PERSISTENCE +PLUS

Nudging to STEM Success

Implementation Report

JFF

Building a Future That Works

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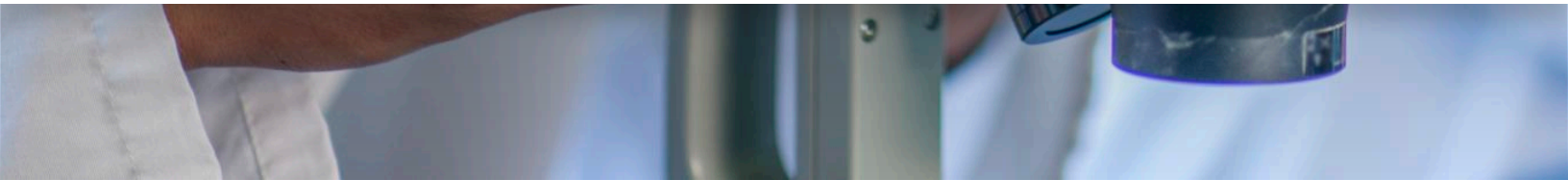

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- Lakeland Community College (Ohio), Laura Barnard, executive vice president and provost
- Lorain County Community College (Ohio), Aaron Weiss, dean, Science and Mathematics Division
- Stark State College (Ohio), Lada Gibson-Shreve, provost and chief academic officer

About JFF

JFF is a national nonprofit that drives transformation in the American workforce and education systems. For 35 years, JFF has led the way in designing innovative and scalable solutions that create access to economic advancement for all. Join us as we build a future that works.
www.jff.org

About Persistence Plus

Persistence Plus partners with colleges, nonprofits, and workforce development organizations to propel students to college success and a degree. We leverage behavioral nudging, mobile technology, and an intelligent software solution to help students develop mindsets and behaviors for success and navigate the path to completion. Persistence Plus's role in this study was the design and delivery of behavioral nudges for STEM and college success, and collaboration with JFF and the partner colleges to analyze impact and surface lessons.

About The Leona M. and Harry B. Helmsley Charitable Trust

The Leona M. and Harry B. Helmsley Charitable Trust aspires to improve lives by supporting exceptional nonprofits and other mission-aligned organizations in the United States and around the world in health, selected place-based initiatives, and education and human services. The Trust strives to make a meaningful impact in these areas, employing not only its significant financial assets, but also a rigorous and results-oriented approach, and a keen understanding of the relevant issues, needs, and opportunities. www.helmsleytrust.org

Summary

Much attention has been paid to the opportunities presented by science, technology, engineering, and math (STEM) fields, including the fact that a large number of STEM jobs require less than a bachelor's degree and offer higher than average wages. Reports have also highlighted the critical importance of community colleges as a primary provider of college access for large numbers of low-income students, first-generation students, and students of color. The result is a growing national recognition that, with new approaches and support for focused persistence and success interventions, community colleges can be a launching pad for many more students to access high-paying, quality STEM careers and improve equity.

Behavioral nudges use strategies from social psychology to influence behaviors and mindsets to help people meet their goals. Persistence Plus's nudges are designed by social psychologists and use an intelligent text messaging platform to engage college students and support them to completion.

To advance this STEM imperative, JFF (a nonprofit intermediary) and Persistence Plus (a behavioral science organization) launched the Nudging to STEM Success (NTSS) initiative in the spring of 2017 with support from The Leona M. and Harry B. Helmsley Charitable Trust. Four community colleges participated in this initiative to test an innovative behavioral nudging intervention designed to increase the persistence of students (particularly underrepresented populations) in STEM pathways. JFF and Persistence Plus partnered to document colleges' approaches, explore the process of implementation, and examine the outcomes of nudging. The purpose of this implementation report is to help inform community college leaders, foundations, and public education policymakers in understanding the impacts nudges have on student success, especially for students who are underrepresented in college completion. The promising results of the NTSS initiative reflect the opportunities that nudging offers and have important implications for future investments and continued exploration of behavioral nudges to promote student success and advance equity.

