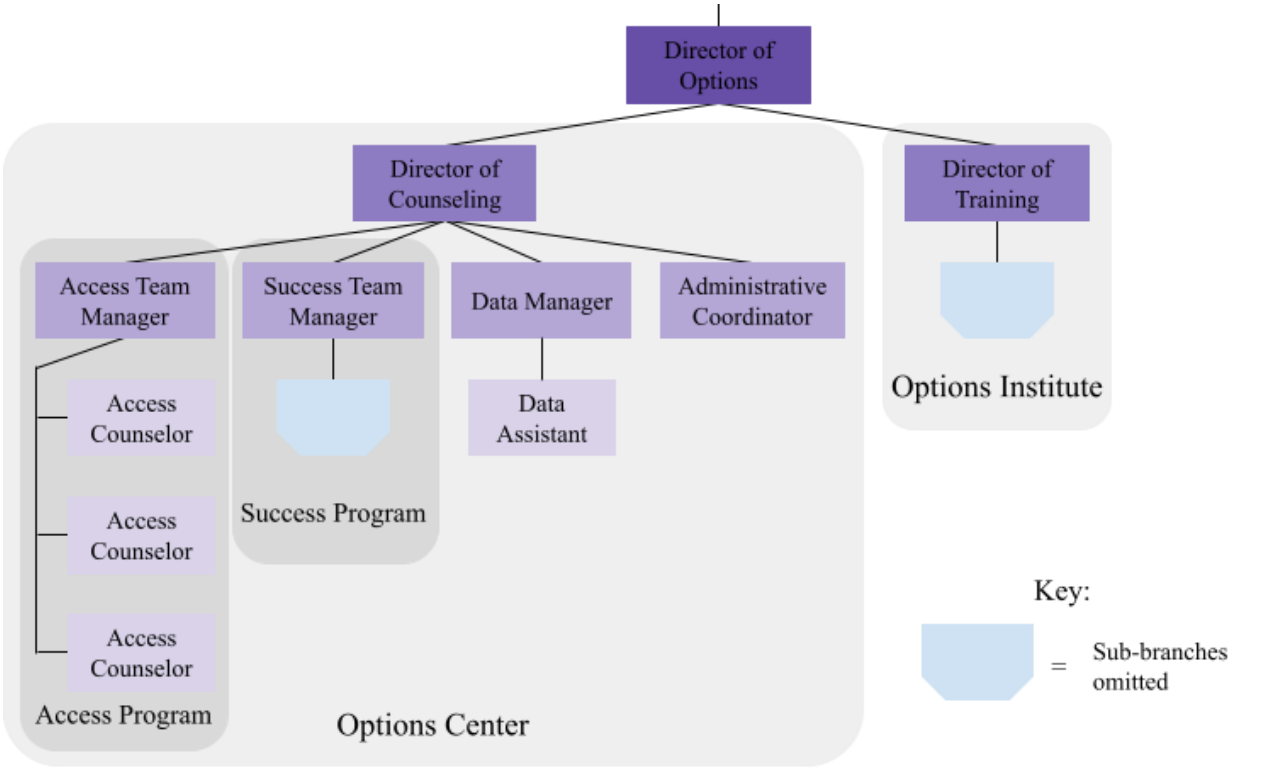


**Figure 9:** Organization chart of the Goddard Riverside Options Center. Sub-branches were omitted for individuals unrelated to the Access Program or intake process.

With the stakeholders identified, we mapped the intake process to understand its operational steps and their owners. From a series of conversations with the Administrative Coordinator and Director of Counseling we created a value stream map (**Figure 10**) that follows students through the current intake process. From this map we identified the main bottleneck to be the processes involving back and forth between the students and Administrative Coordinator. These processes can repeat several times and potentially represent weeks of waiting. The process was further defined in the conversation with the administrative counselor and director of counselor to outline the process. Both charts were crucial to our understanding and definition of the process.

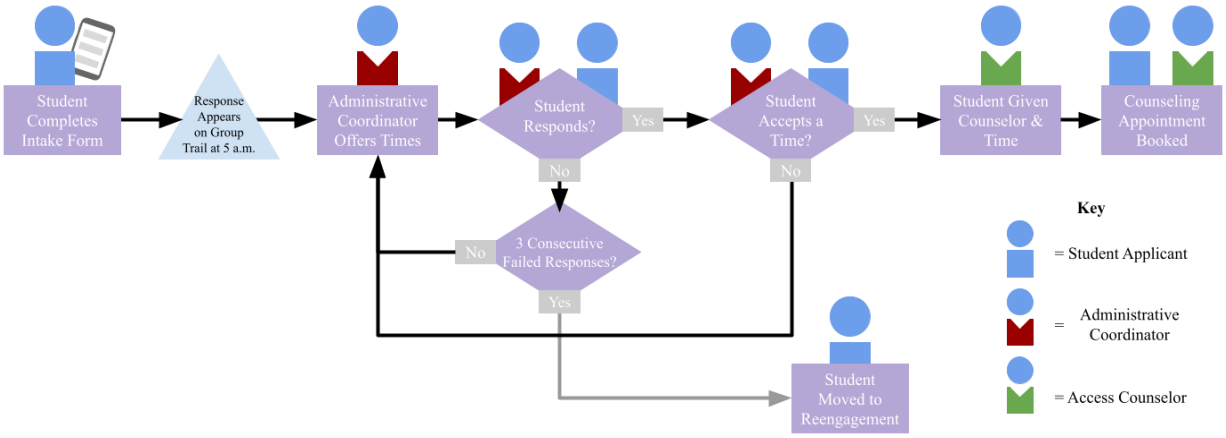


**Figure 10:** Access Program intake process value stream map, revised using discussions and feedback from the Director of Counseling and Administrative Coordinator (A. Floyd, personal communication, October 29, 2021; M. Stockton, personal communication, November 11, 2021).

With the main bottleneck identified, we discussed potential solutions with Access Program staff. We recommended the Access Program adopt a revised intake form and automatic scheduling tool to bypass the back and forth between students and the Administrative Coordinator. We detail the implementation of improvements in the following sections.

### *4.2 Improved Intake Form*

The goal for improving the intake form was to restructure its questions into sections to make it straightforward for students while still functional for the Access Program. The original form created by the Options Center was one long form that listed all questions on the same page without specified formatting. This form also contained many questions that overlapped with

questions asked during initial appointments with counselors. We sifted through this form to identify questions that could potentially be omitted and grouped those that remained into questions that were either personal, academic, or related to the Options Center. We presented these recommendations to the Director of Counseling and learned that certain questions could not be removed because they collected background information necessary for initial appointments or for funding purposes.

With this feedback, we created a new form that was both user-friendly for students and capable of collecting necessary information. This revised form is shown in Appendix A. When creating this form, we removed redundant questions and organized those that remained into three subsections: personal, academic, and the Options Center. An example of a removed question was the optional question to fill out the specific SAT score, which 76.3% of students left blank. The form was shortened and formatted into different pages to encourage students to complete the form. Another addition was the Calendly link at the end of the form, which routes students to an appointment booking page to select a timeslot that works for them. After that they go back to the form to enter if they found a time or need the Administrative Coordinator to reach out to them individually. This removes the back-and-forth communication between the student and Administrative Coordinator. On the other hand, if a student is not able to find a time, they are informed that the Administrative Coordinator will reach out to them.

The revised intake form was designed to make scheduling initial appointments easier for the Options Center and the form's purpose clearer to students. It is organized to be approachable and integrates with Calendly to make intake smooth for students.

### *4.3 Calendly*

To improve the Access Program's intake process, we recommended implementing Calendly. Calendly is a scheduling tool that syncs with a user's digital calendar to book appointments and meetings. Calendly allows users to create events with custom times and locations, assigning each user and event combination a custom link that allows external users to quickly book appointments from their browsers. Calendly also has custom events for organizations that allow users to schedule appointments without specifying a specific meeting host. A screenshot of an example Calendly booking page is shown in **Figure 11**.

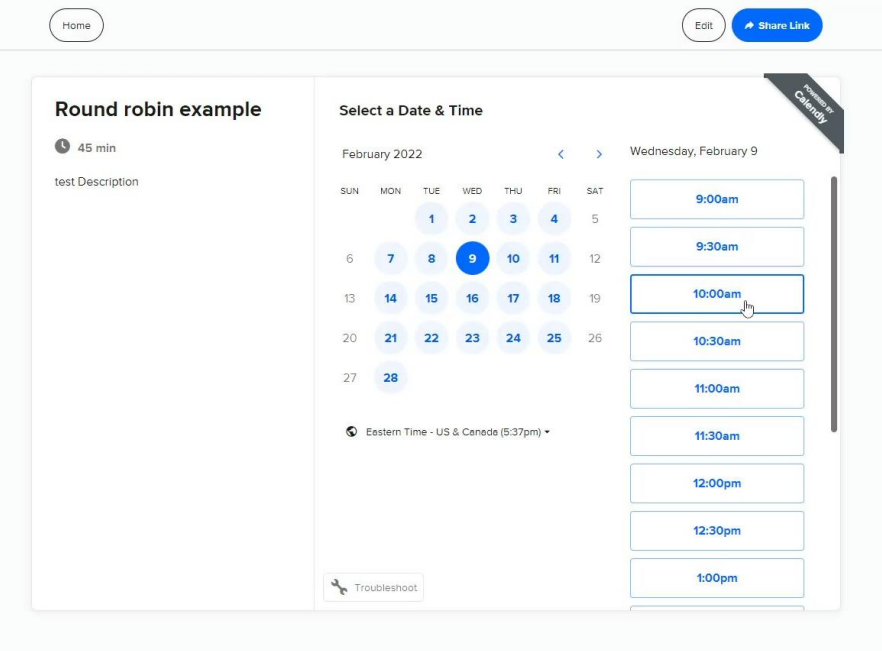


**Figure 11:** Screenshot of the Calendly booking page as it appears when a user clicks on the event link. Listed timeslots represent available openings in the organizer's calendar.

The factors that led us to select Calendly over other scheduling tools were price and its round robin event functionality. Round robin is a feature in Calendly that automatically assigns an external user a host based on pooled availability or appointment distribution. Setting a round robin event to assign by availability shows a user the total pooled availability of all users. The administrator of the event can set different priority levels for hosts. Hosts with high priority are assigned meetings over those with lower priority, while hosts with the same level priority are chosen based on who was booked least recently. If the event is set to assign by distribution, Calendly attempts to assign each host an equal number of appointments. In this case, if one host has more meetings than all others, then their availability is hidden on the Calendly booking page. The Access Program has three main counselors, and a fourth Access Team Manager that takes a reduced caseload. Since the Access Team Manager accepts fewer appointments than the other counselors, the equal distribution tool cannot be used. We recommended that the Access Program use the availability option in combination with their Administrative Coordinator, who will reschedule appointments if any one counselor is overbooked.

After selecting Calendly as a viable scheduling tool, we presented it to the Access Counseling Team, receiving positive feedback. We obtained this feedback during a semi-

structured meeting over Zoom. We followed several prompts that we prepared in advance to guide the conversation and isolate the counselors' opinions (see Appendix B to view these prompts). During this meeting, the counselors raised several questions concerning possible functionalities of Calendly, with a few voicing potential concerns they had with the app. These concerns mostly pertained to syncing calendars and maintaining multiple Calendly events, all of which we were able to address. Ultimately, no counselor opposed the implementation of Calendly.

Following the reception and introduction of Calendly, we worked with the Director of Counseling to integrate Calendly into the intake process. This involved creating the administrator and counselor accounts, syncing them with counselor calendars, and setting up the initial appointment round robin event page. We inserted the link to this booking page at the end of the new intake Google Form (see Section 4.2 and Appendix A). Additionally, we created five narrated walkthrough training videos which covered: (1) adding additional counselor accounts; (2) connecting accounts with Zoom and Outlook; (3) editing counselor availability in Calendly; (4) rescheduling and canceling appointments; and (5) an overview of the round robin event type. Files of these videos were shared with the Access Program for future reference and to aid in new counselor onboarding.

After Calendly was successfully integrated, we organized a follow up meeting as outlined in Section 3.5, following the guiding questions listed in Appendix B. In the time since implementation, five students had used the updated form and Calendly link. Four of those students successfully used Calendly to book an appointment, while the fifth opted to schedule a meeting directly with the Administrative Coordinator. The Administrator Coordinator noted that the student who scheduled through them instead of Calendly required considerably more effort to manage and schedule. There was some confusion about how to export appointments to Excel and on how to reschedule appointments. The export appointment function was discussed in this meeting and explained to the satisfaction of the administration. We once again walked through rescheduling appointments and referred counselors to our video tutorial covering the topic. Overall, applicants had used the tool successfully to schedule and meet with counselors, and the problems raised at this meeting were general questions about functionality rather than constraints that were not satisfied.

### *4.4 Discrete Event Simulation*

To measure the impact of our improvements, we created DES models of the current and proposed intake processes. These were modeled on our intake value stream map (see **Figure 10** in Section 4.1) and interviews with the Director of Counseling and Administrative Coordinator. Both models capture the interactions between the students and Administrative Coordinator from right after they fill out the intake form to when they schedule their first appointment. We then ran these two models across twelve scenarios and compared the results of each to evaluate the impact of Calendly on the intake process.

#### *4.4.1 Intake Process DES Model*

The logic of the current process DES model is shown in **Figure 13**. This model consists of three subprocesses: (1) the intake form process highlighted in purple, (2) the administrative coordinator process highlighted in orange, and (3) the counselor process highlighted in blue. The Arena modules we used are defined in **Figure 12** to help understand what each shape means in the DES figures. For a complete overview of the parameters used within both DES models, see Appendix E.

| Flowchart Module Symbol | Module Name/ | Description |
|---|---|---|
|  | Create | Entities enter the simulation here. Example: *Entities are students.* |
|  | Process | An activity that requires some time to complete. Example: *When a task is being done.* |
|  | Accepted/Returned (Dispose) | Entities are removed from the simulation here. Example: *Students leave the intake process.* |
|  | Decide | A branch in entity flow, only one branch is taken. Example: *When a student does or does not complete a task.* |
|  | Assign | Changes the value of some parameters (during the simulation). Example: *Assigns a value to a students each time they fail to respond.* |

**Figure 12:** The five modules used in Arena DES software to create our models and descriptions of each (Olusanya, 2020).

Entities representing students arrive after completing the intake form from the “Student Intake Form” module, following an exponential arrival distribution calculated from historical form response timestamps. The “Admin Coordinator” process module represents the Administrative Coordinator responding to their intake form response and writing an initial outreach email containing potential appointment times. This module includes a delay to represent the communication exchange. Student entities then proceed through the “Student Replies?” decision module. The percentage of student entities that were labeled as ‘true’ through the decision module are routed to the “Student Accepts Time?” decision module to determine if they accept the proposed first appointment time. This decision module was based off of a percentage of student entities being routed to true (students accept the appointment) and the remaining percent routed towards false (students decline the appointment). If they accept, they proceed to the “Counselor Appointment Booked” process module which represents the Administrative Coordinator confirming their appointment and scheduling it in their counselor’s calendar. Student entities are routed to the “Appointment Occurs?” decision module to determine if they show up to the appointment or if it gets canceled; another decision module that routes entities by percentages. If the appointment occurs, then student entities exit the intake process through the “First Appointment” module, signifying them entering the Access Program and that the process is completed.

