This report provides a summary of the research projects designed to improve undergraduate students’ success at the University of Pittsburgh. The insights gained from these projects can further our institutional goal of more effectively personalizing the educational experience for Pitt students.

Report prepared by the Office of Special Projects

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Overview of Projects

This summary report represents a sample of projects that have been designed to help students thrive at the University of Pittsburgh. In line with the institutional goal of personalizing the education experience, the Office for Special Projects intends to continue to track the impact of these projects, and make recommendations on the continued investment in initiatives that support our students’ success.
Introduction

Value of Post-Secondary Education

More American students are enrolling in college than at any point in history. Between 1980 and 2012, the overall college enrollment rates increased from 26 percent to 41 percent (see Figure 1). More than ever before, students now see college as an option because, in part, more students are now eligible to consider college than ever before. The percentage of young women and men with at least a high school education increased from 79 to 84 percent for women and from 75 to 81 percent for men from 1980 to 2012. These higher population of high school graduates are now considering a path through college.

Figure 1.

A university education has never been more important for a good life. From an individual economic perspective, the development of a more knowledge-based economy means that the value of undergraduate and graduate degrees (measured in lifetime earnings) is increasing. In addition, life expectancy, happiness and other indicators of personal satisfaction correlate with having a college degree. Collectively, a more educated populace contributes to the cultural
and economic vitality of cities and regions. Socially, a liberal education provides a basis for understanding and appreciating differences between individuals across cultures and history. So by many measures the value of higher education is high and universities represent a good investment for individuals and societies.

Economic Value of Education

For many Americans, higher education has acted as a gatekeeper to the workforce and financial prosperity. Since 2010, 86% of incoming freshman have said that getting a better job represents a critical factor in their decision to enroll in college, compared with 73% of incoming freshmen between 2000 and 2009 who said the same (Gallup-Purdue Index Report 2016, n.d.). Over the long term, education provides the surest path to increasing economic opportunity (Economic Report of the President (2017), n.d.). A high-quality education is often more than just the first step in one’s career; it can be one of the most important investments young people can make in their futures. College graduates enjoy an earnings premium that is at a historical high, reflecting a trend over several decades of increasing demand for skilled workers (See Figure 2). In 2015, the median full-time, full-year worker over age 25 with a bachelor’s degree (but no higher degree) earned roughly 70 percent more than a worker with just a high school degree (CPS ASEC, CEA calculations). Moreover, people with a college degree are more likely to be employed—benefitting from both lower unemployment rates and higher rates of labor force participation.

Figure 2.

Unemployment rates tell a similar story. The unemployment rate for all workers in 2011 was 8.9 percent. According to the Bureau of Labor and Statistics unemployment rates in 2011 decreased with educational attainment:

- Less than high school diploma: 14.1 percent
- High school: 9.4 percent
- Some college: 8.7 percent
- Associate degree: 6.8 percent
- Bachelor’s degree or higher: 4.3 percent
Personal and Social Value of Education

While the primary argument in justifying education has been, and to a large extent continues to be, based on its direct personal and economic effects, a college education also provides other benefits, including a better way of taking care of ourselves, and consequently creating a better society to live in. Those with a college education are less likely to commit serious crimes, less likely to place high demands on the public health care system, and less likely to be enrolled in welfare assistance programs. And finally, a meaningful and engaging college experience is also one of the major predictors of well-being, including life-satisfaction and engagement with work (Gallup-Purdue Index Report 2016).

Though it is difficult to accurately measure, a good education provides substantial benefits to individuals and, as individual benefits are aggregated throughout a community, creates broad social and economic benefits. Investing in public education is thus far more cost-effective for society than paying for the social and economic consequences of under-funded, low quality schools. The link between education and social benefits has long been recognized, as far back as Ancient Greece when Aristotle and Plato pointed out that education is central to the well-being of society. More recently, in the past few decades, research has supported this conventional wisdom, revealing that education not only enables individuals to perform better in the labor market, but also helps to improve their overall health, promote active citizenship and contain violence.

More broadly, in today's knowledge-based world, the value of higher education has never been greater. The University of Pittsburgh is one of the top 10 research universities in the country and, as such, develops graduates with many benefits to society. Pitt's research-focused program activities attract top talent in high-growth fields, and provide an environment for preparing the next generation of professionals and entrepreneurs. Simply put, retaining and graduating qualified and talented individuals benefits the region and society from having an educated populace, a globally competitive workforce, and a vibrant research community.

Cost of Inaction for Pitt

But despite the high average personal and social returns to a college degree, Federal policy in higher education has had to confront several longer-term challenges. Research shows that college enrollments have not kept up with the rising demand for college-related skills in the workplace (Goldin & Katz, 2007). This suggests that, on the whole, Americans are investing too little in higher education. At the same time, some students who attend college do not reap the high returns, especially when they attend low-quality programs or fail to complete a degree. The challenges of investing in higher education are particularly acute for students from disadvantaged backgrounds, who are less likely both to enroll in college and to complete a high-quality program. And as a growing number of students borrow to finance their education, too many struggle to manage their debt.

Although a post-secondary degree is the surest path to a family living wage in the US, 70% of students who enroll in 2-year institutions and over 40% of those in 4-year institutions will not graduate—especially for first generation and/or historically underrepresented groups (U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Winter 2015–16, Graduation Rates component).

At the University of Pittsburgh, we are averaging significantly better than the national average, with a first-year retention rate of 92%, and a 6-year graduation rate between 80% and 84%. However, we struggle with the same challenges of
equality of educational attainment among students from at-risk populations. Specifically, first-gen and students of color seem to graduate at lower rates compared to other groups.