Summary Results

Quantitative Results

- A randomized control trial involving over 2,700 students in the summer of 2017 found that nudges resulted in a 10 percentage point increase in persistence for STEM students compared to a control group, a statistically significant result.

- In the full implementation phase, about 9,500 students were served across the four colleges; overall, 72 percent persisted after their first semester of nudging, compared to 56 percent of those students who opted not to receive nudges.
- Among students of color, 62 percent of those who received nudges persisted, compared to 46 percent of those who opted out.
- Among adult students over age 25, nudging had an even greater effect, with 64 percent of those opting for nudging persisting, compared with 44 percent of those who opted out.

Student Response Analytics

The Persistence Plus platform provided student response analytics that shed light on the sometimes hidden factors that play a role in persistence, such as those identified here. Among students who participated in nudging and who responded to related prompts:

- Those who acknowledged missing meals due to financial constraints persisted at a lower rate (69 percent), compared with those who said they don't face this issue (78 percent).
- Those who reported having paid their tuition early in the term persisted at a higher rate (81 percent) than students who said they had not paid early in the term (71 percent).
- Students who committed to meet with their advisors persisted at a higher rate (84 percent) than those who didn't commit (65 percent)

Implementation Highlights

No initiative fatigue: Colleges reported significant ease of implementation, citing very little time in setup given the role Persistence Plus played installing the text-based technology; there was no need to set up time- and labor-intensive, campus-wide implementation teams or design and change major systems.

Communication and student responses: Using artificial intelligence and analytics to synthesize student responses, colleges received strong data around what students actually needed and accessed on campus. Because the nudges are received via text message and perceived by students as neutral and delivered non-judgmentally, the stigma of going to the food pantry, tutoring center, faculty office hours, or asking for emergency aid is largely removed. This required the college to notify and plan across services when nudges would be scheduled to be delivered.

Student Voice: The platform was able to elevate the student voice around life challenges, motivational aspirations, and other candid levels of feedback in ways that the colleges have never been able to capture from traditional focus groups or surveys.

Equity: All of the colleges noted that the results improved persistence for students, but particularly for students of color, advancing stronger equity.

Sustainability: Three of the four colleges will be continuing the implementation and utility of behavioral nudging across a broader student experience, including application, enrollment, and the completion of a credential or degree.

Introduction

Community colleges have the potential to provide the nearly 15 million students enrolled across the United States with pathways into good jobs. However, many students who enroll in community college do not persist or complete a certificate or degree. Fewer than 40 percent of community college students earn a certificate or degree within six years (Bailey, Jaggars, and Jenkins, 2015). Students who do not complete any type of certificate beyond a high school degree or equivalency face significantly reduced earning potential (Belfield and Bailey, 2017). Finding ways to support student persistence, completion, and connection to high-wage careers is critical.

But what are the most strategic opportunities to connect community college students to high-growth/high-wage careers? In today's economy, half of jobs in STEM fields require less than a bachelor's degree; they are referred to as "middle-skill" careers (Rothwell, 2013). Students with middle skills have access to a range of opportunities, because careers in STEM are growing three times faster than non-STEM careers; moreover, these students' earning potential increases, because STEM workers earn over 25 percent more on average than their non-STEM counterparts (Langdon, McKittrick, Beede, Khan, and Doms, 2011). Not surprisingly, then, STEM education has been rapidly growing within community colleges, and more than 20 percent of community college students major in a STEM discipline at some point (National Student Clearinghouse Research Center, 2017). The majority, however, do not earn a STEM degree: Approximately 30 percent graduate in a non-STEM major but, more concerningly, another 30 percent fail to obtain any kind of postsecondary credential (Chen and Soldner, 2013; Henderson and Dancy, 2011).

The research is clear that there are multiple reasons why so many community college students abandon STEM, not least of which is that STEM courses are difficult and many students haven't had the opportunity to build the academic preparation to succeed in them (Warschauer, Knobel, and Stone, 2004). In addition to academic challenges, students must manage stereotypes and other implicit messages about who belongs in a STEM career and who does not. Some of these stereotypes, such as science being perceived as exclusively for men or for "nerds" (Cheryan, Siy, Vichayapai, Drury, and Kim, 2011; Etzkowitz, Kemelgor, and Uzzi, 2000), can conflict with a student's self-identity and dampen their motivation to persist in a STEM pathway.