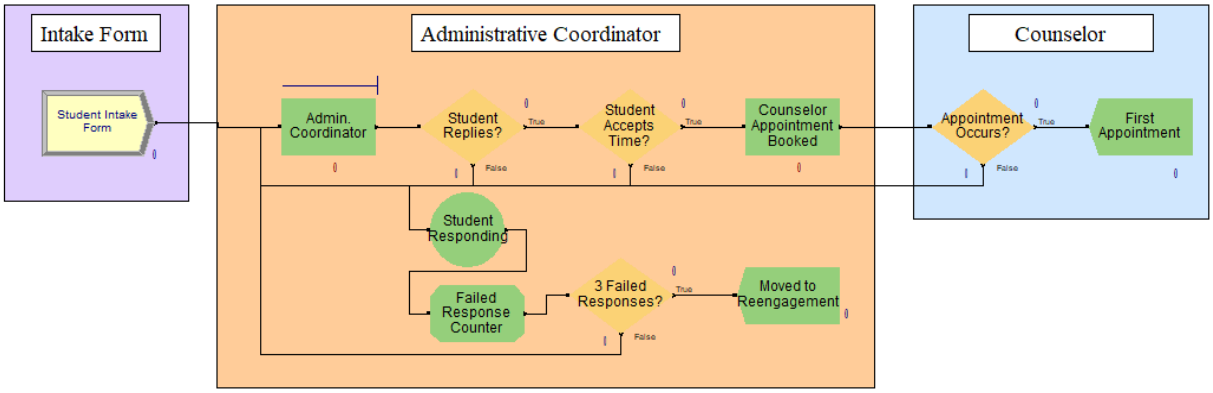


**Figure 13:** Our Arena DES model of the current Access Program intake process.

This model flow occurs if a student entity meets the “True” criteria for every decision module. If the student entity fails to respond to the outreach email or rejects their appointment

time, or if their appointment does not occur, then their flow is slightly different. Student entities that reject their given time at “Student Accepts Time?” or do not have their appointment at “Appointment Occurs?” are routed back to the “Admin Coordinator” module, receiving a new outreach email and proposed time. If the student entity does not reply in the “Student Replies?” decision module, they are routed to three new modules to go through the “Admin Coordinator” process module again. The first module after they fail to reply is the “Student Responding” delay module which accounts for the Administrative Coordinator waiting up to one week for their response. Student entities then go through the “Failed Response Counter” assign module that tallies the number of times they have failed to respond and passed through it. They then proceed to the “3 Failed Responses?” decision module, which checks whether they have failed to respond three times. Student entities that have had less than three failed responses are routed up to the “Administrative Coordinator” module to restart the Administrative Coordinator subprocess. Student entities that have had three failed responses are routed to the “Moved to Reengagement” dispose module, exiting the system. This represents how the administrative coordinator reaches out to a student up to three times, after which they move them to inactive status in re-engagement and stop reaching out. Students in reengagement are essentially “lost” and receive no counseling from the Options Center.

**Figure 14** shows the model logic of the proposed intake process. This model is identical to the current state model except for one additional decision module in the intake form sub-process (highlighted in purple). This “Filled Out Calendly?” decision module decides if a student entity uses Calendly to schedule their initial counseling appointment instead of going through the Administrative Coordinator.

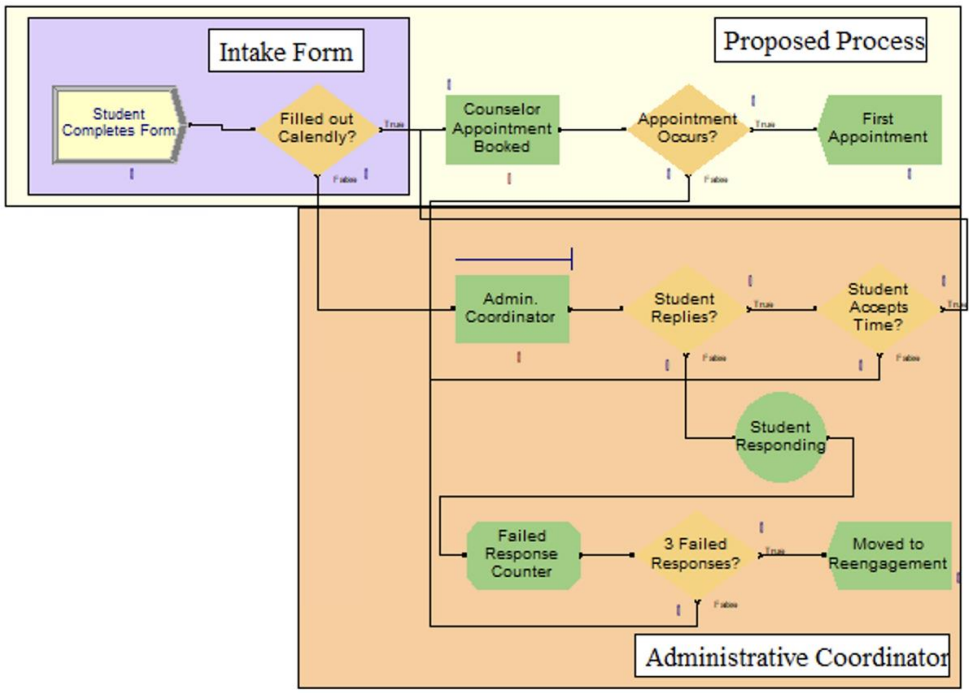


**Figure 14:** Our Arena DES model of the proposed intake process integrating Calendly.

Student entities that fill out Calendly bypass the Administrative Coordinator subprocess (highlighted in orange) and proceed directly to the "Counselor Appointment Booked" process module, which represents the administrative coordinator verifying their appointment in Calendly. Student entities then proceed through the rest of the simulation as previously described, either exiting through the "First Appointment" dispose module or cycling through the Administrative Coordinator subprocess when applicable. Choosing an appointment time is not required on the intake form, however, and student entities that fail to use Calendly are contacted by the Administrative Coordinator. These entities go through the same Administrative Coordinator subprocess as described above in the current intake process simulation. Note that if all student entities fail to fill out Calendly, then this model is functionally identical to the current state model.

### *4.4.2 DES Model Results*

The number of students that exit the system through Access or re-engagement depends on the probability that a student fills out Calendly or accepts their appointment time from the Administrative Coordinator. Accordingly, we conducted a sensitivity analysis in which we varied these percentages to predict how the different response and acceptance rates would affect the

number of students that successfully completed the intake process or moved to reengagement. Given that no data existed on what percentage of students would use Calendly, this also served as a sensitivity analysis for our estimates. We ran a total of twelve scenarios using pessimistic, likely, and optimistic probabilities for both parameters (**Table 4**).

**Table 4:** The average number of students that successfully entered the Access Program after 90 days, over 50 replications of each scenario.

| | | Probability that a Student Accepts Appointment Time | | |
|---|---|---|---|---|
| Percentage of Students using Calendly | | Pessimistic | Likely | Optimistic |
| | | 50% | 67% | 80% |
| No Calendly | 0% | 89 students | 93 students | 97 students |
| Pessimistic | 40% | 92 students | 99 students | 99 students |
| Likely | 85% | 101 students | 102 students | 103 students |
| Optimistic | 95% | 103 students | 105 students | 104 students |

The two variables representing students using Calendly and students accepting their appointment time were manipulated on the two decision modules seen in **Figure 14**: (1) "Filled out Calendly?" and (2) "Appointment Occurs?". Each decision module has a "True" or "False" outcome that is based on percentages of the entities, or students, being routed to either "True" or "False." If an entity is routed to "True," then the student filled out Calendly. If the student entity is routed to "False," the student did not fill out Calendly. The same logic is also applied to the "Appointment Occurring?" module. The percentages on the leftmost column of **Table 4** is the percentage of entities that exit the decision module "Filled out Calendly?" as "True." The top row of **Table 4** is the percentage of entities that exit the decision module "Appointment Occurs?" as "True." Changing each percentage allowed us to look at the impact Calendly had on the current system.

When comparing the percentages of students using Calendly to the baseline simulation, we found that Calendly still increased the average number of students entering the Access Program

when only 40% of students utilized the scheduling application. We expect that as more students use Calendly, the percentage of students that accept their appointment time will increase. Giving students the option to schedule their own appointment time using Calendly, without communicating with the Administrative Coordinator multiple times, demonstrates that the rate of students scheduling their appointments will increase. **Figure 15** and **Figure 16** are group bar charts we created from the sensitivity analysis outputs that compare the average number of students entering the Access Program and moving to reengagement across the twelve scenarios. As a result of the percentage of students scheduling their first appointment time, there was a 92% decrease of students being moved to re-engagement compared to the baseline system with "No Calendly". The inverse relationship of these two variables is seen in the figures as the number of students being moved to reengagement continues to decrease as the percentage of students using Calendly increases.

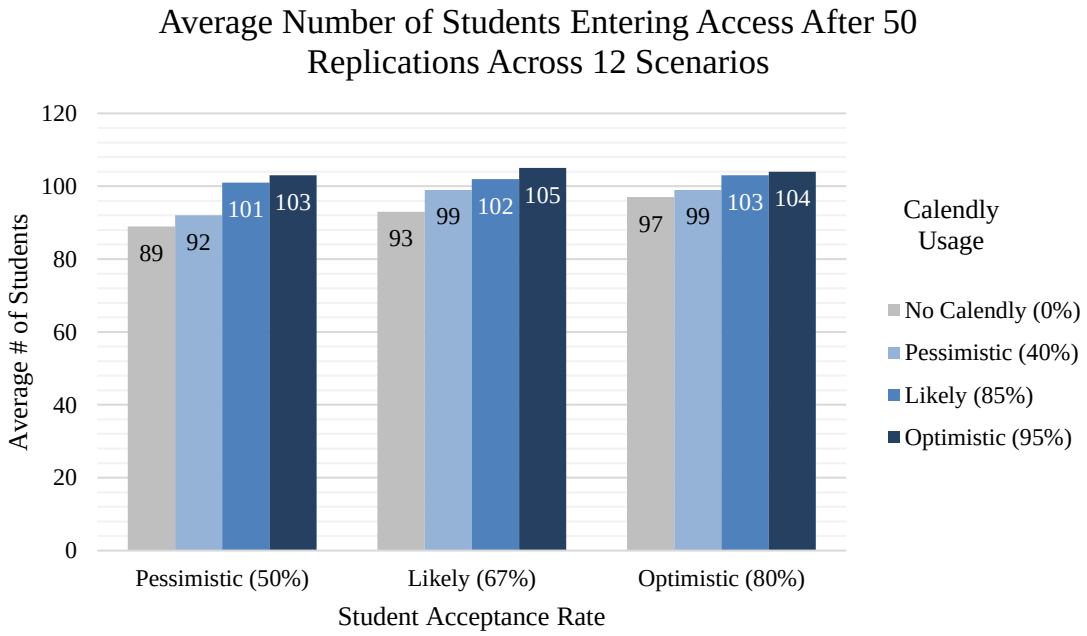


**Figure 15:** A bar chart of the average number of students successfully entering the Access Program after 50 replications across the twelve scenarios.

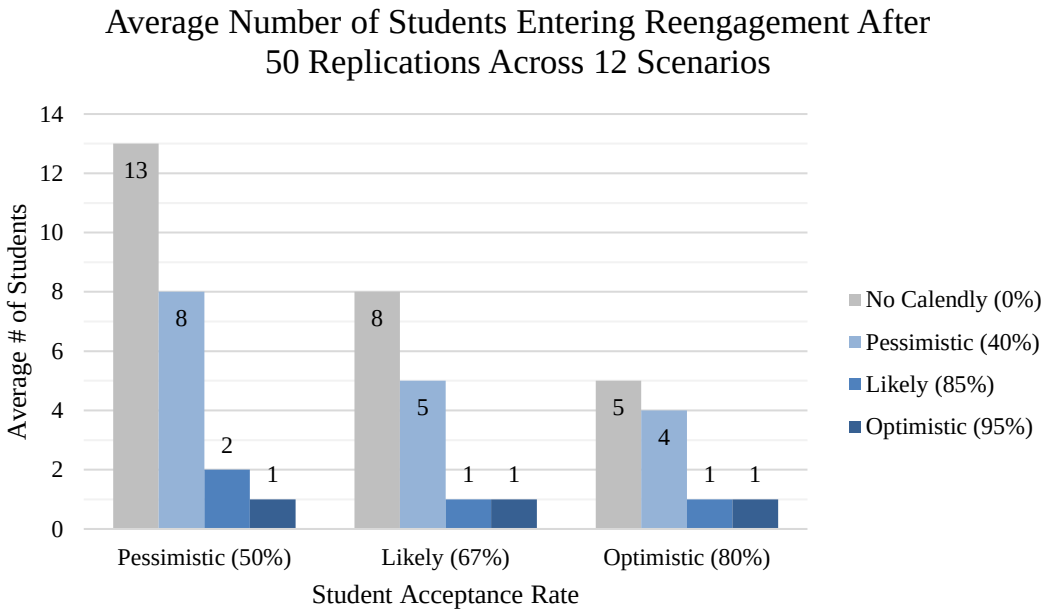


**Figure 16:** A bar chart of the average number of students entering re-engagement after 50 replications across the 12 scenarios.

The results that were collected validate our recommendation that Calendly will benefit the Access Program by increasing its student retention rate. As previously mentioned, Calendly helps to reduce the initial communication of scheduling an appointment with a counselor, the time it takes for an appointment to be scheduled on a counselor's calendar, and the amount of outreach messages that need to be sent. If students do not use Calendly, the software is still beneficial for the administrative coordinator as it assists in scheduling appointments on counselor's calendars, automates reminder messages for appointments, and the counselor's availability can be seen in real-time. Given the results from the sensitivity analysis, Calendly will be a beneficial addition to the Access Program.

### *4.5 Analysis of Historical Case Trajectories*

Through our analysis of historical case trajectories, we sought to uncover patterns of when students had certain types of contact throughout their time with the Access Program. We began our analysis by extracting case trajectories from anonymized data provided by the Director of Counseling (see Section 3.3.1). In total, this dataset spanned 2,963 contact points across 333 students: an average of 8.9 contact points per student. Using this data, we analyzed both average case trajectories and patterns amongst individuals over several groups of students.

### *4.5.1 Analysis of Average Case Trajectories*

Our analysis of average case trajectories measured the relative frequency of each contact type, both in general and at different points in time, and the spread of trajectory lengths. This analysis was performed primarily using Excel.

The 2,963 contact points were divided into fourteen separate types. We calculated the relative frequency of each type, shown in **Figure 17**.