“At Pitt, the yearly cost of losing 1% of students in their freshman year amounts to nearly $1M per year. Taken over the 4 to 6 years, this equates to about 4 to 6 million in lost revenue.”

Even with retention and graduation rates that surpass national average benchmarks, the cost to the institution is tremendous. Based on the average tuition costs, fees, and room and board of $33,960 for in state students and $45,100 for out of state students, the cost of losing 8% of our students in their first year is approximately $12,247,900. At Pitt, the yearly cost of losing 1% of students in their freshman year amount to nearly $1 million dollars per year (see Appendix 1). Taken across multiple years, this equates to a lost revenue of about 4 to 6 million dollars for every 1% of freshman we lose. In addition to losing students in their first year, students continue to drop out throughout their academic journeys, further increasing the toll of attrition to the university.

<table>
<thead>
<tr>
<th>Description</th>
<th>Yearly Cost</th>
<th>Lost Income to Pitt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition and Fees - In state</td>
<td>$18,618.00</td>
<td>$4,168,808.51</td>
</tr>
<tr>
<td>Tuition and Fees - Out of state</td>
<td>$29,758.00</td>
<td>$3,064,097.94</td>
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<tr>
<td>Room and Board</td>
<td>$10,950.00</td>
<td>$3,579,336.00</td>
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<tr>
<td>Books and Supplies</td>
<td>$1,170.00</td>
<td>$382,449.60</td>
</tr>
<tr>
<td>Other Expenses</td>
<td>$3,222.00</td>
<td>$1,053,207.36</td>
</tr>
<tr>
<td>Cost of Attendance - In state</td>
<td>$33,960.00</td>
<td>$7,604,078.69</td>
</tr>
<tr>
<td>Cost of Attendance - Out of state</td>
<td>$45,100.00</td>
<td>$4,643,820.72</td>
</tr>
<tr>
<td><strong>Total Yearly Cost to University</strong></td>
<td><strong>$12,247,899.41</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Yearly Cost Per Percentage Lost</strong></td>
<td><strong>$979,831.95</strong></td>
<td></td>
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</tbody>
</table>

At leading research-intensive schools, such as the University of Pittsburgh, we are generally able to replace vacant positions with new and transfer students to are admitted later in order to fill up capacity. Thus, the above estimate may not necessarily be a true estimate of the final loss in revenue due to attrition. However, this estimate does not add in the costs of acquiring or replacing students, which typically runs in the range of $5,500. This administrative cost alone amounts to $1,782,000 per year—a cost that cannot be recuperated. 

The administrative cost of acquiring or replacing students costs Pitt an additional $1,782,000 per year—a cost that cannot be recuperated.
In looking at the institutional model of student success, we are struck by how rarely social science researchers collaborate with educators and administrators to develop and refine institutional practices—a goal that all parties agree to be important. Clearly, practitioners’ knowledge, gained over many years of experience, provides singular insight into how, when, and why some students struggle in their academic pursuits. Equally obvious is that social science research offers its own unique contribution through its understanding of the psychological and structural factors that either aid or impede students’ performance and learning. For example, research on identity threat has illuminated how powerful the impact of being stereotyped can be. It can restrict a person’s ability to use their cognitive and environmental resources to perform, learn, and grow. Identity threat helps explain the achievement gaps plaguing the education system (Steele, 2010; see also Cohen, Garcia, Apfel, & Master, 2006; Garcia & Cohen, 2011; Steele, Spencer, & Aronson, 2002; Walton, 2014; Yeager & Walton, 2011).

In spite of the fact that many research studies relevant to higher education are published every year, social scientists rarely conduct experimental research aimed at accomplishing change outside of a lab setting or other limited contexts. Moving beyond such confines provides social science researchers the opportunity to increase their ability to initiate and influence change in educational policy and practice. This opportunity arises out of the chance to observe student behavior where it occurs naturally, and allows for the collaboration with educators, administrators, and practitioners needed to conduct research in a more open and fluid way. Each of these collaborative projects deepens our knowledge and understanding of the school, the classroom, and the points in these systems where targeted intervention could yield large benefits. Moreover, such collaborative field experiments allow us to maximize the impact of social science research by using it in a way that is shared with the people who have direct influence over educational policy and practice.

The list of intervention projects listed in this report provides an illustration of how social science researchers and university administrators can enter into a unique collaboration designed to close the gap between research and practice. As part of their independent lines of work, researchers, faculty, and administrators at Pitt have, over the past several years, developed practices for projects to improve student thriving and academic performance by using rigorous and innovative research methodologies. And recently, many of these interventions have been paired with the expertise of administrators and practitioners throughout the University for greater ecological validity and greater impact on students at Pitt. A future direction for these initiatives would include the goal of integrating key research findings into the ongoing policies and practices of the university. Such collaborations seek to optimize the process of helping students thrive. By doing so, they also aim to close academic achievement gaps, insofar as they exist, between first-generation college undergraduates and other underrepresented students on the one hand and their more advantaged classmates on the other.

By bringing scientists and practitioners together to improve the practices of an entire institution, this type of collaboration can serve as a model for researcher-practitioner-administrator partnerships to bring about improvement in higher education.

The Researcher-Practitioner Partnership Model

These interventions reflect the general approach of researcher-practitioner-administrator collaboration that is at the heart of the Office for Special Projects’ approach for improving student success. This approach involves first identifying situations where an intervention could prove beneficial and be introduced. The next step is introducing the intervention
and empirically testing its effects, an approach not typically taken with new initiatives. If the intervention proves effective, it then begins the process of full adoption as institutional practice and integration into the new status quo. This phase also calls for a continual refinement of the practice and iterative testing of these refinements. Once fully integrated as a best practice into the institution, all those that benefit from the intervention would engage in it. Obviously, because of the dynamic nature of institutional systems and the equally fluid psychological demands placed on individuals in such systems, what counts as a best practice today may not remain so forever. Thus, what we aim to develop and ultimately scale to other academic institutions is not a specific product. It is also a process of action-based scientific collaboration.