This NTSS initiative was driven by the need to research, explore, and test targeted psychosocial barriers to success in order to improve persistence among community college students and, in

particular, STEM students. This more than two year-effort follows closely the idea of "wise interventions," which are programs designed to create behavior changes that endure past the end of treatment (Walton, 2014). Instead of attempting to directly change a maladaptive behavior, a wise intervention targets the attitude, belief, or mindset underlying that behavior.

Our theory of change is this: When students can get reinforcing messages that they belong in college, that they are smart and can be successful, and that overcoming challenges is possible, then persisting to be anything they want to be—such as a scientist in STEM—is possible. This implementation report is designed to showcase how behavioral nudges were implemented across four diverse community colleges and the outcomes that resulted. We hope this report serves as a starting point for more colleges to explore and test how this innovative approach can directly impact student persistence, with the largest impacts observed for the students least likely to succeed.

Nudging to STEM Success Initiative

Through a competitive request for proposal process in early 2017, JFF and Persistence Plus selected four applicants. Over its more than two years of operation, the initiative brought nudging support to more than 10,000 students at four innovative community colleges:

- Lakeland Community College, Kirtland, Ohio
- Lorain County Community College, Elyria, Ohio
- Stark State College, North Canton, Ohio
- John Tyler Community College, Chester, Virginia

Methodology

This report integrates findings from two strands of inquiry. Persistence Plus partnered with colleges to examine student level data to assess the effect of behavioral nudging on student persistence. Data sources included student responses contained in the Persistence Plus platform, as well as college student level records. In parallel, JFF explored the experience of colleges participating in the NTSS initiative to understand what colleges needed to do to support implementation and the impact of nudging in relation to colleges' equity and other goals. Drawing on interviews with college leadership and staff implementing the program, a survey of 18 other college employees, and a review of program documents and student focus group findings, the report presents persistence findings, describes the college experience, and offers recommendations for other colleges considering implementing nudging as a means to improve student success. [1]

About Behavioral Nudging

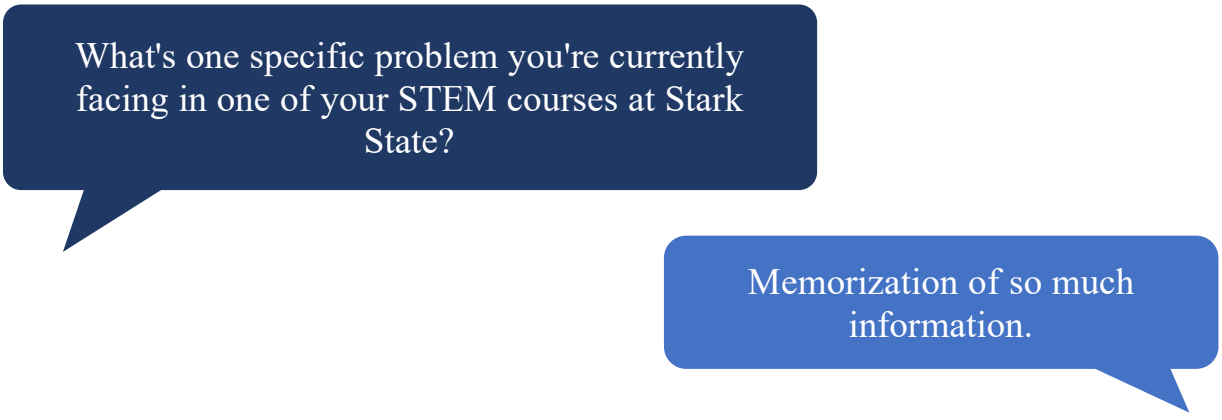
The Persistence Plus model of nudging draws on behavioral science and social psychology to address the challenges that community college students often encounter in STEM courses and more generally in their early college careers. Nudges are delivered through an intelligent texting software that reacts to real-time student responses, providing students with differentiated support delivered at scale.