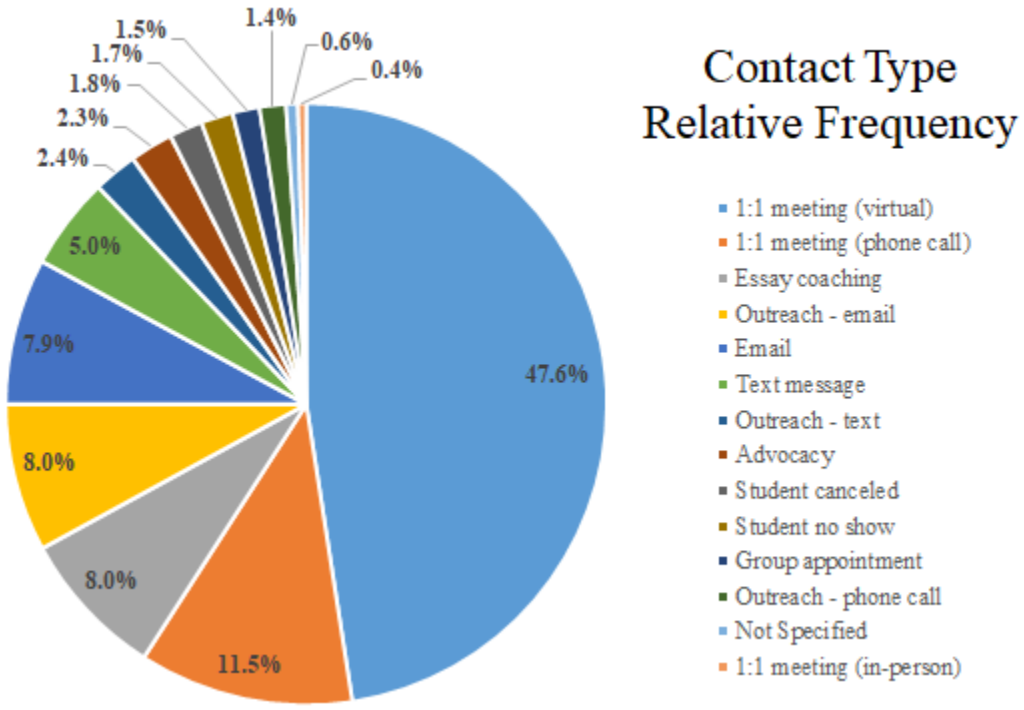


**Figure 17:** Relative frequency of the fourteen contact types across the 2,963 recorded contact points. Note that 1-on-1 meetings are done by Access counselors, outreach is by the Administrative Coordinator, and essay coaching is by separate essay coaches.

One-on-one meetings with access counselors accounted for most contact points, totaling 59.0% across virtual (47.6%), phone (11.5%) and in-person (0.4%). Other meetings totaled 9.5%, including group counseling meetings (1.5%) and essay coaching (8.0%). Communication outside of meetings, including outreach and non-outreach emails, phone calls, and texts, totaled 24.7%. Student no-shows (1.7%) and cancellations (1.8%) totaled 3.5%. The remaining 2.9% was advocacy (2.3%) or not specified (0.6%). With meetings, whether one-on-one, group, or essay coaching, composing 68.5% of all contact points, these relative frequencies indicated that most contact students made with the Access Program was value-added. Meanwhile, the high frequency

of emails, phone calls, and texts did not necessarily indicate inefficiency in the intake process. With roughly 8.9 contact points per student, this equates to around 2.2 of these per student, assuming they are equally distributed.

Contact type frequencies varied between current designations of students (see **Figure 18**). These designations included students in the Access Program, students in the Success Program, students in re-engagement due to inactivity, past-participants, and students with no designation.

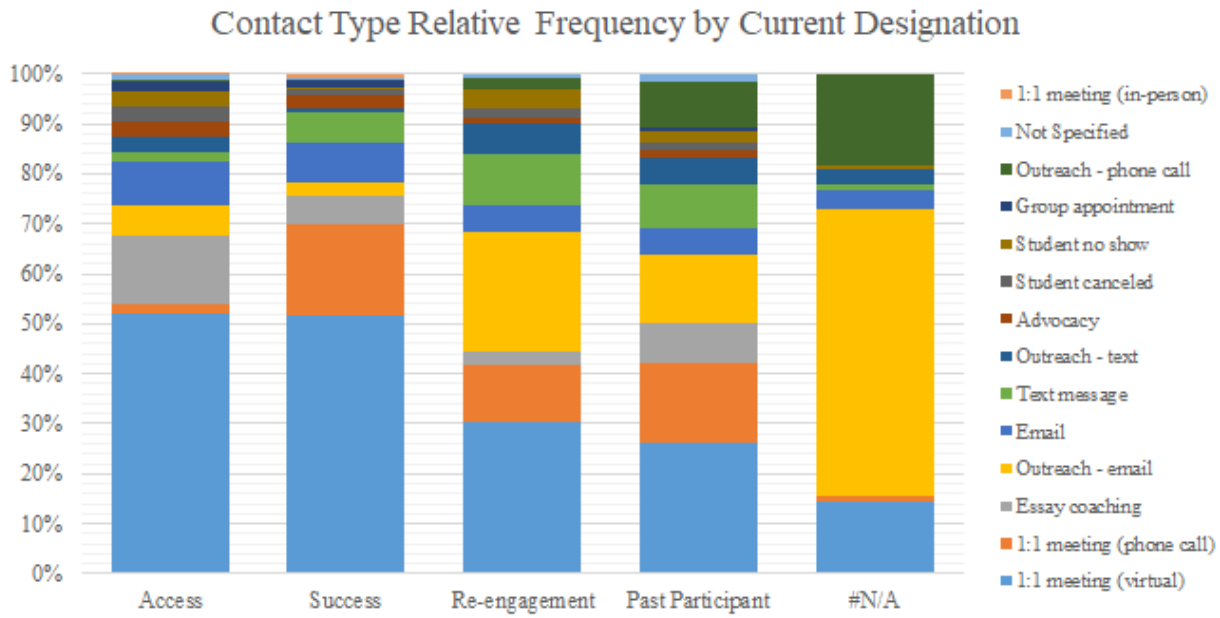


**Figure 18:** The relative frequency of the fourteen contact types among the five current student designations. "#N/A" indicates students without a designation.

Of the five designations, Success had the highest frequency of value-added meetings (including one-on-one, group, and essay coaching) at 78.3%. Access was slightly lower at 69.2%, followed by past participants at 50.8%, re-engagement at 44.4%, and unassigned at 15.4%. These results were unsurprising. Students in Access and Success are typically more closely connected to counselors for a longer period, which is consistent with their higher frequency of value-added meetings. Students in re-engagement and past participants have typically left the program before having much time to work with counselors, giving more weight to their non-value-added outreach contact.

To understand how contact type frequencies varied at different stages in student trajectories, we analyzed time-ordered case trajectories. We first created charts to visually compare

samples of individual students, such as **Figure 19**, which shows one random sample of fifteen student trajectories.

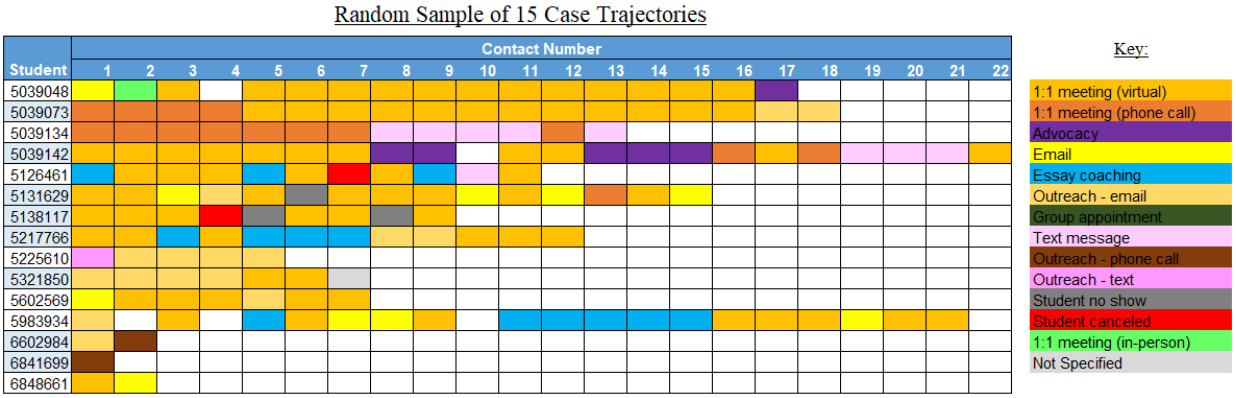


**Figure 19:** Random sample of fifteen case trajectories, drawn from all 333 cases, with color-coded contact points. The vertical axis lists anonymized student ID numbers, and the horizontal axis lists the contact number, with later points of contact towards the right. Note how each trajectory varies in length and contact type composition.

These visuals demonstrated that trajectories varied significantly in length and composition. In fact, there were 275 unique trajectories across all 333 students. In total, 258 students (77.5%) had unique sequences, 12 (3.6%) shared a sequence with one other student, and the remaining 63 (18.9%) that shared with more than one other student had short sequences. For example, 10 students (3.0%) had trajectories with a one-on-one virtual meeting and nothing else. These students were likely early in their time with the Access Program, meaning their trajectories would later lengthen and diverge. **Table 5** gives an overview of how many sequences were shared by how many students.

Trajectory visuals also illustrated that students tend to have strings of one contact type in a row, such as the first two students in **Figure 19** that both have twelve one-on-one virtual meetings in a row. These same-type-strings can be short as well, like the two-to-three contact strings that compose student 5217766's trajectory. However, these visuals showed that certain contact points can occur at different times student to student. For instance, no one contact type starts or ends each trajectory. From our conversations with Access Program staff, we assumed cases would generally start with external communication like an email or phone call, and end with one-on-one meetings. This is not always the case, as eight trajectories shown in **Figure 19** started with value-added meetings, and eight cases ended with external communication or advocacy.

**Table 5:** Table summarizing trajectory uniqueness. The first column is the number of students that shared a sequence group, with 1 indicating unique sequences and 10 indicating sequences shared by 10 students. The second column is the number of sequences shared by each number of students, the third column is the number of students sharing these sequences, and the fourth column is these same student counts normalized.

| Sequence Shared by ___ Student(s) | Number of Sequences | Total Students | % of All Students |
|---|---|---|---|
| 1 | 258 | 258 | 77.48 |
| 2 | 6 | 12 | 3.60 |
| 3 | 2 | 6 | 1.80 |
| 4 | 2 | 8 | 2.40 |
| 5 | 3 | 15 | 4.50 |
| 6 | 1 | 6 | 1.80 |
| 9 | 2 | 18 | 5.41 |
| 10 | 1 | 10 | 3.00 |

Merging trajectories together gave a clearer picture of when different contact types occur chronologically. To do this for a group of students, we counted the number of each contact type that occurred at each chronological sequence step in their trajectories. We put these counts in stacked bar charts, using absolute counts to create charts resembling survivorship curves, like **Figure 20a**, and relative frequencies to create percentage charts, like **Figure 20b**. Charts for all students combined, each current designation, and each student type, are contained in Appendix A.

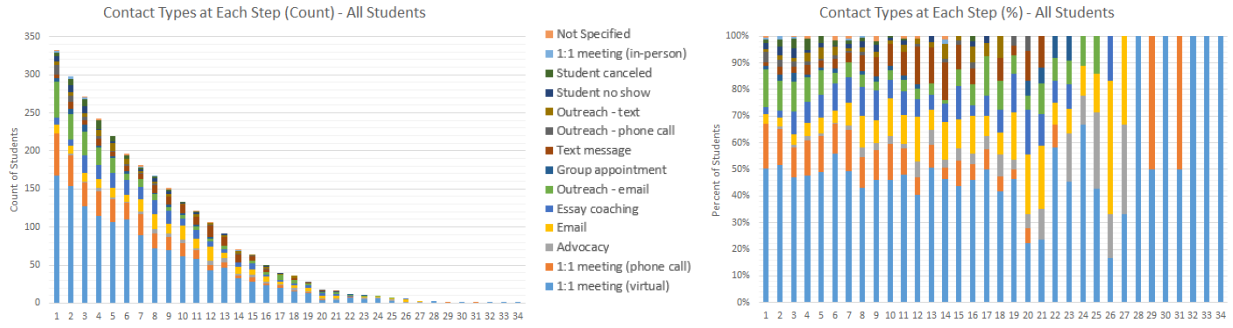


**Figure 20a (Left):** Contact counts across chronological contact steps for all students, color-coded according to contact type. The horizontal axis shows step number, increasing from the first contact step to the 34th contact step.
**Figure 20b (Right):** Relative frequency of each contact type across chronological contact steps. Note, these are normalized versions of the same counts in **Figure 20a**.

While total contact counts roughly followed a Type II survivorship curve for all students combined, the same was not true for all subcategories. For example, Success student counts were

close to a Type I, while Re-engagement, and to some extent Access students, followed Type III curves. This was understandable, because students in re-engagement have left Access early, students in Access still have time left with the program, and students in Success have already completed their full trajectory.

Normalized contact counts demonstrated that the relative frequency of contact types was somewhat consistent over the first several contact points. This was especially true for all students combined, with the case type frequency distribution remaining similar over the first 19 contact steps, as shown in **Figure 20b**. Success trajectories up to the nineteenth step, and Access trajectories up to the fourteenth step also maintained consistent distributions as well. Re-engagement trajectories maintained a consistent distribution to around only the seventh step. This suggests that, while contact points of one type tend to succeed each other in individual trajectories, different types of contact occur for the most part independent of time.

Among Access, Success, and all students, around 50% of each contact step were one-on-one virtual meetings and 10% were emails. For Access trajectories, an additional 20% were essay coaching, and for Success trajectories, an additional 20% were one-on-one phone calls. Re-engagement trajectories had few one-on-one virtual meetings, between 30-40%, and a high proportion of outreach emails, anywhere from 10-100% per step. This suggests that the type of contact still differs between subcategories of students, despite remaining somewhat consistent across contact steps.

### *4.5.2 Analysis of Granular Case Trajectories*

We followed our average trajectory analysis with a granular review of individual cases. To perform this analysis, we created a Python script utilizing regular expressions which allowed us to quickly sort and search trajectories for different contact types. This script and a breakdown of its key functionalities can be found in Appendix B. We focused this analysis on students with cancellations or no-shows to understand what students are most likely to miss an appointment and how missing one impacts a case's prognosis. The Access Program defines cancellations as counseling appointments that are called off in advance by either the counselor or student. No-shows are appointments that do not occur because of a student absence that is not communicated in advance.

We first looked at who missed counseling meetings. **Figure 21** and **Table 6** compare the relative and absolute number of students with cancellations, no-shows, and in general in each designation. We observed that the relative and absolute number of students in Access, past participants, and no designation were almost identical between cancellations and no-shows. However, more students in re-engagement had a no-show than a cancellation, while the reverse was true for students in Success While we found no statistically significant difference in the designation distributions of cancellations and students in general, we found the difference in distributions of no-shows and students in general to be statistically significant. The chi-squared p-values comparing cancellations to all students and no-shows to all students were 0.1749 and 0.0082, respectively.[2] In other words, we found no indication that cancellations were unproportionally distributed between designations. There is evidence that no-shows are unproportionally distributed, however, due to the large percentage of re-engagement students with a no-show. In fact, while 13.2% of all students had a no-show, more than double this percentage of re-engagement students had a no-show at 27.8%. This was somewhat expected because we hypothesized no-shows contributed to losing contact with a student and them prematurely leaving the Access program. Cancellations, on the other hand, represent closer communication because students proactively reach out to the Access Program when they cancel.

[2] It should be noted that these statistics may not be reliable given the small cancellation and no-show sample sizes. With the smallest designation in all students having a percentage of 4.8%, a minimum sample size of 105 is required to meet the requisite expected value of 5 in all designations.