The mission of the Office for Special Projects is to use the complementary strengths of researchers, educators, and administrators at Pitt to integrate science and practice. In partnership with institutional practitioners and the support of the Provost’s Office, we are beginning to invest more heavily in intervention projects that seek to integrate research-based practices into the lives of college students. By developing productive working relationships with Pitt administrators and applying rigorous research methods, we have designed and tested several practices at Pitt aimed at improving student thriving and performance. Obviously, because of the dynamic nature of institutional systems and the equally fluid psychological demands placed on individuals in such systems, what counts as a best practice today may not remain so forever. Thus, what we aim to develop and ultimately scale to other academic institutions is not a specific product. It is also a process of action-based scientific collaboration.

If successful, this project will provide a model for how social science can be used to improve the functioning of an entire institution. This model has two key features. First, it provides an approach for testing and integrating science-based interventions into an institution to better the lives of an entire student body. A scientifically informed model of the scale-up process is clearly needed, and should be addressed with consideration. Previously, interventions were tested one at a time, limiting social science’s ability to have a broader impact. Second, our project provides a model for collaborations with practitioners that can facilitate and enrich the application of social science in an institutional setting. Rather than “top-down” processes, with scientists determining the time, place, and content of a practice, our model is collaborative (Lewin, 1997/1948). It leverages the wisdom of both researchers and practitioners, bridging the researcher-practitioner gap. It is nothing less than a contemporary model of rigorous and socially relevant action-based research.

Next Steps

In the coming year, we are committed to continuing to invest in such intervention collaborations to improve our students’ outcomes through ongoing research design, implementation, and refinement of the interventions. Our long-term vision is to turn our researcher-practitioner-administrator partnership into an official institutional initiative. The initiative’s mandates would be to evaluate and integrate practices based in social science research, and to use the insights of scientific research to enhance existing institutional initiatives such as student advising and support services. Achieving these goals, in our estimation, will require an additional 4 years.

During this time, we will work to establish a new institutional standard by fully integrating our approach into standard institutional practices and develop a unique Pitt model of rigorous and collaborative research. It is a model that exists nowhere else to the same extent. This model could be disseminated to other beneficiaries, including colleges, secondary, and elementary schools, with the potential to transform education for the better. Our approach could have this impact because it provides a formal and effective process for bridging the gap between science and practice and, as such, it would serve as a model for instituting pragmatic, scientifically informed positive change.
Intervention to Reduce Belonging Uncertainty

Experience with discrimination and knowledge of social stereotypes can lead first-generation college students and students from negatively stereotyped ethnic groups to feel that they may not belong in college (Steele, 2010; see also Aronson, 2002; Stephens, Fryberg, Markus, Johnson, & Covarrubias, 2012; Walton & Cohen, 2007). The specter of being stereotyped or devalued based on one’s group can create chronic stress (i.e., stereotype or identity threat; Steele, 2010). This can impede performance, discourage students from asking for help from professors or TAs, attending office hours, and taking social risks, such as those required to make new friends. These behaviors can deprive students of key social and academic supports needed to succeed in college (Coleman, 1988).

Fortunately, past intervention research has demonstrated that these negative psychological barriers can be minimized by addressing students’ nearly universal uncertainty about whether they belong when they first transition into college (Walton & Cohen, 2007, 2011). In this line of research, students were given what could be called a “psychological roadmap” for the transition to college. Incoming students were exposed to the stories of sophomore, junior, and senior year classmates who describe the challenges common to the transition to college they had experienced and how they had overcome them. This helps new students to anticipate the challenges that face them, to see that such challenges are not unique to them, and to view credible evidence that the challenges can be met.

Initial trials of this belonging uncertainty intervention have found beneficial effects that raised the first-year grades of African American, Latino, and Native American students as well as European-American students who were the first in their family to attend college (first-generation students). This improvement corresponded to between a 35% to 50% reduction of the raw achievement gap between them and their more advantaged peers, as measured by GPA. Moreover, the minority and first-generation students participating in the intervention reported using student support services more, forming more close friendships, developing more mentor relationships, and being more involved in student groups than those in the control condition.

As a consequence of its initial success in 2013, the College Transition Collaborative—a group of researchers based in Stanford—have been working with post-secondary institutions to scale and replicate the findings of these initial trials. The University of Pittsburgh is among the 23 schools that are collaborating on this trial. Should the effect prove promising, the belonging intervention materials will be made available to the University of Pittsburgh to use in perpetuity at its discretion.
### Belonging Uncertainty Intervention

**Pitt Class of 2016 and 2017**

<table>
<thead>
<tr>
<th>Partner</th>
<th>The Learning Research and Development Center (LRDC) and the Psychology Department in the Dietrich School of Arts and Sciences</th>
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<tbody>
<tr>
<td>Timeframe</td>
<td>Summer 2016 &amp; Summer 2017</td>
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This intervention was intended to help students more effectively deal with the possibility of experiencing threats to their sense of belonging during the transition to college. The intervention was included in the pre-matriculation materials that freshmen complete the summer before their first year at Pitt, embedded in the orientation materials they receive. The materials conveyed to students that early struggles in college are common, rather than indicative of a lack of belonging or potential (based on Walton & Cohen, 2007 and Walton & Cohen, 2011) using brief online exercises and testimonials from sophomore, junior, and senior year students. Students were randomly assigned to one of three different conditions: (1) a standard version of the intervention materials that have been shown to be effective at other schools; (2) a customized set of intervention materials, informed by analyses of historical data and survey data collected from current students; and (3) a control condition in which they read about the challenges of adjusting to the new physical environment when starting college.