The nudges for this initiative were designed to help students:

- Develop a strong college completion and STEM identity.
- Connect STEM studies to personal values and goals.
- Utilize college supports like tutoring, advising, and financial aid.
- Reveal and address hidden barriers and misconceptions that hinder their success.

For example, a nudge designed to encourage students to seek help and build their academic network might say: "Students who meet with a STEM professor outside of class find it rewarding and helpful. Will you commit to talking to a professor in the next week?" This type of nudge, based on research on the power of social norms and implementation intentions (Jordt et al., 2017; Miyake et al., 2010), establishes connecting with a professor as a normal and expected part of being a college student, and asks the student for a specific plan to do so. Nudging can help address students' lack of support networks and reluctance to seek assistance via college resources. Nudges encourage social belonging, goal setting, a growth mindset, and improved time management.

Below are examples of student interactions that occurred between the Persistence Plus platform and students in this initiative:



What kinds of feelings are you having with regard to this problem? Try to be as specific as possible in describing your emotions.

I worry I'm too old for college. I have so much pressure to get As.

It's normal to have those feelings. We're here to support you and answer questions you may have, as well as point you to resources on campus that can assist you.

Thinking about your experiences in class can help make your learning more meaningful. What's your most challenging math or science course right now?

Chapter 14 in math.

What's something you learned recently in this class that's helpful in your life right now?

My instructor telling me not to give up.

The Persistence Plus model has demonstrated impact to improve retention among community colleges. In a randomized control trial involving over 2,700 first-year students at three of the colleges participating in the initiative, students were randomly assigned to receive nudging during the summer between their first and second years of college. The intervention increased fall re-enrollment by 7 percentage points for the overall group and by 10 percentage points among students pursuing STEM pathways—differences that were statistically significant (O'Hara and Sparrow, 2019).

Why Nudging?

Given the widespread use of cell phones among students, texting offered a way of directly reaching students to get important messages to them. College leaders acknowledged prior challenges in communicating with students through more typical channels like email and not always being aware of what students do or do not understand about college processes and resources. Nudging offered a way to encourage students to seek out information and resources available to them and motivate them to push through their uncertainty and challenging moments to strive toward their goals. Moreover, nudging could help colleges address their equity goals by better meeting the needs of underrepresented and minority students. In addition to promoting student success, colleges hoped nudging would provide them with insights to help them better address students' academic and non-academic needs.

All colleges participating in NTSS saw nudging as a way to address student persistence and completion, and complement other efforts to help retain students. For example, Lorain County Community College had adopted a set of key indicators to track and improve outcomes related to student advancement and persistence. Their "What Matters Most Metrics" include overall completion rate, number of students who've taken the college orientation course, and number who complete a gateway math or English course in their first year, among other metrics. Metrics are disaggregated by student group to keep the college on track toward its equity goal of success for all students. Nudging provided a way to influence those metrics by providing ongoing support to students.

Participating colleges had little or no prior experience with texting. John Tyler Community College had used a simple texting platform to provide announcements to students (e.g., pertaining to a financial aid course audit). Stark State College had used nudging as a communication tool to inform students of the timing of registration or FAFSA deadlines, but the colleges did not utilize any behavioral nudging strategies or products as part of their student success interventions, or as part of their student success agenda.

Lakeland Community College had an early alert system underway, using technology to allow faculty to flag student issues and provide some behavioral nudging through email messages. Nudging was integrated into the system to more effectively reach students. While nudging

started as a STEM initiative at Lakeland, the college soon saw the value of the approach for all incoming students, as students often change their majors; they might not remain in a STEM pathway but they would benefit from nudging as a support.

Implementing Nudging to STEM Success

Implementing nudging in NTSS was a straightforward process for participating colleges. Persistence Plus staff met with college staff to understand the context—including processes, calendars, resources, and particular terms or names—to be able to tailor nudges to each college setting. Implementation of nudging required very few changes in colleges' processes. Most important was ensuring that students provided a cell number and granted permission for the college to text them. Colleges simply changed applications to add a question granting permission. As the nudging pilot unfolded, college coordinators worked in partnership with Persistence Plus staff to adjust texts if the language was too generic or messages were unclear in the particular college context.