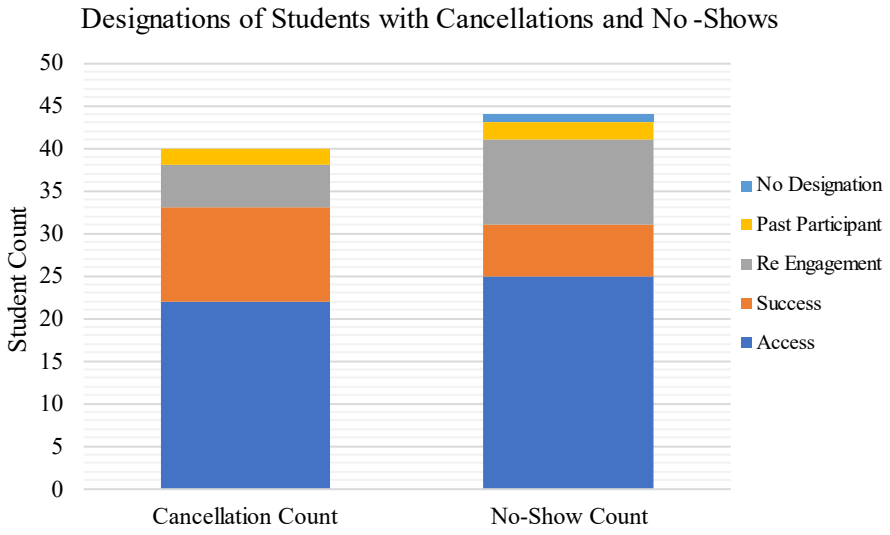


**Figure 21:** Count of students with one or more cancellation or no-show, grouped by designation.

**Table 6:** Summary of how many students of each designation had a cancellation or no-show in their case trajectory. Chi-squared p-values are calculated for cancellation and no-show students compared to all students

| | **Access** | **Success** | **Re Engagement** | **Past Participant** | **No Designation** | **Total** | **$\chi^2$ p-value** |
|---|---|---|---|---|---|---|---|
| cancellation Count | 22 | 11 | 5 | 2 | 0 | 40 | 0.1749 |
| % of all cancellations | 55% | 27.5% | 12.5% | 0.5% | 0% | 100% | |
| No-Show Count | 25 | 6 | 10 | 2 | 1 | 44 | 0.0082 |
| % of all No-Shows | 56.8% | 13.6% | 22.7% | 4.5% | 2.3% | 100% | |
| All Students Count | 127 | 119 | 36 | 35 | 16 | 333 | |
| % of all Students | 38.1% | 35.7% | 10.8% | 10.5% | 4.8% | 100% | |

We further divided these distributions by the total number of missed meetings to see which groups tend to cancel or no-show multiple times (**Figure 22a** and **Figure 22b**). Overall, 33 out of 40 students that canceled and 39 out of 44 students that no-showed only did so once. This suggests that missing multiple meetings is somewhat rare. Those that did miss multiple meetings are overwhelming in the more "active" designations. Students with two or three cancellations were about evenly split between Access and Success. Except for one student in Success and one past

participant, all students that no-showed multiple times were in Access. Interestingly, more students had three cancellations than two (5 vs 2, or 12.5% vs 5%), while more students had two no-shows than three (4 vs 1, or 9.1% vs 2.3%). We hypothesized that students who proactively cancel have more frequent communication with the Access Program, which would in turn make them more likely to stay longer and communicate further cancellations.

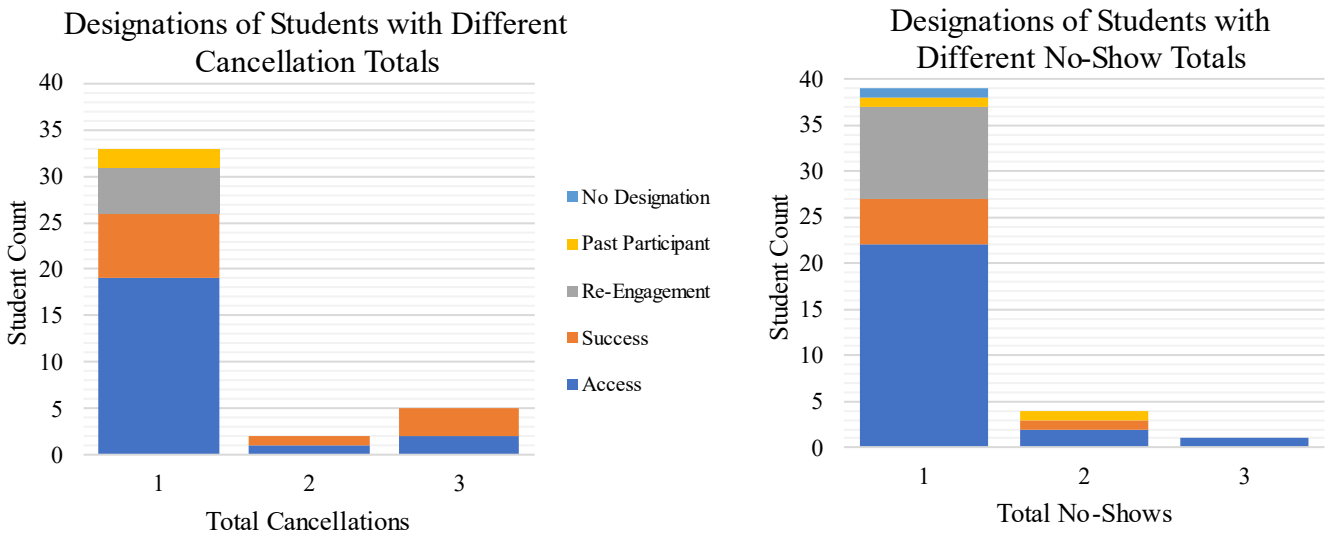


**Figure 22a (Left):** Counts of the number of students with 1, 2, or 3 cancellations in their trajectories, grouped by current designation.
**Figure 22b (Right):** Counts of the number of students with 1, 2, or 3 no-shows in their trajectories, grouped by current designation.

To evaluate whether this was the case, we compared cancellation and no-show trajectory lengths to those of other categories. We first found trajectory length summary statistics for all students, each current designation, and students with one or more cancellation or no-show in their trajectory (**Table 7**). We found the mean and median all-student trajectory lengths to be 8.7 and 8 steps, respectively. All current designations had shorter mean and median lengths than the all-student averages, except for Success students with a mean of 11.7 and median of 12. The mean and median lengths of no-show trajectories were also below those of all students, at 8.114 and 7. However, this mean length was greater than the means of the four designations below the all-student mean, and this median was only shorter than the median of one of the same four. The cancellation trajectory mean and median of 10.8 and 11 steps were second in length to only Success students. These statistics suggest that students who miss a meeting, especially because of a cancellation, tend to have more points of contact than most other categories of students.

**Table 7:** Trajectory length summary statistics across current designations and students with one or more cancellation and or no-show.

| Student Category | Number of Students | Mean Length | Minimum Length | Median Length | Maximum Length |
|---|---|---|---|---|---|
| All Students | 333 | 8.697 | 1 | 8 | 33 |
| Success | 127 | 11.693 | 1 | 12 | 33 |
| Access | 119 | 7.739 | 1 | 7 | 24 |
| Re-Engagement | 36 | 7.167 | 1 | 4 | 25 |
| Past Participant | 16 | 8.063 | 1 | 7.5 | 19 |
| No Designation | 35 | 2.943 | 1 | 3 | 10 |
| 1+ Cancellation | 40 | 10.775 | 3 | 11 | 22 |
| 1+ No-Show | 44 | 8.114 | 1 | 7 | 18 |

To understand where this additional contact fell relative to the missed meeting, we calculated the number of steps before and after each trajectory's first cancellation or no-show (**Figure 23a** and **Figure 23b**). We found cancellations were concentrated near the beginning of contact, with 85% of first cancellations happening between steps 1 and 5. First no-shows were also somewhat concentrated near the beginning, with 56.8% occurring between steps 1 and 3, however the remaining first no-shows were evenly spread out from steps 4 through 13. The first cancellations and no-shows of Access and Success students happened across the full range of steps. However, re-engagement students and past participants only missed meetings within the first three steps, aside from one exception. One possible explanation for this is that missing a crucial first meeting could be a factor that eventually led to these students prematurely leaving the Access Program.

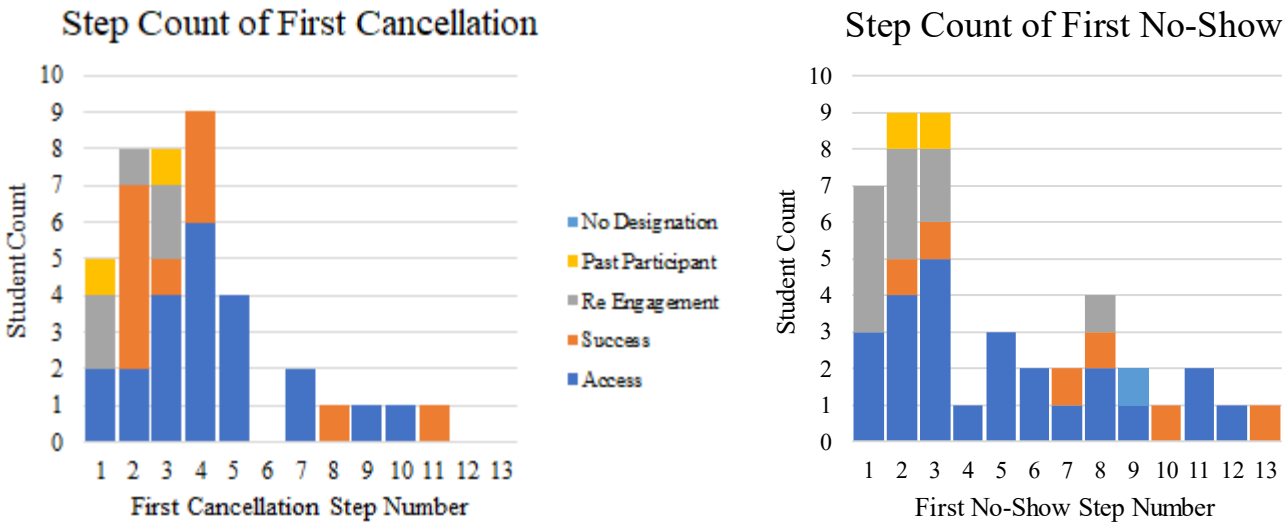


**Figure 23a (Left):** Count of students whose first cancellation occurred at different step numbers, grouped by current designation.
**Figure 23b (Right):** Count of students whose first no-show occurred at different step numbers, grouped by current designation.

Analyzing the number of remaining contact points after the first cancellation or no-show gave further evidence of the impact of each. We created remaining contact count distributions for both cancellations and no-shows (**Figure 24**). Cancellations were followed by a mean of 6.95 and median of 5.0 contact steps, compared to no-shows which were followed by a mean of 3.48 and median of 2.0 steps. The no-show remaining contact counts distribution was also heavily skewed to the right, with 59.1% of these trajectories ending within two contact points of the first no-show. In comparison, the 62.5% of cancellation trajectories ending the soonest after the first cancellation ended within seven contact points. Furthermore, 12 cancellation trajectories continued for more than 10 contact points after the first cancellation, compared to only 2 no-show trajectories. These results indicate that a no-show signals that a case trajectory will end soon. This does not necessarily mean the trajectory will end because of the no-show. The trajectory ending and no-show may both be symptoms of an underlying reason, like loss of contact with the student.

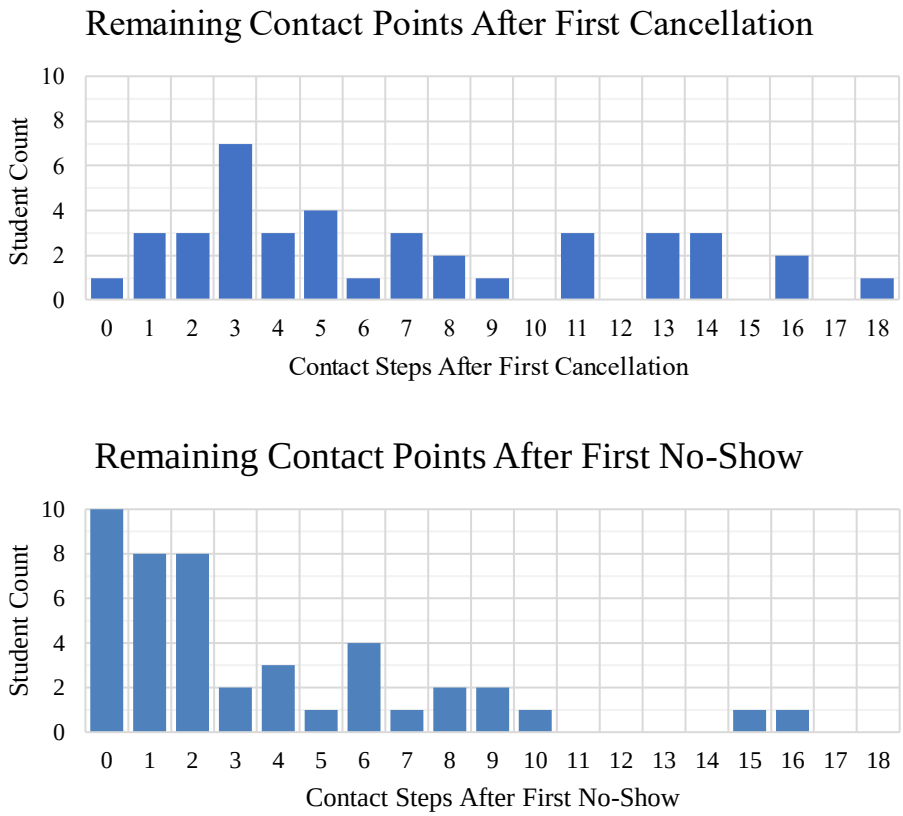


**Figure 24:** Count of students with a given number of remaining sequence steps following their first cancellation or no-show.

This analysis highlights the negative impact of a no-show on a student's Access Program outcome. While most students that do no-show will only do so once, even one no-show is associated with a higher chance of entering re-engagement and the end of the case trajectory. We therefore recommend the Access Program investigates why no-shows occur and what causes this negative association. Following the approach presented in this section, this further analysis could identify patterns in the contact points that precede and succeed no-shows. This would allow the Access Program to anticipate a no-show and proactively change their contact strategy to avoid it or mitigate its effects.

# 5 Conclusion and Recommendations

## *5.1 Conclusion*

Our project successfully helped streamline Goddard Riverside's Options Center Access Program's intake process through a revised intake form and integration of Calendly. The purpose of our project was to balance caseloads and to make it easier for students to connect with counselors. We utilized the DMAIC process to help guide and carry out our project. We first communicated with the Director of Counseling to understand the intake process and its associated challenges. We then identified the bottlenecks in the process and researched calendaring tools to see which application would best address the intake process's challenges. We found the main bottleneck to be delays in initial appointment scheduling due to difficulties connecting with students. Our scheduling improvements were designed to decrease the amount of time required for the Administrative Coordinator to schedule initial appointments. Throughout this project we focused on four distinct areas: the Access Program intake form, historical case data analysis, implementing Calendly, and discrete event simulation. The Access Program intake form was updated to be user-friendly and connect students to Calendly. Calendly is an external calendaring app that provides students with a link to select time slots for counselor appointments. The data collected was used to simulate the current process and the process we recommended to see how implementing Calendly would help the Access Program. Our simulation indicated that if only 40% of the students that fill out the form utilize Calendly, then it will still significantly decrease the number of students sent to re-engagement.