### Purpose & Procedure

Students completed a battery of non-cognitive measures to assess the impact of the intervention. Post-intervention results show that students who were exposed to either of the belonging treatment conditions reported (1) anticipated growth in belonging (e.g., “How much do you feel you will belong at Pitt?”) once they began their college experience; (2) more realistic expectations and greater confidence about the challenges of transitioning to college (e.g., “How confident are you that you will be able to handle any difficulties you face in the transition to Pitt?”); and (3) reported learning more from the intervention materials.

Past research has shown that negatively-stereotyped minority students and first-generation college students benefited from the standard version of the belonging intervention materials. Early trials have shown a reduction in achievement gaps by as much as 50% in student; GPA. Grades data is currently being collected for the intervention delivered to freshman at Pitt, so we will be able to examine the relative impact on students’ performance here as well.

<table>
<thead>
<tr>
<th>Research Team</th>
<th>College Transition Collaborative at Stanford; Omid Fotuhi (LRDC); Kevin Binning (Psychology); Susie Chen (Psychology); Charles Perfetti (LRDC)</th>
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In the first year of the intervention, over 37.4% of the first-year students at Pitt ($N=1,335$) opened the intervention link, and a total of 30.1% completed both the intervention and follow-up survey.
In-Class Belonging Intervention in Introductory Biology Recitation

When delivered before students begin the transition into college, the belonging intervention mentioned above holds promise to assuage students concerns about belonging in the college context. The results found the belonging intervention boosted college outcomes among students who tend to be most at risk of poor college outcomes, namely, underrepresented minorities and first generation college students. However, research suggests that belonging concerns are common among all college students, regardless of their background. The finding that the intervention had no impact on White, continuing generation students (majority students) raises an important possibility. Namely, perhaps the intervention was not effective among these students because they derive feelings of belonging from the campus context itself. If so, then an intervention that is designed to leverage the social context may yield stronger benefits for more students. Kevin Binning (Department of Psychology and LRDC) and his have tested an embedded social belonging intervention in Introductory Biology that uses small groups and social interaction with classmates to instantiate the intervention. Findings to date suggest the intervention significantly improved classroom engagement (i.e., attendance and homework completion), course grades, and college retention among all students who received the intervention, including but not limited to students from at-risk backgrounds.

<table>
<thead>
<tr>
<th>In-Class Belonging Intervention in Bio Recitation Classes</th>
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<tr>
<td>Partner</td>
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<tr>
<td>Timeframe</td>
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<tr>
<td>Purpose &amp; Procedure</td>
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<tr>
<td>Sample</td>
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<tr>
<td>Results</td>
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<tr>
<td>Research Team</td>
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</table>
Improving Planning through Text-Based Behavioral Nudges

Despite the abundance of research in behavioral economics and marketing demonstrating that minor modifications in how information is framed can dramatically impact people’s decisions and behavior, there is a limited understanding of the temporal dynamics of such “nudges.” How do their effects unfold? Is the impact immediate, stable, and invariant? Should interventions be strategically timed in accordance with specific temporal reference points?

**Postponing Planning (Nudges)**

<table>
<thead>
<tr>
<th>Partner</th>
<th>External Project</th>
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<tbody>
<tr>
<td>Timeframe</td>
<td>After FAFSA early application (October 2016)</td>
</tr>
<tr>
<td>Purpose &amp; Procedure</td>
<td>Researchers conducted a randomized control trial field study, modifying a set of university financial aid email communications sent to prospective students days before and again days after the FAFSA early-application date (October 1, 2016). Whereas some students received basic informational email messages, others received messages encouraging students to plan ahead to complete their FAFSA.</td>
</tr>
<tr>
<td>Sample</td>
<td>Prospective college students (N=1,247)</td>
</tr>
<tr>
<td>Results</td>
<td>In comparing the effectiveness of these two message framings, the researchers found that the planning messages boosted students’ behavioral engagement (i.e., email opens) after, but not prior to, the early-application date. Thus, despite encouraging preparatory behavior in advance of a perceived “optimal” action date, planning-framed nudges demonstrated no added behavioral efficacy until after the optimal date had passed. This pattern of results was replicated in a subsequent online field study with 681 participants, again finding that people were more likely to engage in (future) enrollment behavior when exposed to planning-framed messages (relative to messages without the planning intervention), but only after the most personally advantageous enrollment period had passed. Taken together, both studies suggest that planning interventions may alter how individuals psychologically represent a salient temporal marker – in ways that delay its benefit. Additional experimental research is planned to investigate the specific mechanism driving these results.</td>
</tr>
<tr>
<td>Research Team</td>
<td>Jillian Hmurovic (Ph.D. candidate in Marketing), Lindsay C. Page (Assistant Professor of Research Methodology), and Cait Lamberton (Associate Professor of Marketing)</td>
</tr>
</tbody>
</table>
Many students entering college do not persist in their first declared major through graduation. According to data used for the current study, 46% of all first-time, full-time students entering four-year institutions in 2003 switched majors at least once by 2009.

Alternate pathways to a bachelor’s degree may be needed for students who dislike their current major or who cannot successfully complete the requirements of their current major, and changing majors is a common option. Yet students seeking to change majors may be concerned about potential delays in graduation and expenses that could be incurred if additional time is needed to complete the degree requirements in the new major. In addition, administrators and academic advisors may be under the impression that high change of major rates could decrease timely graduation rates, increase time to graduation and decrease retention rates, thereby discouraging some students from leaving their current major. It has been suggested that decreasing the number of students who change major may improve university graduation rates (Allen & Robbins, 2008), but no substantial evidence has been provided to support this claim.