Beyond the staff coordinating with Persistence Plus, college Institutional Research staff were involved to help establish processes for sharing student phone numbers and providing outcome data to track students' persistence term to term. IR staff also helped to gather data to answer specific questions, such as follow-through on student commitments. For example, if students responded to a nudge saying they would meet with their advisor, IR staff would gather data to show how many actually followed through.

Although colleges admitted concerns at the outset that students might see nudging texts as an intrusion, across all four colleges most students to whom nudging was offered opted to continue receiving the texts, with the understanding that they could opt out at any time.

Persistence Plus provided nudges for the entire population of incoming cohorts of students across the colleges (over 9,500 students total) in the fall of 2017 and the spring of 2018 as part of the initiative.

All four participating colleges noted that implementation was easy for college staff. In addition, college leaders reported that faculty appreciated that the process put no additional burden on them. As Laura Barnard, executive vice president and provost of Lakeland Community College noted:

> ***We tend to have multiple initiatives going on at any one time. This was without a doubt the most user-friendly and easiest to implement we have ever seen. . . . Persistence Plus was an absolute pleasure to work with. They were nimble and flexible. Early on, we were just nudging STEM students but wanted to change to nudge all incoming students, and they made it happen. Not all grants do this.***

The survey of staff and faculty showed that they were well informed that nudging was taking place on campus. The principal challenge reported by NTSS college staff was ensuring that their supportive services were prepared to accommodate the influx of students seeking them as a result of nudging. For example, Stark State maintains a crisis fund providing small grants to students to cover emergency costs. Nudges sent out a link to the grant application, which facilitated the process; however, the response to the nudge was overwhelming for the single staff member who manages the grant. Similarly, John Tyler Community College had an emergency fund supported by staff donations that students could apply to access by filling out a form. The college had to stop directing students to the fund as there wasn't enough money to meet the needs of the many students that responded.

The Value of Nudging

College leadership saw the value of nudging in multiple ways. For students, colleges appreciated the individualized support that nudging made possible and the important frames of mind that nudging could foster. As leaders at Stark State College saw it, nudging became a way to add support into the daily lives of students. For leaders at John Tyler, part of the power of the nudges was helping students to see themselves differently as learners. Nudging instilled a growth mindset among students (i.e., helping them see that with effort they could improve and meet their goals); nudges encouraged students to be more intentional about being a student, helping them see the things they need to do and what they need to focus on.

For the colleges, nudging offered new insights into their students, the challenges they encounter, and ways that colleges could be more supportive to encourage their success. In one instance, a student reported how the death of her pet affected her morale and how her own motivational nudging texts helped her push through her sadness to succeed. Such examples helped colleges see that even seemingly small challenges can significantly impact students' motivation to persist in school. As Lada Gibson-Shreve, provost and chief academic officer at Stark State College, noted, "We focus so much on what goes on in the classroom that we can lose sight of the fact that retention is influenced by factors outside the classroom."

Some student challenges that emerged were tied directly to services that colleges offered or could make available. Nudging during a summer pilot at Stark State showed that 72 percent of summer students felt they were poorly managing finances, indicating to the college that students needed help with financial planning at the start of their college career, a service that the college could offer. Staff at Lorain found the nudges amplified their efforts to help food-insecure students take advantage of the campus's food pantry. Within one month of nudging, the college food pantry saw 46 new families, raising the new family proportion of those served from 43 percent of households to 67 percent of households. Use of the pantry from September 2017 to September 2018 increased by 217 percent. Similarly, at Lakeland, when a nudge went out

around food insufficiency, many students came out requesting assistance. College staff acknowledged that they hadn't realized the depth of need on their campus, that despite the fact that the college is located in a wealthier county, many people struggle to pay for food, especially when they are paying for college. This revelation led to a college initiative on student hunger. The college obtained additional funding and now has a more cohesive and publicized campaign under way so students know about services and can get help. As Laura Barnard of Lakeland Community College noted:

> ***Efforts like this remove the onus on students to take care of themselves, putting more on the institution. . . . Nudging streamlines the opportunity to seek help. This is about a fundamental shift in higher education thinking that "they'll just figure it out."***