To provide the Access Program with practical recommendations we researched and communicated our ideas with the Options Center team to confirm feasible implementation. From those discussions we were able to provide the counselors and Administrative Coordinator with certain deliverables. The intake form was updated to minimize the amount of time required for students to complete it. The Calendly scheduling application was set up for the counselors and our team walked through to tool to illustrate how we envisioned Calendly implemented at Riverside. In addition to the Calendly link itself, we also created tutorial videos to go along with Calendly in case they have any questions in the future about how to use it and need to reference back. These tutorial videos were uploaded to a drive for Access Program staff to access in the future when questions might arise. In short, we recommend that Access Program staff use the updated form

and Calendly link to help increase the number of students that successfully schedule initial appointments. The implementation of this system created a successful model for students to use. 80% of the students who participated in the first two weeks of our streamlined process scheduled an appointment. The other 20% of students did not follow up communication with the Administrative Coordinator indicating the students possible lack of interest in the program altogether. This preliminary data supports our tools have an immediate positive impact on the system.

### *5.2 Future Work*

If repeated, future process improvement efforts would allow the Options Center to further improve the intake process for both students and Access Program staff. We recommend a custom intake form and scheduling tool as potential tools to build on our deliverables. These tools would require application design expertise to develop but would allow the Access Program to enforce additional scheduling rules not possible in Google Forms and Calendly. For instance, Access Program counselors are limited by policy to five new students per week and two per day. Calendly currently lacks a way to enforce these limits besides manually restricting counselor availability once they are met. A custom tool, however, could be designed to do so automatically. This would limit manual work for Access Program staff and save students frustration from signing up for a fully booked counselor. A custom intake form that fully integrates with the scheduling tool could also be created. This would allow students to book an appointment without navigating to another web page, further simplifying the process for them, and potentially increasing the form response rate.

Our analysis of historical case trajectories could also be expanded upon by future research to analyze other trajectory patterns and contact types. We focused on general summary statistics and comparing cancellations and no-shows, and our analysis demonstrates the ease and utility of searching trajectories with regular expressions. More complex scripts could be used to investigate what types of contact follow or precede cancellations and no-shows. This would give insight on how missing meetings impacts the quality of contact. The entire analysis could also be repeated with other contact types. For example, the impact of virtual versus in person one-on-one meetings on student retention and trajectory length could be compared to see their effectiveness. Future

work will also be able to use a larger dataset. Since the Access Program adopted its new database in 2020, our dataset spans from June 2020 to November 2021. A larger dataset will allow for the use of more robust statistical inference tools and the analysis of long-term trends.

# 6 Reflection

To meet the needs of the Options Center, we modified the intake process with existing tools and problem-solving concepts. We followed the DMAIC process improvement framework to focus and organize our work. It shaped our approach to the problem and the structure of this report. We worked closely with Access Program staff to identify the problem at hand, utilizing online meetings over Zoom to discuss the needs of their counselors and students. From our discussions, we realized that a scheduling tool would greatly reduce the workload of the Access Program Administrative Coordinator. After some research, we identified Calendly as the best scheduling tool for the task. To stay within the constraints of the DMAIC process, we implemented Calendly and measured its effects through defined metrics to compute the effectiveness of our strategy. We developed DES models to test Calendly's impact before its implementation. We also analyzed case data to gain additional insights about trends in contact types and the impact of cancellations and no-shows on student outcomes.

A major constraint faced throughout this project was the Covid-19 pandemic and the requirement to work remotely with the Options Center. Ordinarily, the team would have visited the Options Center in New York to get acquainted with the sponsor and the team we were helping. This helps to foster a sense of trust between us and the sponsor, which is fundamental to introducing changes. Furthermore, the lack of in person meetings meant we were not able to observe the process in person and instead had to rely on accounts from the counsellors. This meant that the quality of our process map relied on our ability to interview, document, and understand these accounts. Another constraint that was amplified by remote work was the initial lack of trust between our team and our recommendations. The Access Program had a negative experience with Calendly prior to us coming to work with them, which acted as a small barrier for entry. Additionally, it can be hard to address concerns when meeting time is limited. Other constraints we ran into involved money and time. We did not want a lengthy installation process that would miss peak applicant season in the fall, nor did we want to give the Options Center any unnecessary costs. Finally, we also had to make sure our chosen improvements worked with other parts of their system, such as their centralized case records database.

Building a strong working relationship with our sponsors at the Options Center challenged us to learn new soft skills. As students of a technical-focused industrial engineering program, we had limited experience acting as consultants and navigating organizational cultures going into this

project. We learned through doing, taking deliberate steps to gain the trust and understand the needs of Access Program staff. From the outset, we organized regular Zoom meetings and established email communication with the Director of Counseling. Proactively using these channels allowed us to quickly grasp the Access Program's internal culture and scope the intake process's operational challenges. Taking the time to understand the Options Center and update the Director of Counseling also built mutual trust between her and our team. This demonstrated to us the importance of having an ally in a partner organization. The Director of Counseling's support and enthusiasm ultimately proved vital to the project's success, as she procured the case data, set up the administrator Calendly account, and won the support of other key stakeholders. We learned several lessons throughout the process improvement implementation phase, like how to apply DMAIC to a non-profit service organization and how to integrate premade tools like Calendly. However, the largest lesson was still that consultant-driven process improvement is built on a foundation of inter-organizational trust and communication. We advise future project teams working with the Options Center to also take the time to lay this foundation.

Just as our relationship with our sponsors relied on trust and communication, these values also created a healthy team working environment. To allow us to equally apply our project management skills, we each took ownership of the four facets of the project (the intake form, calendaring tool, simulation, and data analysis) instead of delegating one central team leader. During regularly occurring internal meetings, we collectively set milestones and deadlines for each facet, entrusting these milestones to their respective owners. This strategy allowed us to keep the project moving forward, while also giving each member the autonomy to lead in their area on an appropriate timetable. To guarantee each member's voice was heard, we also rotated the roles of facilitator and scribe across sponsor and advisor meetings and encouraged openly voicing major disagreements. The latter was especially important in writing this report due to differing views on its audience and purpose. In addition to open communication, such disagreements were resolved by understanding each opinion and seeking outside guidance from our advisors and related literature. We anticipate future groups will experience similar disagreements and advise them to develop a workflow that suits their team. While our autonomous approach may not be universally applicable, trust and open communication are required to find an approach that does work.

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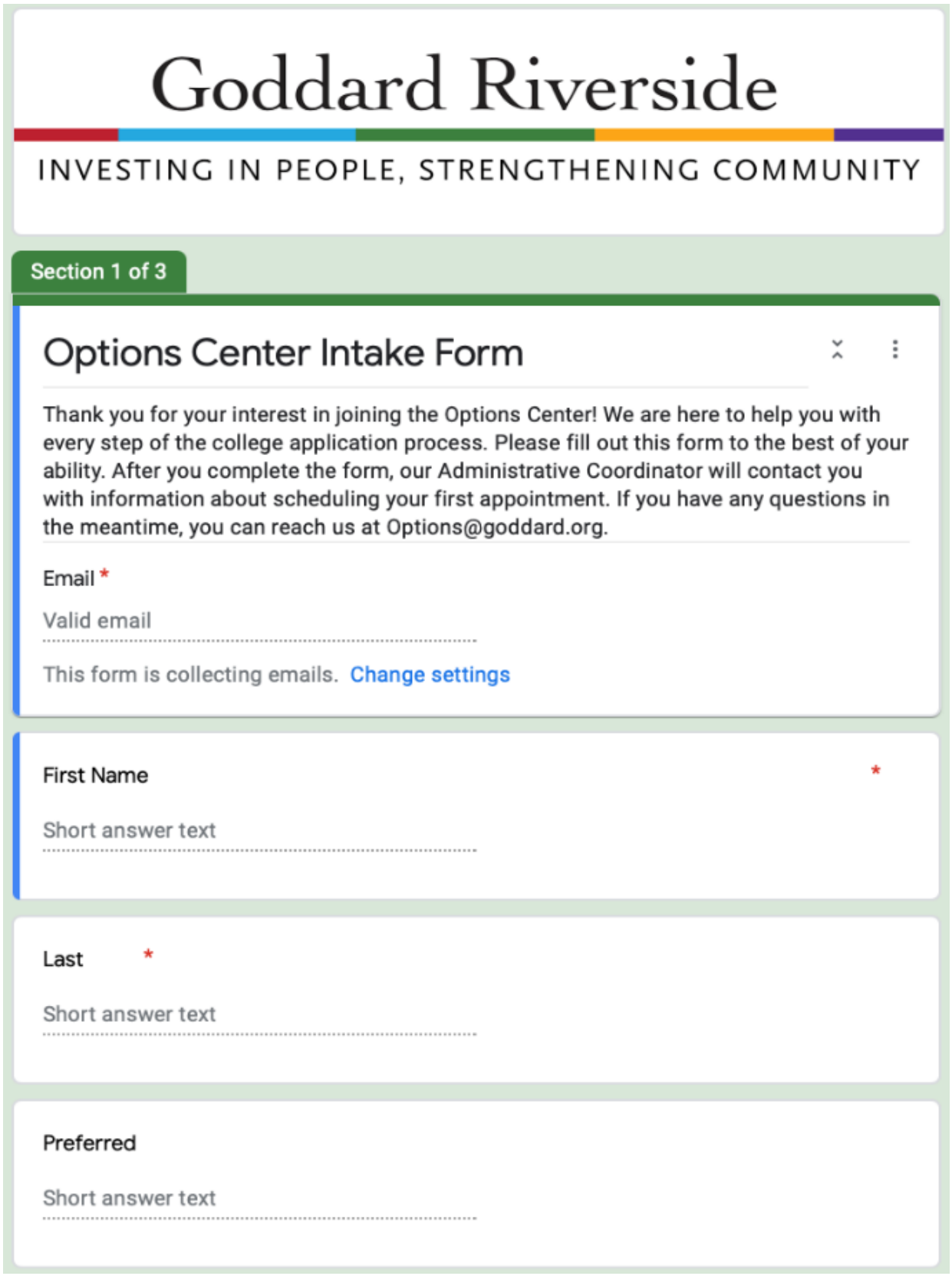
## Appendix A: Revised Intake Form



Cell Phone Number (use this format: xxx- *

Short answer text

Home Phone Number (use this format: xxx-

Short answer text

Date of *

Month, day, year

Country of

Short answer text

Addres *

Long answer text

Cit *

Short answer text

Stat *

Short answer text

Zip *

Short answer text

Gende *

- Female
- Male
- Gender non-conforming
- Other:

Pronouns

- She/Her
- He/Him
- They/Them
- Other:

Preferred language

Choose

Language spoken most at home

Your answer

Ethnicity

- ○ Asian or Pacific Islander
- ○ Black or African American
- ○ Latino/a or Hispanic
- ○ Middle Eastern
- ○ White
- ○ Native American or Alaska Native

Disability

- ☐ Autism Spectrum Disorder
- ☐ Deaf or hard of hearing
- ☐ Emotional Disability
- ☐ Intellectual Disability
- ☐ Learning Disability
- ☐ Orthopedic Disability
- ☐ Speech or Language Impairment
- ☐ Traumatic Brain Injury
- ☐ Visual Impairment or Blindness
- ☐ Other Disability
- ☐ No Disability

Next Clear form

## Academic information

Please try to fill out to the best of your ability. If able, you will need to have your test scores and transcripts for your initial meeting.

Student Type *

- ◯ HS Junior
- ◯ HS Senior
- ◯ Not in school (16-24)
- ◯ Not in school (25 and above)
- ◯ College Sophomore
- ◯ College Junior

What high school did you attend? *

Choose

Type of diploma

- ◯ Regents
- ◯ Advanced Regents
- ◯ Honors
- ◯ Local

- ◯ HSE/TASC
- ◯ Private High School
- ◯ CDOS
- ◯ SACC
- ◯ Outside of NYC

Have you taken the SAT *

- ◯ Yes
- ◯ No

Have you taken the ACT *

- ◯ Yes
- ◯ No

Other Exams

- ◯ TOEFL/IB
- ◯ AP
- ◯ SATII

OSIS # (write NA if you do not have one) *

Your answer

Back Next Clear form

Section 3 of 3

## Options information

Description (optional)

How did you hear about us? (check all that

- [ ] GRCC Youth Center
- [ ] Flyer/Poster
- [ ] Website
- [ ] Walk-In
- [ ] School Counselor/Teacher
- [ ] Relative
- [ ] Options Student
- [ ] Friend (not in Options)
- [ ] Options Workshop
- [ ] Sponsor/Social Worker
- [ ] GRCC Staff
- [ ] Media Coverage
- [ ] Other Organization/CBO

Are you a first generation college *

- ○ Yes
- ○ No

What college assistance do you *

- ☐ College list creation
- ☐ College research
- ☐ Financial aid application (including FAFSA)
- ☐ College application essays
- ☐ College application
- ☐ Workshops
- ☐ All of the above
- ☐ Other...

Calendly appointment *

https://calendly.com/d/cgz-vt9-8br/round-robin-example-event?month=2021-12

- ○ I got an appointment scheduled!
- ○ I need Aledra to reach out to me to schedule an appointment

## Appendix B: Guided Discussion Questions

**Questions for Pre-Implementation Meeting**

These questions were asked at a meeting with the Director of Counseling, Administrative Coordinator, Access Team Manager, and the three Access Program counselors. This meeting occurred a few days before Calendly, and the revised intake form were fully implemented. At the midpoint of this meeting, we gave an in-depth introduction and walkthrough to Calendly.

**Before Calendly Intro**

1. What are the main challenges with the intake process for you now?
2. How do you schedule your workdays?
3. What is your typical weekly calendar/availability?
4. What do you want out of a scheduling system?
5. How do you think Calendly will impact your day-to-day workload?

**Calendly Intro**

**After Calendly Intro**

1. What do you foresee that the implementation of Calendly will do for you?
2. Is this new system intuitive so far?
3. Do you have any ideas of your own for changes that can be made?

**Questions for Post-Implementation Meeting**

These questions were asked at a meeting with the Director of Counseling, Administrative Coordinator, and Access Team Manager. This meeting was less structured than the pre-implementation meeting and occurred a week after Calendly and the intake form were fully implemented.