At Pitt, undergraduate science classes are largely filled with students with other career goals, most notably medicine and other health careers. Initial goals are rarely held for long, with large attrition coming from poor performance and other interests developing. Problems occur when there are demographic biases in attrition and when students over-persist in career goals that are not realistic given past performance.

From the students’ perspective, it is unclear what factors influence them to either stay in a given major, switch to a different major, or simply to drop out because of the difficulty of incongruence of interests found in their initial chosen major. The following project attempted to interview students in science courses who also report having an interest in a health major. The goal was to assess what factors influence their decision to stay in their chosen major, or to switch. The preliminary results from students’ surveys may serve to guide advising practices to students who are identified at risk of changing majors.

### STEM+M Career Pathways

<table>
<thead>
<tr>
<th>Partner</th>
<th>Provost’s office, undergraduate advising offices</th>
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</thead>
<tbody>
<tr>
<td>Timeframe</td>
<td>2018 - 2019</td>
</tr>
<tr>
<td>Purpose &amp; Procedure</td>
<td>Career information targeted guide career change and course selection</td>
</tr>
<tr>
<td>Sample</td>
<td>First and second year students in large chemistry lecture courses</td>
</tr>
<tr>
<td>Results</td>
<td>Pilot data suggests that students vary on what information is most needed based on whether health careers are driven by intrinsic factors (interest, social value) or extrinsic factors (prestige, pay, family).</td>
</tr>
</tbody>
</table>

Research Team

Christian Schunn (LRDC); Susie Chen (Psychology); Eben Whiterspoon; Rafael Qintana
Data-Informed Foundational Course Selection

Course sequencing is sometimes a difficult task when designing college science majors. Students vary widely in which foundational courses they select and when they enroll in these courses in their undergraduate degree, both for general education requirements and core major requirements. Some of these courses should be taken earlier on to improve later outcomes, but little data guides current recommendations given to students. In some circumstances the proper sequencing of courses may be clear-cut, for example, it is necessary to take Organic Chemistry I before Organic Chemistry II. However, often there are courses (e.g., related to independent research and analytic skills) that do not strictly need to be taken prior to other content courses, but nevertheless could confer a learning benefit if taken earlier in a student’s career. Further, competing theoretical arguments could be made for placing different courses first in the sequence (e.g., skills development first vs. interest development first). In the current research, we take an empirical approach to uncover whether the sequencing of different foundational courses within the psychology major is associated with performance in subsequent psychology courses.

<table>
<thead>
<tr>
<th>Data-Informed Foundational Course Selection</th>
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<tbody>
<tr>
<td>Partner</td>
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<tr>
<td>Research Team</td>
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First-Year Experiences in Research

There are numerous benefits for undergraduate students who get involved in research. Research experience allows undergraduate students to better understand published works, learn to balance collaborative and individual work, determine an area of interest, and jump start their careers as researchers. Through exposure to research as undergraduates, many students discover their passion for research and continue on to graduate studies and faculty positions.

Pitt has invested in the First Experiences in Research (FER) program for years, but has little data on its impacts, especially on who benefits. We believe that these programs are vital for our students’ achievement, yet the research documenting positive outcomes of first-year seminars is still in its inaugural stage.

The following project attempts to quantify the impact of participating in FER experiences at Pitt.

| First-Year Experiences in Research (FER) |
|-------------------------------|----------------------------------|
| Partner                       | Prior and current directors of the FER program |
| Timeframe                     | Past 10 years                     |
| Purpose & Procedure           | We examined institutional data to statically examine impacts on various outcomes, controlling for demographic and academic preparation, as well as disaggregating effects by demographic subgroups. |
| Sample                        | ~14,000 students who first year undergraduates on main campus and enrolled in introductory science courses during the 2009-2014 time frame. |
| Results                       | Participation in FER has a large effect on 2nd year retention, especially for students with lower academic preparation. They also are more likely to do well in difficult courses like Organic Chemistry, are more likely to persist through the pre-med pathway, and are more likely to be accepted to medical school. |
| Research Team                 | Ben Rottman; (LRDC); Tim Nokes (LRDC); Chris Schunn (LRDC) |
Climate Assessment of Non-Cognitive Competencies

Overview

There is a scientific consensus in the behavioral sciences that success in school and beyond depends critically on many attributes other than cognitive ability. Thus, interest in measurement of such non-cognitive skills or personal qualities has surfaced in the literature recently. A growing body of evidence confirms that student skills not directly captured by tests of academic achievement and ability predict a broad range of academic and life outcomes, even when taking into account differences in cognitive skills (Almlund, Duckworth, Heckman, & Kautz, 2011; Angela Lee Duckworth, Tsukayama, & May, 2010). Both intra-personal skills (such as the ability to regulate one’s behavior and persevere toward goals) and inter-personal skills (such as the ability to collaborate with others) are key complements to academic achievement in determining students’ success. This evidence, in combination with a new federal requirement that state accountability systems include an additional indicator of school quality or student success not based on test scores, has sparked widespread interest in the possibility of incorporating such “non-cognitive” or “social-emotional” skills into school accountability systems.

In addition, greater insight into benchmark levels of such non-cognitive skills can provide the fodder to help inform the necessary investment in interventions to help foster and cultivate those domains where students may be struggling. For instance, baseline measures of lay theories of intelligence (mindset) for Pitt students (Dweck, 2006), compared to students from other institutions, can help inform whether incorporating a growth mindset intervention will benefit students at Pitt. Like most psychological interventions, the greatest effects tend to appear among those who are vulnerable in specific domains. Thus, identifying those areas of need is a critical first-step in the design of effective interventions.