In addition to offering colleges new insights on student needs, nudging provided improved communication with students. As staff at Lakeland noted, the college had not recognized the importance of how they talk to students. Staff appreciated that many of the nudges, such as those where students' own words were sent back to motivate them, were affirming for students and didn't just tell them about the help available. Staff at John Tyler commented that they had learned a lot from how Persistence Plus phrased the nudges, particularly the way they asked questions to normalize the challenges experienced by students who are in difficult STEM classes. With roughly a third of their students being first-generation college goers, the college found these messages especially powerful and helpful. Leaders at Lorain valued the fact that the college could communicate to students in a way that suits them. Aaron Weiss, dean of mathematics and science at Lorain County Community College, sees it this way:

> ***I believe in communicating, getting information to a student in a way they want to be communicated with—which is texting. If you know that nudging is a powerful tool to influence behavior and you know students are attached to their mobile devices, why not use it to influence behavior?***

While texting helped colleges to more effectively reach students, colleges also found that the two-way nature of Persistence Plus nudging provided a valuable mechanism for offering students a greater voice in their college experience. Student responses revealed significant challenges that included homelessness, job loss, and family illness. One nudge asked students to finish the sentence, "I wish my college knew. . ." and students answered quite candidly. For example, one student noted frustration at having paid for a book that was not actually required for a course, while another said s/he wished the college knew that "I am striving to do better but am struggling to survive." Colleges interpreted students' responses positively as a reflection of their comfort in being "brutally honest" without fear of being judged. Colleges greatly appreciated this opportunity to hear directly from students to be better informed and more effectively address student needs. Responses pushed the colleges to reflect on the supports they were offering and increased their empathy for the struggles that students were facing.

Results

An initial randomized control trial (RCT) involving over 2,700 students during the summer of 2017 found that nudges resulted in a 10 percentage point increase in persistence for STEM students compared to a control group, a statistically significant result.

Building from the promising summer of 2017 RCT results, all four community colleges continued implementation of behavioral nudges from the fall of 2017 through the fall of 2018. Overall, NTSS produced positive results among the more than 9,500 students who participated, with outcomes including the following:

- 72 percent of subscribed students persisted after their first semester of nudging, compared to 56 percent of those students who opted not to receive nudges;
- 62 percent of subscribed students of color persisted after their first semester, compared to 46 percent of those who opted out;
- Among students over age 25, nudging had an even greater effect, with 64 percent of those opting for nudging persisting after their first semester, compared with 44 percent of those who opted out.

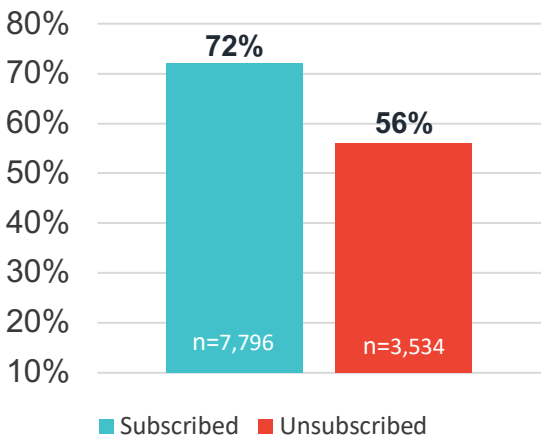
Looking at continuous enrollment over three terms (fall 2017 to fall 2018), student persistence rates held:

- 65 percent of students who remained subscribed to nudges persisted, compared to 52 percent of students who unsubscribed from nudges;
- 58 percent of subscribed students of color remained continuously enrolled across three semesters, compared to 38 percent of unsubscribed students;

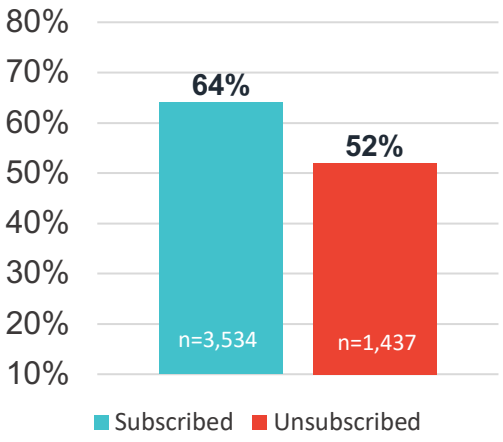
- 64 percent of students over 25 who were subscribed to nudges stayed enrolled over three terms, compared to 52 percent of unsubscribed students.