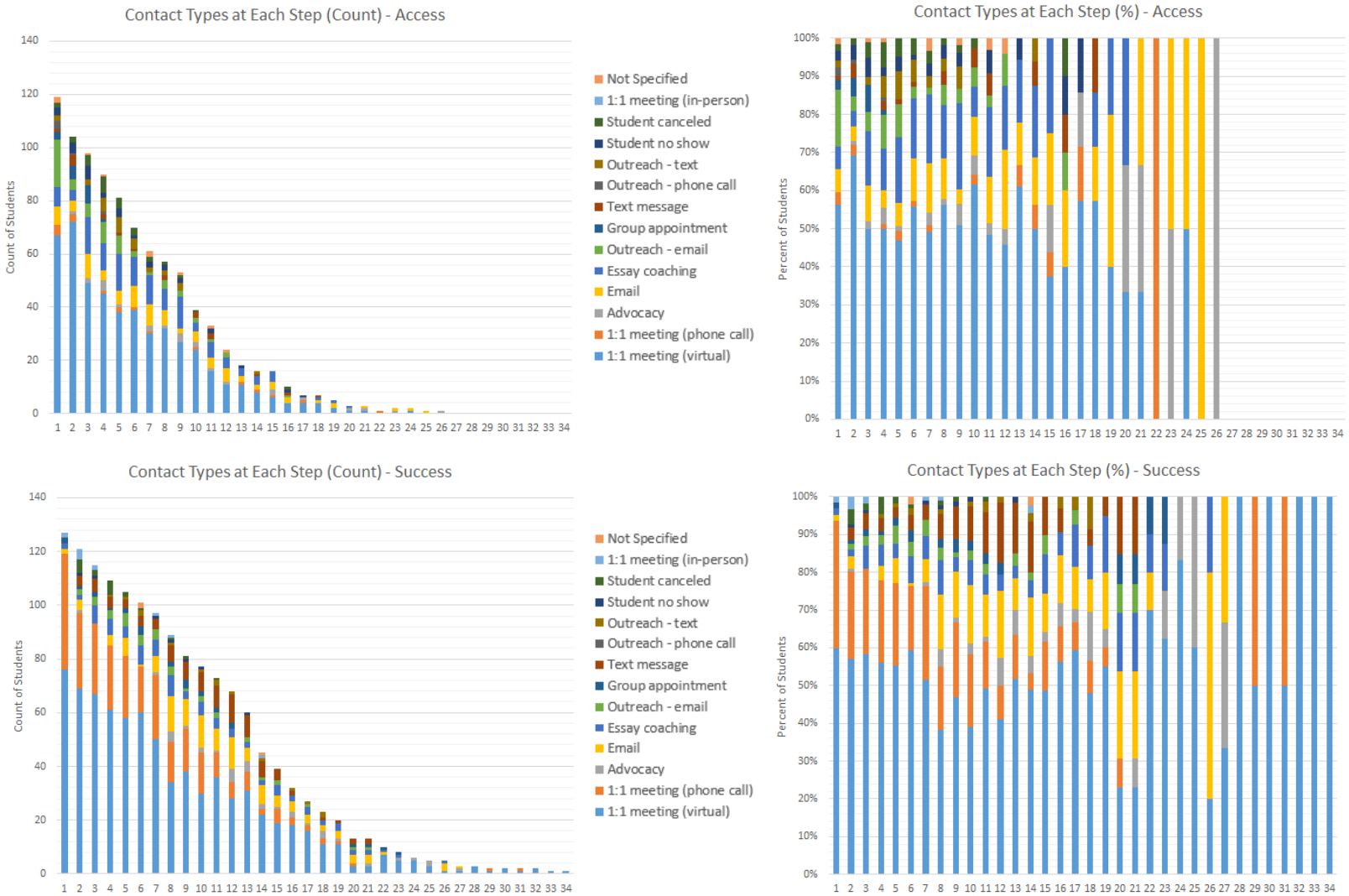
1. What's been easier?
2. What's been difficult?
3. How many new students have gone through the new system?
4. How has Calendly changed your interaction with scheduling first appointments (positive

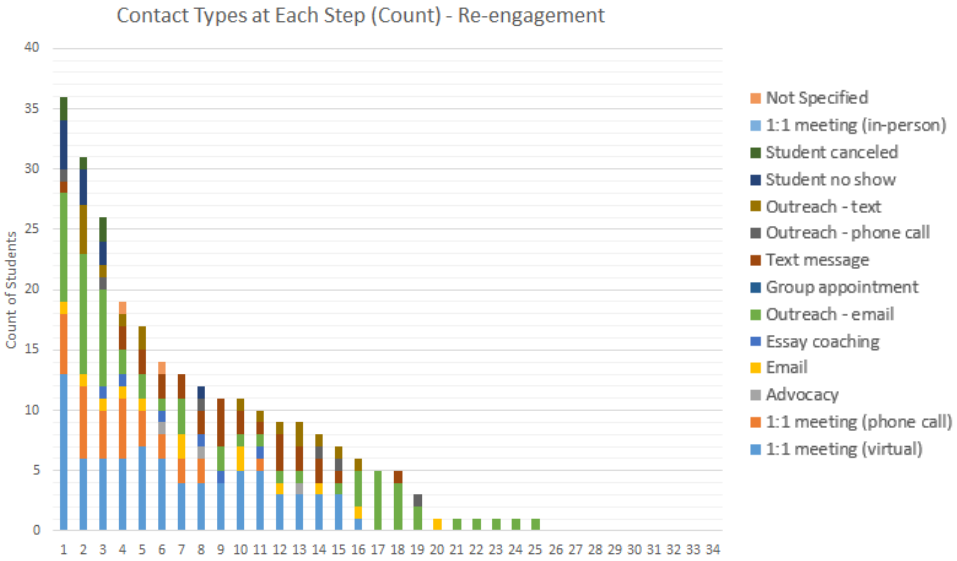
and challenges)?

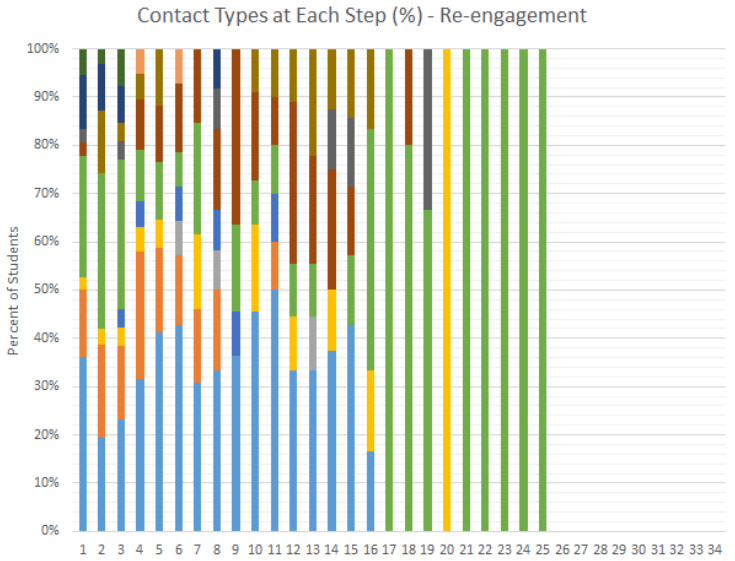
5. Are there other features you wish Calendly could have?
6. What have been your challenges in utilizing Calendly?
7. how could those challenges be addressed?

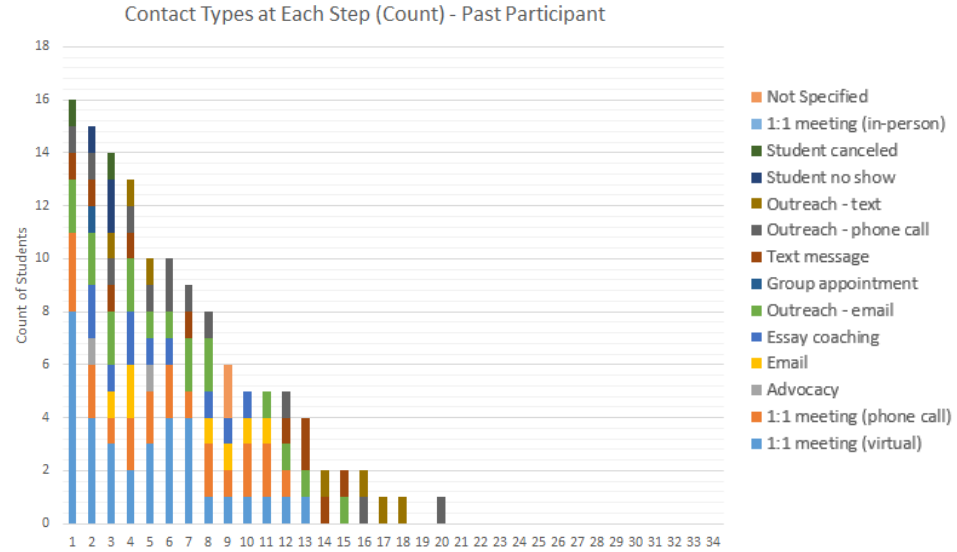
# Appendix C: Historical Case Trajectory Figures

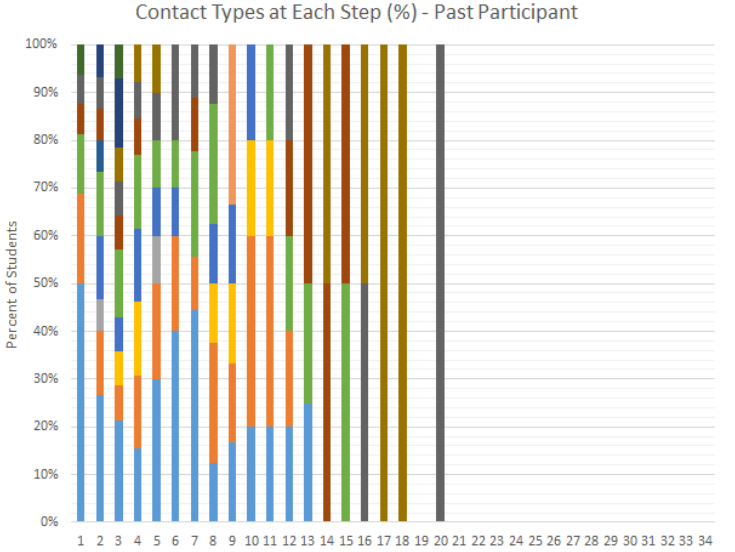
## Case Trajectories by Current Designation

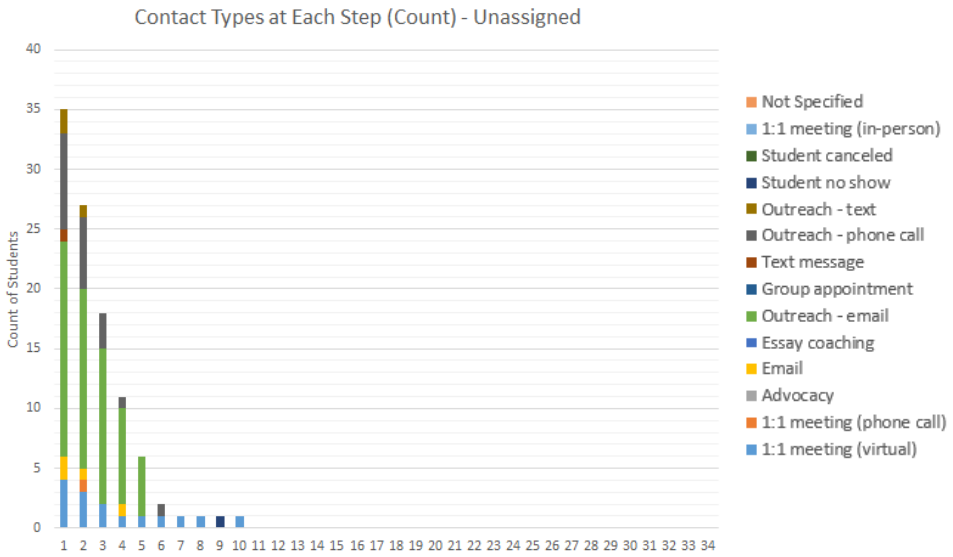


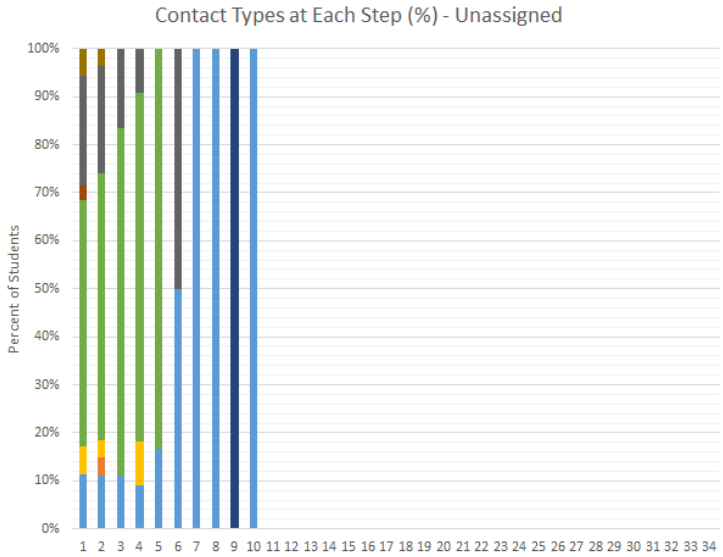

Contact Types at Each Step (Count) - Re-engagement
Count of Students
Not Specified
1:1 meeting (in-person)
Student canceled
Student no show
Outreach - text
Outreach - phone call
Text message
Group appointment
Outreach - email
Essay coaching
Email
Advocacy
1:1 meeting (phone call)
1:1 meeting (virtual)


Contact Types at Each Step (%) - Re-engagement
Percent of Students

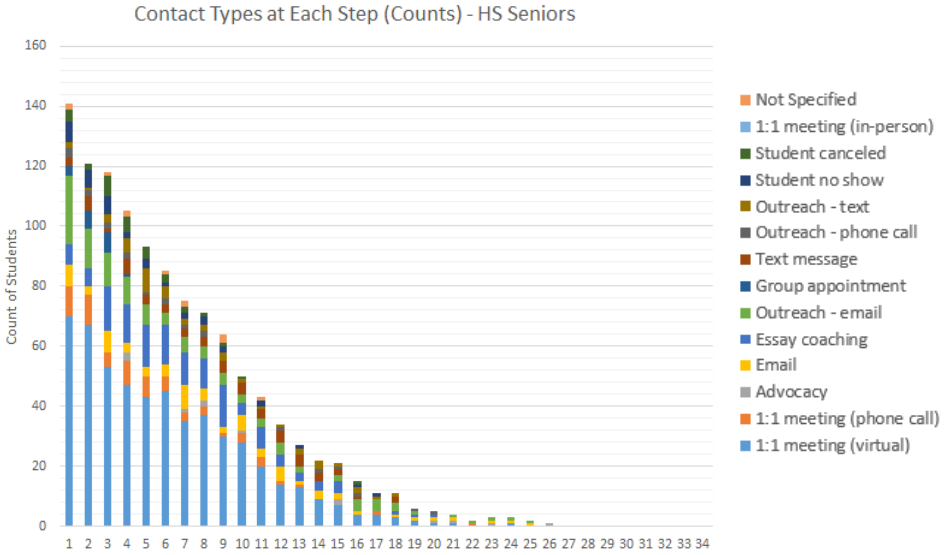

Contact Types at Each Step (Count) - Past Participant
Count of Students
Not Specified
1:1 meeting (in-person)
Student canceled
Student no show
Outreach - text
Outreach - phone call
Text message
Group appointment
Outreach - email
Essay coaching
Email
Advocacy
1:1 meeting (phone call)
1:1 meeting (virtual)