Finally, in line with the University of Pittsburgh’s mission of personalizing the educational experience, having access to information about students’ baseline (and predictive) levels of non-cognitive skills or personal qualities1 can facilitate institutional decisions about which programs to invest in, as well as providing an ongoing measure of effectiveness. In addition to the standard measures of academic performance (e.g., GPA), assessing the impact of programs on students’ non-cognitive skills will shed light into the latent markers of success and well-being. For example, Pitt participates in the nation-wide research project that has consistently shown that one of the greatest predictors of later life outcomes is the level of social and academic engagement that students experience while in school (Gallup-Purdue Index Report, 2016) – an outcome that is not as visible by relying on grades alone.

1 There is little consensus on the best terms to use to describe the predictive skills and qualities that are not based on academic measures. For a review, see Duckworth & Yeager, 2015.
Attempts to identify the core set of non-cognitive skills reveals a very broad range of characteristics including motivation, confidence, tenacity, trustworthiness, perseverance, and social and communication skills. Each of these factors has a long and distinct history of theoretical and methodological approaches, and different instruments exist to assess them. Importantly, a review of such domains typically attempt to differentiate relatively stable characteristics, such as personality traits, and more flexible and modifiable characteristics, such as self-perceptions, motivation, and social competencies. While personality traits are important in shaping individual choices and attainments, they are considered to be less malleable than other more flexible characteristics. Thus, greater emphasis is placed on key competencies that can be modified, are more flexible, and malleable characteristics which have been linked to positive outcomes among students (American Institutes for Research, 2017; Duckworth & Yeager, 2015; Gaertner & McClarty, 2015; Lazowski, Barron, Kosovich, & Hulleman, 2016). The below set of commonly identified competencies have been shown to be both predictive of later positive outcomes, and to hold potential for improvement through intervention.

- **Behaviors related to conscientiousness**—behaviors related to self-control, hard work, persistence, effective study habits, and achievement orientation
- **Sense of belonging**—a student’s sense that he or she belongs at a college, fits in well, and is socially integrated
- **Academic self-efficacy**—a student’s belief that he or she can succeed in academic tasks
- **Growth mindset**—a student’s belief that his or her own intelligence is not a fixed entity, but a malleable quality that can grow and improve
- **Utility goals and values**—personal goals and values that a student perceives to be directly linked to the achievement of a future, desired end
- **Intrinsic goals and interest**—personal goals that a student experiences as rewarding in and of themselves, linked to strong interest
- **Prosocial goals and values**—the desire to promote the well-being or development of other people or of domains that transcend the self
- **Positive future self**—a positive image or personal narrative constructed by a student to represent what kind of person he or she will be in the future

Notably, evidence shows that low-cost interventions aimed at developing sense of belonging, growth mindset, and utility goals and values have sometimes generated the largest benefits for underrepresented student groups that are most at risk for academic failure. Although encouraging, this evidence is limited and recent, and further research is needed to replicate and extend it.

**Pitt’s Strategy**

At Pitt, we already have much of the resources and strategies in place to capture baseline measures of students’ non-cognitive skills. Two broad sources include (1) data from the collection of student surveys that Pitt routinely delivers to students throughout their academic experience at Pitt, and (2) the baseline set of non-cognitive measures included within the College Transition Collaborative (CTC) intervention survey.
1. Pitt is already investing significantly in ongoing data collection of student information through annual student surveys (see below for an approximate timeline of student surveys at Pitt). First-time, full-time, freshman students living on campus can expect to complete an average of 15 surveys per year, throughout their academic journey. By carefully standardizing, organizing, and analyzing the data from myriad surveys, we can contribute significantly to uncovering the baseline of, and tracking the change in, core non-cognitive skills that predict students’ success at Pitt.

2. The second source of data comes from the baseline survey of the CTC survey—delivered in the month before students start their freshman year, and beginning from the fall of 2016—and the follow-up survey delivered in the following spring term in students’ freshman year. The CTC survey was designed to include many of the core non-cognitive competencies list above.

In addition, and importantly, the CTC project is structured in a way that allows us to conveniently complement or substitute the intervention content without any interruption on the ongoing assessment component. Specifically, the CTC content is delivered through an online platform (Qualtrics), delivered to students before they start their freshman experience, allow randomization at the student level, and linked to students’ unique student IDs—four key elements necessary to implement and evaluate any intervention effectively. Once we know more about which core non-cognitive domains student at Pitt are struggling with most, we leverage these existing structures afforded to us by the CTC framework to experiment with different intervention content and assess—in a timely fashion—their impact on students.

By building on and customizing the measurement tools afforded to us through these two data-sources, we can get a more comprehensive benchmark of students’ levels of non-cognitive skills, and determine their relative predictive value for students at Pitt. These tools can also provide us with insights about the impact of new and existing intervention projects. Finally, by taking advantage of the CTC project model, we can incorporate and evaluate new intervention projects in a timely fashion.
Academic Probation Intervention

For a wide range of reasons, students from time to time struggle academically. In the hopes of motivating these students to seek out the support they need, post-secondary institutions will sometimes send a letter informing students of their academic probation standing. From the student's perspective, receiving such a letter is a scenario which puts their sense of belonging into question like few others. Feelings of shame and doubt—among the most harmful emotions for motivation—can ensue (Graham, Taylor, & Ho, 1992, cited in Rubin, Bukowski, & Laursen, 2011). Such feelings may lead students to isolate themselves rather than seek help, the opposite of what the letter was intended to do. In response to this, we partnered with a selective liberal arts school on the West Coast to address their concern that students were not availing themselves of the resources needed to help put academic probation behind them. Together we designed an intervention that minimized the threat to students’ sense of belonging when notified of their probationary status.