It needs to be noted that this method of measuring impact does have some limitations. Students who chose not to engage with a support service may differ from students willing to receive help, and students who opted out may already have made the decision not to continue in college. Still, and particularly in conjunction with the earlier results from the related randomized control trial, these outcomes suggest that nudges have a meaningful impact on student persistence at scale.

Figure 1. Fall 2017 to spring 2018; and three terms fall 2017 to fall 2018



Persistence to Next Term After First Semester on Persistence Plus



Continuous Enrollment Over Three Terms: Fall 2017, Spring 2018, and Fall 2018

The findings noted above are aggregated data across all four colleges. While a comparative analysis of individual colleges was not part of the scope of work, nor the intention, *individually*, *all four colleges saw positive results* from the nudging intervention, with especially clear evidence that nudging could help address equity gaps:

- Overall, John Tyler Community College saw an 11 percentage point (pp) increase in continuous three-term enrollment for subscribed students compared to unsubscribed students, Lorain County Community College a 13pp increase, Lakeland Community College a 16pp increase, and Stark State a 10pp increase.
- Students of color demonstrated particular benefit across three schools. At John Tyler, subscribed students of color demonstrated a 26pp increase in continuous enrollment, Stark a 26pp increase, and Lakeland a 33pp increase. Students of color at Lorain had an increase of 9pp, but Lorain's students of color had the highest rates of continuous enrollment over three terms for both subscribed and unsubscribed students.
- Both first-generation students and students over age 25 at Lorain were notable for a 16pp increase in continuous enrollment for subscribed students. In addition, the college

saw higher math completion and higher enrollment in math for the next term, with the largest increase for developmental math students.

From their efforts to gather feedback on the nudging intervention from surveys and interviews among participating students, colleges reported that students found the intervention helpful in motivating them to keep going through difficult times, and in helping them remember what they needed to do for classes and processes like registration and financial aid applications.

In addition, students appreciated the timeliness of helpful messages and the validation of their own thoughts as messages for self-motivation were gathered and shared with students. Julie Ranson, associate vice president of enrollment management at John Tyler, noted, "Students want to know you care. They like knowing someone is out there." Student reactions confirmed that they appreciate feeling like they belong and that someone at their college cares and will reach out to them to understand what they need.

Over 80 percent of nudged students across all four schools said that they would recommend this service to other students. When students were asked what they like best about the nudges they received, typical comments included:

> *"I always get a text when it's needed the most."* —John Tyler student
>
> *"It made me feel like there was always someone looking out for me."* —Lorain County student
>
> *"It gave me motivation when I wanted to quit."* —Lakeland student
>
> *"[The nudges keep] me engaged and connected. Knowing that I'm not alone in a lot of my struggles and the words of encouragement and excitement as I succeed."* —Stark State student

Moving Beyond the Pilot

The value of nudging seen by colleges led all three of the Ohio colleges to sustain their work with Persistence Plus. Lorain County Community College was so pleased with the pilot that it has decided to continue the partnership with Persistence Plus. Results that a fall-to-spring persistence rate was 10pp higher among nudge recipients than non-recipients, along with a 12pp higher rate for adults over 25 and a 19pp higher rate for students of color, caught the eye of the college's administration. While improved persistence is a benefit to students, it also translates into increased revenue for the institution, making the financial argument for investing in the strategy of nudging. The college also saw the opportunity to use nudging for additional students beyond those in STEM pathways. The college conducted a nudging pilot to increase the number

of students who apply to the college and follow through to register (as currently only 45 percent of applicants do). And, in the fall of 2018, the college instituted nudging for all incoming students. Lakeland Community College plans to continue nudging with Persistence Plus through the 2019 academic year and beyond. Stark State also plans to continue nudging with Persistence Plus and is exploring funding opportunities to finance the expansion to satellite campuses.