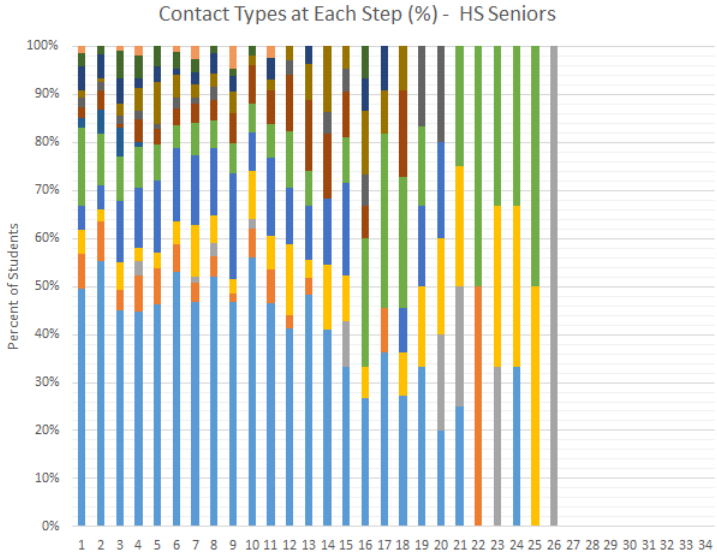

Contact Types at Each Step (%) - Past Participant
Percent of Students

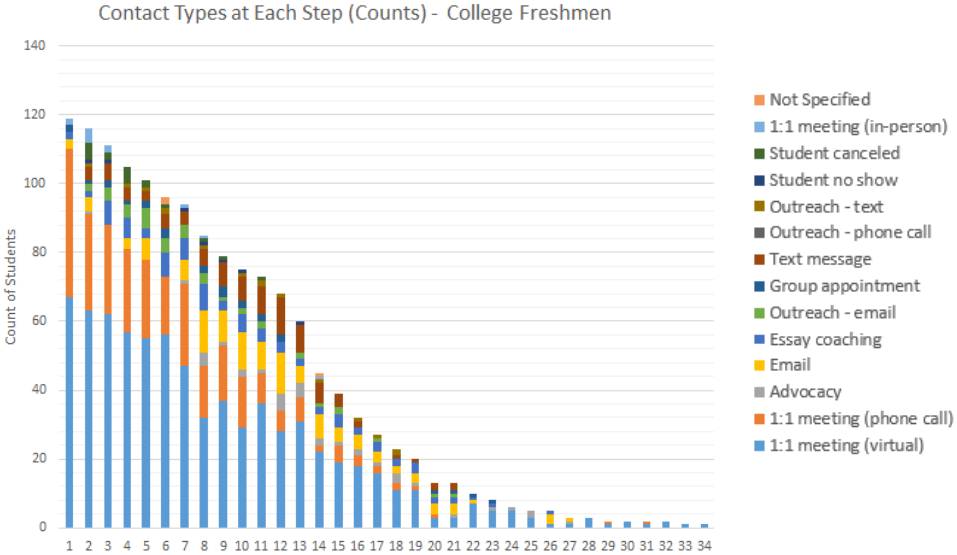

Contact Types at Each Step (Count) - Unassigned
Count of Students
Not Specified
1:1 meeting (in-person)
Student canceled
Student no show
Outreach - text
Outreach - phone call
Text message
Group appointment
Outreach - email
Essay coaching
Email
Advocacy
1:1 meeting (phone call)
1:1 meeting (virtual)

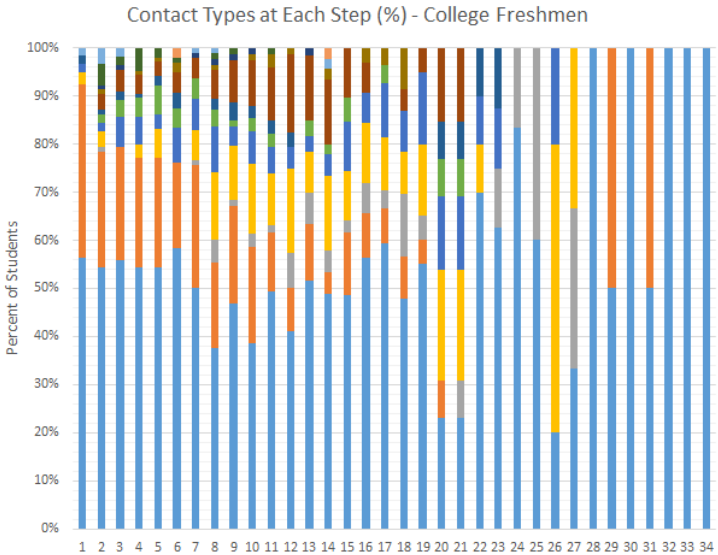

Contact Types at Each Step (%) - Unassigned
Percent of Students

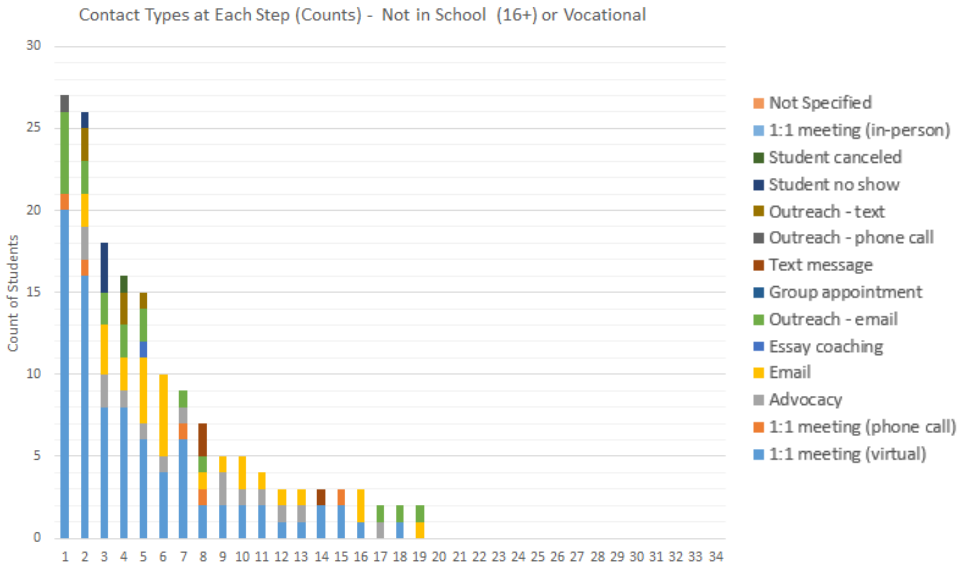
# Case Trajectories by Student Type

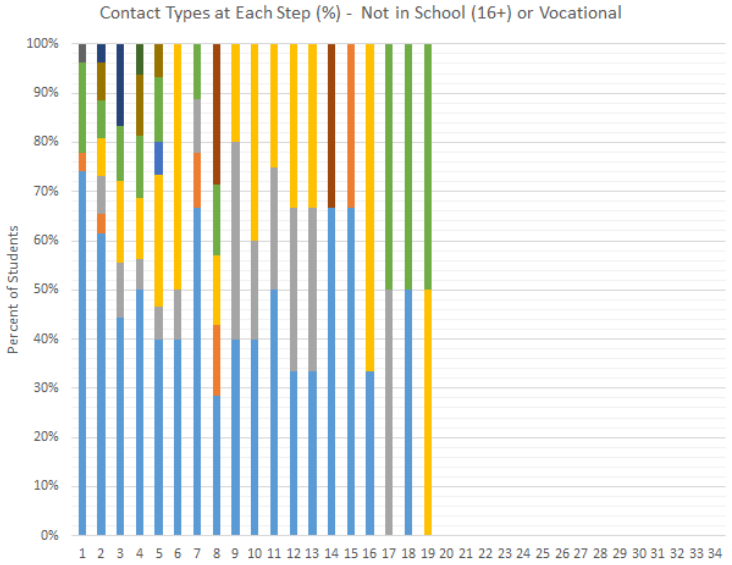


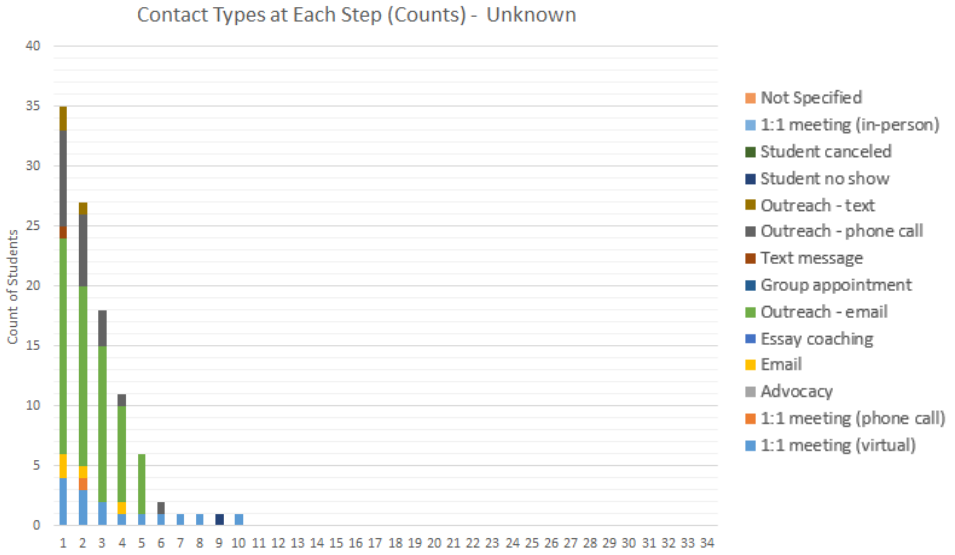



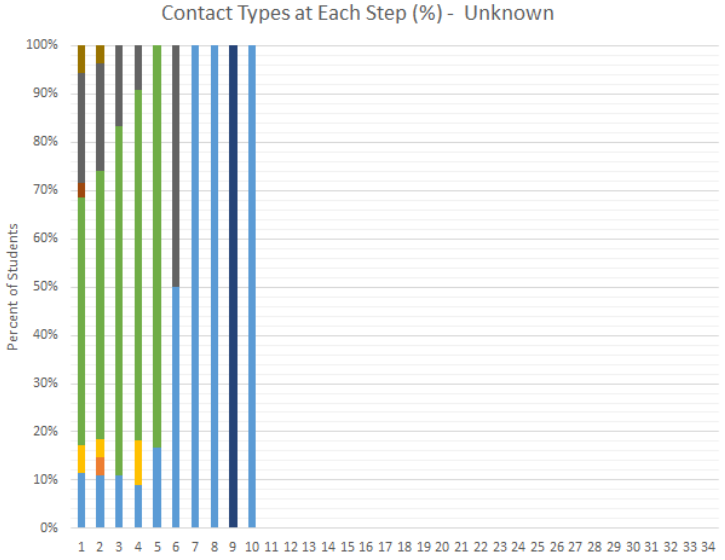



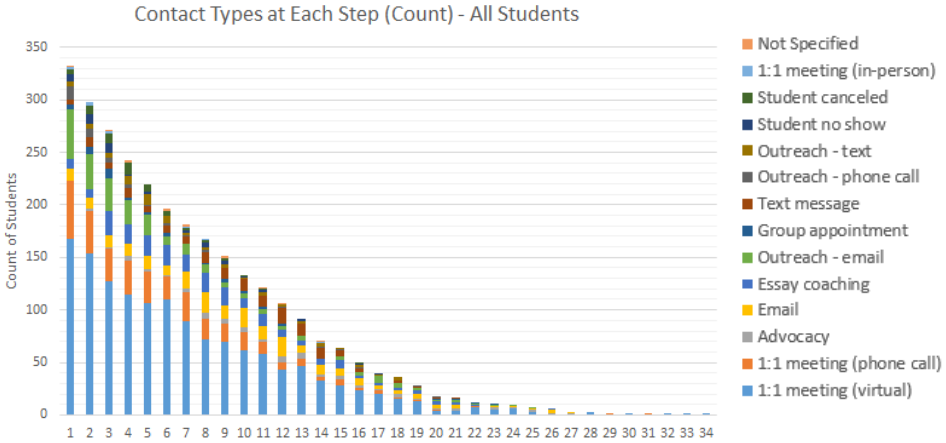

Contact Types at Each Step (Counts) - Not in School (16+) or Vocational
Count of Students
Not Specified
1:1 meeting (in-person)
Student canceled
Student no show
Outreach - text
Outreach - phone call
Text message
Group appointment
Outreach - email
Essay coaching
Email
Advocacy
1:1 meeting (phone call)
1:1 meeting (virtual)

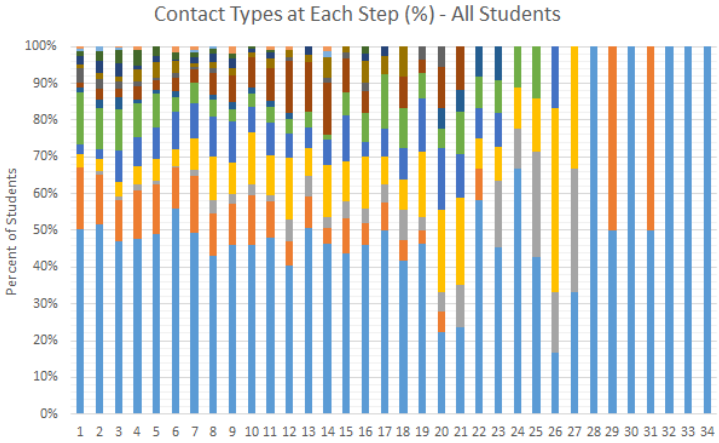

Contact Types at Each Step (%) - Not in School (16+) or Vocational
Percent of Students


Contact Types at Each Step (Counts) - Unknown
Count of Students
Not Specified
1:1 meeting (in-person)
Student canceled
Student no show
Outreach - text
Outreach - phone call
Text message
Group appointment
Outreach - email
Essay coaching
Email
Advocacy
1:1 meeting (phone call)
1:1 meeting (virtual)


Contact Types at Each Step (%) - Unknown
Percent of Students

## Case Trajectories for All Students Combined



## Appendix D: String Generation and Regex Search Python Scripts

### String Generation Script

This script takes in a csv file of student case trajectories and converts them into a csv file of trajectory strings. Each row in the input file contains a student workspace number, the associated series of contact steps, and other information including student type and current designation. Each row in the output file contains a student workspace number, its trajectory string, the sequence length, current designation, and student type. This script fills in missing designation and student types as “Unknown.”