This project, called the Academic Probation intervention, was borne out of the advising office's concern that too few students entering the academic probation process left it in a timely manner. After reviewing the materials sent to students placed on probation and interviewing students who had gone through the process, it became clear that probation engendered feelings of guilt and shame. In response to this, in collaboration with the administration at our partner institution, we designed an alternative version of the letter that alerts students that they are being placed on probation. In this new letter, academic probation was presented as part of the ongoing process of acquiring academic competence and not as an assessment of the individual's academic capability. This was done by characterizing it as the "academic standing process", and including actual statements from students previously on probation discussing how the process went. In a randomized trial, students who received the revised letter were less likely to report negative emotions like shame or guilt, were more hopeful, and importantly, were more likely to meet with their academic advisors after going on probation, compared to those receiving the standard letter. Preliminary results for this intervention are shown below.

<table>
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<tr>
<th>Partner</th>
<th>The Office of the Provost – Special Projects</th>
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<tbody>
<tr>
<td>Timeframe</td>
<td>Beginning in the Winter of 2014, and continuing until the Spring of 2015.</td>
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A preliminary survey was sent to students who had previously been on probation about their reactions when they first received the letter.

In addition, in order to circumvent student disengagement, we designed a letter emphasizing that the university recognizes that many students struggle from time to time. It also stated that each undergraduate is a valued member of the school and has the potential to succeed. The school's primary goal is to work with students to help them return to normal academic status. They also read stories from other students who had gone through the probation process, stories we collected through interviews and surveys. These stories discussed the strategies students had used to get out of probation.

Working in close partnership with the advising office at our partner institution, we randomly assigned students on academic probation to either the standard letter that has been used in the
past, or the revised version of the letter that was intended to lessen the tendency to feel shame or guilt. Two weeks after they received either the standard probation letter or the revised letter, we surveyed the students and collected information from their advisor.

<table>
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<th>Sample</th>
<th>62 students who went into academic probation during the Spring of 2014</th>
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Students in the initial survey reported feeling stigmatized, judged, and ashamed when they received the probation letter. Consequently, they reported not wanting to engage with academic resources because of the shame they felt.

After we revised the probation letter, those receiving the revised letter reported significantly less negative emotion and were more hopeful. In addition, the composite score of negative emotions was significantly different between conditions. Additionally, based on official records submitted by their advisors, receiving the revised letter also increased the likelihood of students’ contacting their academic advisor and seeing him or her in person. Importantly, one year after receiving the revised letter, students were less likely to have accelerated to a more severe status (e.g., suspension), and were nearly twice as likely to have successfully moved out of probationary status and back into normal status.

With the support of the University of Pittsburgh’s Office for Special Projects, we propose to replicate this intervention here at Pitt by revising the letter that students who fall on probation receive.

Furthermore, this model of program evaluation and refinement can be applied to other institutional messaging—when students are most likely to be susceptible to psychological vulnerability or are at a decision point—in order to optimize the impact of the intended messaging efforts. For example, this model of message improvement can be tailored to recruitment and admissions letters, as well as routine correspondence between faculty, the administration, and students. Another example of such a messaging improvement is provided below.
Reappraisal of Test Anxiety

Regardless of the merits of testing, students’ desire to perform well can cause them to “stress out” and experience negative emotions when faced with an important exam (Beilock & Ramirez, 2011). These emotions, often collectively labeled as test anxiety, can impair performance by causing people to “choke” under pressure, thereby hindering performance (Hill & Wigfield, 1984). This intervention, led by researchers at Stanford University, aimed to interrupt these effects by reframing anxiety as an asset rather than a liability and was based on an intervention previously tested with a smaller sample in earlier research by Jamieson et al. (2010).

Reappraisal of Test Anxiety
Fall 2013

Partner
Psych 1 Course Instructor and TAs

Timeframe
Fall 2013

This study examined whether a message encouraging students to see how anxiety can help them perform well on a test, rather than hinder their performance, could be embedded in the everyday activities of a college course and improve students’ academic performance.

Purpose & Procedure

This study was embedded in Psych 1 classes. Students received an email the night before their first exam. One version of the email featured general encouragement and exam reminders, similar to the email that had been sent to students for the past several years. It was received by half of the students. The other half of students received the same email but with an additional paragraph designed to lead them to interpret any anxiety about the exam as neutral or even beneficial. Students were randomly assigned to receive one of the two messages.

Sample

439 students: Approximately half were first-year students (55%) and half were upper-year students (25% sophomores, 11% juniors, and 9% seniors).

Results

In this intervention, a brief reappraisal message enhanced academic performance among first-year students. First-year students receiving the intervention did better on the test the day after the reappraisal message. They also earned a higher grade in the course overall than first year students receiving only the standard email. The reappraisal message did not affect the performance of the more experienced upper-year students.
Moderating Stress and Self-Control Through Mindfulness and Effective Habits

Beyond financial difficulties, emotional and social stress is the most common reason students give for early withdrawal from the University of Pittsburgh. Learning to effectively manage stress during this major life transition may be a key process in helping students succeed in college. Yet, post-secondary institutions provide little support that trains students to effectively navigate the social and academic stress they encounter throughout their college experience.