At John Tyler Community College, other investments in navigation technology to help students identify and pursue academic pathways precluded continued work with Persistence Plus. Since the start of the pilot, the college has become involved in another initiative focusing on students nearing the end of their degrees but acknowledged that they will carry forward important lessons about communicating with students from the NTSS pilot.

Lessons and Recommendations

The implementation of NTSS demonstrates the potential of nudging texts to contribute to persistence among community college students. Moreover, the promising results for students of color and nontraditional students suggest that nudging can be particularly beneficial to student groups that may face more significant challenges in pursuing STEM pathways in community college. The ease of implementation of the Persistence Plus model of nudging provides colleges with a feasible means to address student persistence that benefits both individuals and institutions.

For college leaders seeking ways to augment and strengthen existing efforts to promote student persistence, nudging seems well worth considering. With its capacity for adaptation to particular college contexts and differentiated messaging for students, nudging affords the opportunity to bring support to students without the need to hire many more advisory staff. It is an effective strategy for helping students through transitions from term to term.

For colleges that do adopt nudging as a persistence strategy, the NTSS experience suggests the importance of the following:

- **Communication:** Ensure that all college staff know that nudging is happening. This reinforces the idea that all staff contribute to student success and allows staff in targeted service areas to prepare for a potential increase in the uptake of services. In addition, it is important to communicate results to faculty, staff, and leadership to build buy-in and obtain new information to integrate into nudging to increase its effectiveness.
- **Leadership:** The engagement of leaders around the implementation of nudging is important to help mitigate any barriers and reinforce that the intervention is contributing to larger institutional goals.

- **Equity:** The results of nudging demonstrate its potential to address colleges' equity goals by improving outcomes for historically underperforming student groups. When implementing nudging, colleges should consider how to align the intervention with their equity goals and document changes that occur.
- **Student voice:** Nudging provides a valuable opportunity to provide students across the college with a safe and accessible means to convey feedback to the colleges and provide faculty and staff with insights into their challenges, needs and effective supports. When implementing nudging, consider key questions that should be asked of students and ensure that responses are reviewed to inform services.
- **Student options:** Keep in mind that some students may not have free texting on their phones or simply may not want to receive nudging texts. Make certain that procedures for opting out are clearly presented to students.
- **Reflection and learning:** Nudging provides opportunities to gain new insights into the student experience, as well as immediate feedback on the effectiveness of particular nudges. Develop your own learning agenda to better understand the challenges faced by students, the ways they currently find support, and the impact that nudging is having for them and the institution.

Conclusion

An important takeaway of this initiative is that it addressed the key needs of community colleges not through a single strategy, but by bringing together a number of elements that worked in synergy. Nudging to STEM Success:

- Led to promising persistence gains for students, particularly students of color and adult students, presenting exciting opportunities for more colleges to provide personalized outreach to achieve equity and broaden participation of underrepresented students in STEM fields;
- Provided a model that was easy to implement; and combined all of the best elements for students to succeed, including a smart text-based technology solution, access to campus based support services, and increased engagement with faculty;
- Capitalized on the ubiquity of cell phones, offering the opportunity for two-way communication between colleges and students in a safe and accessible way, giving students a greater voice in their college experience;
- Delivered such strong results that every participating college in Ohio is continuing to partner with Persistence Plus to sustain the work, noting how effectively the nudges met the needs of students; and

- Presented an exciting future of possibilities to further test the strength, utility, and adaptiveness of the Persistence Plus nudging model with adult education providers, workforce development education and training programs, high school dual enrollment, as well as corporate training and certification programs.

As noted, this model and approach both inform and extend the resources that colleges can offer to support their students, while promoting equitable outcomes for different groups of students. The overall experience of NTSS demonstrates the immense and promising value of nudging technology for learners of different ages and backgrounds, and the potential that it might offer beyond college settings into domains that span into other sectors and training settings.

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Endnotes

[1] The survey results were based on responses from a total of 15 staff members and three faculty members from across the four colleges. Five of the respondents worked at John Tyler Community College, one worked at Lakeland Community College, eight worked at Lorain County Community College, and four worked at Stark State College.