### Python Code:

```
import pandas as pd
import re

trajectories = pd.read_csv("CaseTrajectories.csv")

key = {"1:1 meeting (virtual)": "a",
       "1:1 meeting (phone call)": "b",
       "Advocacy": "c",
       "Email": "d",
       "Essay coaching": "e",
       "Outreach - email": "f",
       "Group appointment": "g",
       "Text message": "h",
       "Outreach - phone call": "i",
       "Outreach - text": "j",
       "Student no show": "k",
       "Student canceled": "l",
       "1:1 meeting (in-person)": "m",
       "Not Specified": "n",
       "nan": ""}
trajectoryLists = trajectories.iloc[:,:-2].values.tolist()
sequences = pd.DataFrame(columns=["Student", "Sequence"])

for student in trajectoryLists:
       sequence = ""
       for step in range(1,35):
              sequence = sequence + key[f"{student[step]}"]
       sequences = sequences.append({"Student": student[0], "Sequence": sequence},
ignore_index=True)

#Create the dataframe that will be output, which includes each student, their sequence,
and designation and type
outputSequences = pd.DataFrame(columns=["Student", "Sequence", "Sequence_Length",
"Designation", "Student_Type"])
outputSequences["Student"] = trajectories["Workspace Number"]
```

```
outputSequences["Sequence"] = sequences["Sequence"]
outputSequences["Designation"] = trajectories["Current Designation"]
outputSequences["Student_Type"] = trajectories["Student Type"]

#Fill any missing data with an 'Unknown' string
outputSequences["Designation"].fillna('Unknown', inplace=True)
outputSequences["Student_Type"].fillna('Unknown', inplace=True)
outputSequences["Sequence_Length"] = outputSequences["Sequence"].str.len()

outputSequences.to_csv("CondensedSequences.csv", index=False)
```

**Trajectory Analyzer Script**

This script contains six functions which take groups of students and regular expression strings as inputs. The first function filters student groups by category, finding all re-engagement students or those who had a cancellation, for instance. The second function takes a group of students as an input and outputs its trajectory length summary statistics. The third function counts the number of times a given contact type appears in each trajectory in a given student group. The fourth function finds the distribution of student types of current designations that have a given contact type in a specified student group. The fifth function finds the step number that each student in a given group first has a given contact type, returning -1 for students that never have said contact type. The final function combines the fourth and fifth functions, sorting a given group of students by their designation or type and which step they first had a given contact type.

**Python Code:**

```
def boolFilter(term, category, dataframe, regexOn):
	"""Function for filtering dataframes based on a boolean search"""
	filteredDF = dataframe[dataframe[f'{category}'].str.contains(f'{term}',
regex=regexOn)]
	return filteredDF

def summaryStats(dataframe, description):
	"""Function for reporting some summary statistics for a given dataframe"""
	# Calculate the number of students in the dataframe and their min, max,
median, and mean sequence lengths
	studentCount = dataframe.index.size
	lenMin = dataframe['Sequence_Length'].min()
	lenMax = dataframe['Sequence_Length'].max()
	lenMed = dataframe['Sequence_Length'].median()
	lenMean = dataframe['Sequence_Length'].mean()
	# Print these values
```

```
	print(f'{description} summary statistics:\n\tLength = {studentCount}; Mean =
{lenMean}; Min = {lenMin}; Median = {lenMed}; Max = {lenMax}')

def oneTypeCounter(meeting_type, dataframe):
	"""Function for counting the number of times a student had one type of
meeting"""
	# Count the number of times the meeting type appears in each sequence
	counts = dataframe['Sequence'].str.count(meeting_type)
	# Return an ordered series of the frequency of these counts
	counterSeries= counts.value_counts().sort_index()
	return counterSeries

def distributionFinder(meeting_type, category, dataframe):
	"""Function for finding the distribution of student types or designations that
meet a certain criteria"""
	# Filter the dataframe down to students with the given meeting type in their
sequence
	filteredDF = boolFilter(meeting_type, 'Sequence', dataframe, True)
	# Find the absoulte and normalized number of students in this dataframe in
each designation or student type
	countsDist = filteredDF[category].value_counts(normalize=False)
	normalizedDist = filteredDF[category].value_counts(normalize=True)
	# Combine these absolute and normalized counts into one dataframe
	combinedDist = pd.concat([countsDist, normalizedDist], axis=1)
	# Add a totals row and return the resulting dataframe
	combinedDist.loc['Total',:] = combinedDist.sum(axis=0)
	return combinedDist

def findFirstOccurences(meeting_type, dataframe):
	"""Function for finding the first time each student has a certain meeting
type"""
	# Find which sequence step each sequence had the given meeting type. This
starts with 1
	firsts = dataframe['Sequence'].str.find(meeting_type)
	# Drop all students that did not have the given meeting type and return
absolute value counts
	firstsDict = firsts.value_counts(dropna=False).sort_index()
	return firstsDict

def findFirstOccDists(meeting_type, category, dataframe, normalized):
	"""Function that finds the first occurences of a certain meeting type, and the
category distributions for each"""
	FirstOccDistsDF = pd.DataFrame(data=findFirstOccurences(meeting_type,
dataframe))
	distsDF = pd.DataFrame(columns=FirstOccDistsDF.index,
index=dataframe[category].drop_duplicates())
	for occurencePoints in FirstOccDistsDF.index:
		filteredDF = dataframe.loc[dataframe['Sequence'].str.find(meeting_type)
== occurencePoints]
		countsDist = filteredDF[category].value_counts(normalize=normalized)
		countsDist = pd.DataFrame({f'{occurencePoints}': countsDist.array},
index=countsDist.index)
		distsDF[occurencePoints] = countsDist
	distsDF = distsDF.T.fillna(0)
	finalDF = distsDF.join(FirstOccDistsDF, how='right')
```

```
	return finalDF

# Import pandas and regex
import pandas as pd
import re

# Load the condensed sequences document. This should be in the same folder as this
script
trajectories = pd.read_csv("CondensedSequences.csv")

# Create empty dictionaries to hold the designation and student type dataframes
DesigDataframes = {}
TypeDataframes = {}

# Create filtered dataframes for each student type
# This creates College_FreshmanList, HS_SeniorList,
Other_Post_Secondary_Program_(Not_College)List,
# Not_in_school___16_24List, Not_in_school___25_and_aboveList,College_JuniorList,
College_SophomoreList,
# UnknownTypeList, and 0List
for student_type in trajectories['Student_Type'].drop_duplicates():
	filteredFrame = boolFilter(student_type, 'Student_Type', trajectories, False)
	student_type = student_type.replace(' ', '_')
	student_type = student_type.replace('-', '_')
	if student_type == 'Unknown':
		student_type += 'Type'
	TypeDataframes[student_type + 'List'] = filteredFrame

# Create filtered dataframes for each designation
# This creates 'SuccessList', 'AccessList', 're_engagementList',
'Past_ParticipantList', and 'UnknownDesignationList'
for designation in trajectories['Designation'].drop_duplicates():
	filteredFrame = boolFilter(designation, 'Designation', trajectories, False)
	designation = designation.replace(' ', '_')
	designation = designation.replace('-', '_')
	if designation == 'Unknown':
		designation += 'Designation'
	DesigDataframes[designation + 'List'] = filteredFrame

# Create dataframes of all students with one cancellation ('l') and one no show ('k')
cancellationList = boolFilter('l', 'Sequence', trajectories, True)
noShowList = boolFilter('k', 'Sequence', trajectories, True)

# Find summary stats for all students and each designation dataframe
summaryStats(trajectories, 'All Students')
for designation in DesigDataframes:
	summaryStats(DesigDataframes[designation], designation[:-4])
summaryStats(cancellationList, 'Students with Cancellations')
summaryStats(noShowList, 'Students with No Shows')

# Analysis of cancellations by designation
print('\nCANCELATIONS')
cancellations = oneTypeCounter('l', trajectories)
print(f'Total cancellations:\t {cancellations}')
for designation in DesigDataframes:
```

```
	cancellations = oneTypeCounter('l', DesigDataframes[designation])
	print(f'{designation[:-4]} cancellations:\t {cancellations}')
# Analysis of no_shows by designation
print('\nNO SHOWS')
no_shows = oneTypeCounter('k', trajectories)
print(f'Total no shows:\t {no_shows}')
for designation in DesigDataframes:
	no_shows = oneTypeCounter('k', DesigDataframes[designation])
	print(f'{designation[:-4]} no_shows:\t {no_shows}')

# Find the absolute and normalized distributions of designation types across
# cancellations, no shows, and all students
print(distributionFinder('l', 'Designation', trajectories))
print(distributionFinder('k', 'Designation', trajectories))
print(trajectories['Designation'].value_counts(normalize=False))
print(trajectories['Designation'].value_counts(normalize=True))

# Find how many students of each designation had their first cancellation
# or no show at different sequence steps
print(findFirstOccDists('l', 'Designation', cancellationList, False))
print(findFirstOccDists('k', 'Designation', noShowList, False))

# Calculate the number of sequence steps after each student's first cancellation,
called 'Contacts'
contactsAfterCancel = pd.DataFrame()
contactsAfterCancel['Sequence_Length'] = cancellationList['Sequence_Length']
contactsAfterCancel['First_Cancellation'] =
cancellationList['Sequence'].str.find('l') + 1
contactsAfterCancel['Contacts'] = contactsAfterCancel['Sequence_Length'] -
contactsAfterCancel['First_Cancellation']
print(contactsAfterCancel)
print(contactsAfterCancel['First_Cancellation'].value_counts().sort_index())
print(contactsAfterCancel['Contacts'].value_counts().sort_index())
# Calculate the mean and median remaining contact points after cancellations
tempMean = contactsAfterCancel['Contacts'].mean()
tempMedian = contactsAfterCancel['Contacts'].median()
print(f'Mean Contacts After = {tempMean}\nMedian Contacts After = {tempMedian}')

# Calculate the number of sequence steps after each student's first no show, called
'Contacts'
contactsAfterNoShow = pd.DataFrame()
contactsAfterNoShow['Sequence_Length'] = noShowList['Sequence_Length']
contactsAfterNoShow['First_NoShow'] = noShowList['Sequence'].str.find('k') + 1
contactsAfterNoShow['Contacts'] = contactsAfterNoShow['Sequence_Length'] -
contactsAfterNoShow['First_NoShow']
print(contactsAfterNoShow)
print(contactsAfterNoShow['First_NoShow'].value_counts().sort_index())
print(contactsAfterNoShow['Contacts'].value_counts().sort_index())
# Calculate the mean and median remaining contact points after no shows
tempMean = contactsAfterNoShow['Contacts'].mean()
tempMedian = contactsAfterNoShow['Contacts'].median()
print(f'Mean Contacts After = {tempMean}\nMedian Contacts After = {tempMedian}')

# Script for calculating the number of unique sequences, and the number of sequences
shared by a certain number of students
```

```
print(f'{trajectories["Sequence"].drop_duplicates().size} unique sequences')
print(f'{trajectories["Sequence"].value_counts().value_counts()}')
```

## Appendix E: DES Model Inputs

The following table lists the model parameters input into proposed intake process DES model (see **Figure 14** in Section 4.4.1). Parameters in the current state DES model (**Figure 13**) are identical aside from the exclusion of the "Filled out Calendly?" module.

| Module | Type | Parameters |
|---|---|---|
| Student Completes Form | Create | • Entity Type – Applicant<br>• Arrival Distribution – Random Exponential(0.8605)<br>• Units – Days<br>• Entities per Arrival – 1<br>• Max Arrivals – Infinite<br>• First Creation – 0.0 |
| Counselor Appointment Booked | Process | • Action – Delay<br>• Delay Distribution – Triangular(0.5, 1, 1.5)<br>• Units – Hours<br>• Type – Value Added |
| Admin. Coordinator | Process | • Action – Seize Delay Release<br>• Delay Distribution – Uniform(0.1, 0.5)<br>• Units – Hours<br>• Type – Value Added |
| Filled out Calendly? | Decide | • Type – 2-way by Chance<br>• Percent True – Variable. See **Table 3** |
| Appointment Occurs? | Decide | • Type – 2-way by Chance<br>• Percent True – 94.5 |
| Student Replies? | Decide | • Type – 2-way by Chance<br>• Percent True – 66 |
| Student Accepts Time? | Decide | • Type – 2-way by Chance<br>• Percent True – Variable. See **Table 3** |
| 3 Failed Responses? | Decide | • Type – 2-way by Condition<br>• Condition – If Failed Responses == 3 |
| Student Responding | Delay | • Delay Time – 5<br>• Units – Days |
| Failed Response Counter | Assign | • Type – Attribute<br>• Attribute -- Failed Responses = Failed Responses + 1 |
| First Appointment | Dispose | |
| Moved to Reengagement | Dispose | |

## Appendix F: Simulation Scenarios

This table lists the parameter inputs and statistical outputs of the twelve scenarios run in our DES model using Output Analyzer (see **Table** in Section 3.3.2 for the twelve scenarios and **Figure 14** in Section 4.4.1 for the DES model). "Name" describes the response rate and Calendly scenarios within each scenario. "Program File" is the DES model file, which is the same for all 12 scenarios as they were run on the same model. "Reps" is the number of replications each was run for, and "Num Reps" is a tally of how many have been run so far. "Acceptance Rate" is the percent of students that accept their appointment time and are routed to "True" in the "Student Accepts Time?" decision module. "Calendly Usage" is the percentage of students that use Calendly and are routed to "True" in the "Filled Out Calendly?" decision module. "ReEngagement Counter" and "Access Counter" are the average number of students that exited the system through the "Moved to Reengagement" and "First Appointment" dispose modules over 50 replications, respectively. "Applicant.NumberOut" is the sum of these two, signifying the total number of students that exit the system over 50 replications. Applicant.WaitTime" is the average time in days that students spend queuing at the "Admin. Coordinator" process module over 50 replications.

| | Scenario Properties | | | | Controls | | | Responses | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | S | Name | Program File | Reps | Acceptance Rate | Calendly Usage | Num Reps | Applicant.NumberOut | Applicant.WaitTime | ReEngagement Counter | Access Counter |
| 1 | | Pessimistic Response, No Calendly | 2 : Future State.p | 50 | 50.0000 | 0.0000 | 50 | 102.180 | 0.070 | 13 | 89 |
| 2 | | Likely Response, No Calendly | 2 : Future State.p | 50 | 66.6666 | 0.0000 | 50 | 100.960 | 0.043 | 8 | 93 |
| 3 | | Optimistic Response, No Calendly | 2 : Future State.p | 50 | 80.0000 | 0.0000 | 50 | 102.360 | 0.031 | 5 | 97 |
| 4 | | Pessimistic Response, Pessimistic Calendly | 2 : Future State.p | 50 | 50.0000 | 40.0000 | 50 | 99.760 | 0.023 | 8 | 92 |
| 5 | | Likely Response, Pessimistic Calendly | 2 : Future State.p | 50 | 66.6666 | 40.0000 | 50 | 104.220 | 0.015 | 5 | 99 |
| 6 | | Optimistic Response, Pessimistic Calendly | 2 : Future State.p | 50 | 80.0000 | 40.0000 | 50 | 102.960 | 0.012 | 4 | 99 |
| 7 | | Pessimistic Response, Likely Calendly | 2 : Future State.p | 50 | 50.0000 | 85.0000 | 50 | 103.020 | 0.003 | 2 | 101 |
| 8 | | Likely Response, Likely Calendly | 2 : Future State.p | 50 | 66.6666 | 85.0000 | 50 | 103.740 | 0.002 | 1 | 102 |
| 9 | | Optimistic Response, Likely Calendly | 2 : Future State.p | 50 | 80.0000 | 85.0000 | 50 | 104.200 | 0.000 | 1 | 103 |
| 10 | | Pessimistic Response, Optimistic Calendly | 2 : Future State.p | 50 | 50.0000 | 95.0000 | 50 | 104.120 | 0.000 | 1 | 103 |
| 11 | | Likely Response, Optimistic Calendly | 2 : Future State.p | 50 | 66.6666 | 95.0000 | 50 | 106.140 | 0.000 | 1 | 105 |
| 12 | | Optimistic Response, Optimistic Calendly | 2 : Future State.p | 50 | 80.0000 | 95.0000 | 50 | 104.220 | 0.000 | 1 | 104 |