Dr. Brian Galla, working in the School of Education and the LRDC, partnering with leading motivational and educational psychologists across the nation, have identified a series of interventions that help to foster greater studying strategies, cultivate greater resilience and grit, and help students reduce their stress. As part of this work, these researchers have found increasing awareness for, and adoption of mindfulness meditation strategies among young adults to cope with stress in school. Mindfulness is defined as a nonjudgmental awareness of present moment experience. Numerous studies with adults show mindfulness training is effective in reducing both emotional and social stress, including loneliness. Yet, few mindfulness training programs have been adapted for use with college-age freshman. Dr. Galla intends to provide students with an established training program, offered through a national non-profit organization (www.ibme.info), to specifically to meet the psychological and social needs of middle adolescents (14-18) and emerging adults (19-23). And unlike most mindfulness training programs that span months, the current training program is relatively short (usually five days long). In two different studies, this standardized program has been shown to be effective at boosting mental resilience (e.g., mindfulness skills, self-regulation), and reducing maladaptive coping strategies, stress, and symptoms of depression, in adolescents aged 14 to 19 (Galla, Baelen, Duckworth, & Baime, 2016; Galla & Duckworth, 2015).

In addition, past work by Dr. Galla and Angela Duckworth has targeted factors that promote greater self-control—a leading predictor of student success and many other important life outcomes. Conventional wisdom holds that self-control is used to effortfully inhibit maladaptive impulses, yet this view conflicts with emerging evidence that self-control is associated with less inhibition in daily life. In a series of papers, Galla and Duckworth provide evidence for more effective self-regulation strategies that target the psychological load and stress usually surrounding self-control behavior. For instance, they have shown that students exert less effortful inhibition and make greater progress toward their goals when they rely on beneficial habits. Their extensive expertise on this topic has allowed them to design proven training programs to reduce effortful inhibition and stress through the adoption of more effective habits (Galla & Duckworth, 2015).

By incorporating training during students’ first-year experience, students can elect to learn about effective mindfulness and study habits, which promises to help reduce how they respond to stress and employ effective studying strategies and habits.
Using Artificially Intelligent Virtual Assistant to Help the Transition to College

Every spring, approximately 2.5 million US high school seniors are admitted to college. By September, approximately fourteen percent of those -- 350,000 students -- who “intend to enroll” will fail to matriculate (Castleman & Page, 2014). Of the students who enroll, forty-eight percent will not earn a degree within six years (Kena et al., 2015). Students who “melt” over the summer or fail to complete after having enrolled disproportionately come from underserved communities. These communities frequently lack the supportive resources to help students navigate challenging financial, academic, and social situations. The societal impact of leakage from the college-going pipeline is substantial. For example, the high rates of college dropout costs the United States an estimated $4.5 billion in lost earnings and taxes annually.

In this project (“How an Artificially Intelligent Virtual Assistant Helps Students Navigate the Road to College”), Lindsay C. Page (Assistant Professor of Research Methodology) and Hunter Gehlbach (Associate Professor of Education, UC Santa Barbara) test the impact of conversational artificial intelligence (AI) to efficiently support thousands of would-be college freshmen in the transition to college by providing personalized, text-message based outreach and guidance for each task where they needed support. This effort builds off of Page’s prior work to better support students in the summer transition from high school to college (Castleman & Page, 2016).

Dr. Page and her team implemented this AI-enabled system in summer 2016 in the context of a field experiment with Georgia State University (GSU). Among GSU-committed students (N = 975), those assigned to the treatment condition exhibited greater success with pre-enrollment requirements and were 3.3 percentage points more likely to enroll. These impacts parallel prior interventions but with far less burden on university staff. Given the capacity for AI to learn over time, this intervention has promise for providing personalized college transition guidance at scale.

Although the University of Pittsburgh main campus does not struggle particularly with summer melt, it would be possible to use an AI-enabled communication system such as this in the university’s effort to improve and personalize the learning experiences of its undergraduates. Further efforts directly focused on summer melt and issues of student retention may be relevant for the University of Pittsburgh branch campuses.
Next Steps

These researcher-practitioner initiatives listed in this report are the first efforts to programmatically scale up scientifically informed interventions across an entire institution to improve student achievement in a cost-effective and minimally intrusive way. Transforming these interventions into institutional practices that improve student thriving and reduce the racial and socioeconomic achievement gaps through our continued partnership would be an accomplishment achieved by no other integrated institution of higher education. Two aims are at the center of our continued collaboration with Pitt. First, we will continue to encourage and support administrators and researchers to effectively work together to meet the shared goal of enhancing student outcomes by developing and refining a sustainable set of best practices that are woven into the fabric of the university. Second, we will evaluate the impact of key interventions on student outcomes across a variety of school contexts using multiple intervention delivery methods and touch points between the institution and students.

Long Term Goal: 5-Year Vision

Over the long term, our plan would be to strengthen the pioneering researcher-practitioner partnership at Pitt. The goal is to facilitate researcher-practitioner partnerships to (1) identify social science research of interest; (2) developing and empirically testing interventions based on it; and finally, (3) if proven effective, integrating the intervention as a best practice into the functioning of the institution. Effective in this respect means positively affecting the lives of students, staff, and faculty at Pitt, and doing so in ways that complement existing institutional initiatives. This process would also produce deliverables, such as reports and synthesized analyses, in a cost-effective, transparent, and responsive manner. Such an initiative would serve as a model for other institutions of higher education seeking to improve their students’ thriving and foster equality of opportunity on their campus through an action-research partnership among scientists, educators, and administrators.

This project would place the University of Pittsburgh at the forefront of the field of education by introducing a unique, innovative, and systematic model for integrating impactful and cutting-edge research into the daily practices of institutions of learning. The significance of such a model has already been felt in the lives of students at Pitt. Education needs a rigorous model for bridging theory and practice. What is innovative about the ongoing and proposed projects is not any particular product, but a process: a dynamic partnership between researchers, practitioners, and administrators aimed at improving student thriving. We believe that our efforts at Pitt could serve as a model for programmatic institutional change.

To reach us, please contact Omid Fotuhi at omidf@pitt.edu with any questions you may have.


