Building Student Success with a Co-Requisite Remediation Model and Mindset Know-How

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In much of the world, attending college is the pinnacle of achievement and has been for hundreds of years. Initially posited as a learning forum for the sons of the elite, it was not until the 1940's with the issuing of the GI Education Bill at the close of World War II that the "Everyman" concept of higher education, the economic advantage of higher education for all, took hold in the United States. As globalization sharpens economic insecurity, the completion agenda in higher education has been posited most recently as the means to promote educational and economic advantage. In 2020, 65% of U.S. jobs will require post-secondary education. Projections reveal that almost all states have attainment levels below those needed to fill these positions (Carnavale, Smith, & Stohl, 2014). The loss of human potential as represented by the more than 40% of college students who do not complete their degrees supports the urgency of this issue (Commission on the Future of Undergraduate Education, 2016). This paper focuses on higher education change innovations, specifically, the co-requisite remediation model of simultaneous supplemental instruction and the role of the non-cognitive factors in achieving learning and performance as well as retention.

Remediation

Whether called developmental education, preparatory basic skills education, compensatory education, learning support, or academic upgrading, remediation is by definition designed to assist students to achieve higher levels of competency in core academic skills, such as reading, writing and math. The qualities and skills to

strengthen student learning, intentionally taught and cultivated, can be traced back in various forms to the late 1600's (Arendale, 2002). However, the attributed origin and ultimate purpose for remediation varies in focus globally. In the United States, remediation is generally viewed as the consequence of poor preparation often associated with restricted access to quality education and is an experience that is disproportionately experienced by low income, African-American and Hispanic students. In Canada, remediation focuses on academic upgrading on academic prerequisites necessary at a minimum to enter an occupational program. Far less common in Europe than in the United States, remediation is frequently viewed as a result of the increased student mobility by students from nations engaged in the Bologna Process where educational networks vary in differing levels of preparation. Regardless of the terminology or attributed origin, remediation is quite simply the response to being underprepared regardless of ability to pursue one's educational or occupational dreams.

To Enroll or Not to Enroll and in What, That is The Question

In fall 2000, American colleges provided remedial education to 28% of all enrolling freshmen (National Center for Education Statistics, 2004). A decade later approximately 50% of all college students, 1.7 million according to the National Center for Educational Statistics, take one or more remedial courses during their matriculation (Scott-Clayton, Crosta, & Belfield, 2012). Given these staggering numbers, how to assess college readiness, whether or not a student should enroll in remedial coursework and the potential benefit that might be gained remain surprisingly challenging.

In general, most universities and community colleges rely heavily on "cognitive factors" or "hard skills of cognitive ability such as literacy or numeracy" (Gutman & Schoon, 2013) measured by nationally normed tests such as the ACT, SAT, or ACCUPLACER to determine college readiness. The long-standing use of standardized test scores has persisted despite research showing that high school grades are generally perceived as better predictors of positive, long-term educational outcomes (e.g., college enrollment, college graduation) and life outcomes

(e.g., wages, health, longevity, civic participation) (Consortium on Chicago School Research, 2014). The likelihood of being placed in developmental courses in lieu of, or in support of a standard undergraduate program of study, varies on a numerous factors including high school preparation, student demographics, transcript analysis, and state policies for assessment and remediation (Adelman, 2006). Whether students referred as a result of placement tests enroll into remediation courses actually benefit by enrolling and receive the necessary support for the specific skills needed remains questionable. Estimates of actual enrollments in remedial courses varies by state and is not synonymous with the number of individuals identified using placement tests. This further confounds the question of the value of remediation education and for whom.

The continued growth and diversity, both economic and demographic, of the higher education student body has forced higher education to develop increasingly sophisticated approaches to human-capital development by creating new remediation models and embracing environmental engagement.   Enriching the student's environment with an emphasis on advising, student affairs programming, increased technological innovations, career relevant courses, and evaluation has impacted students' matriculation experiences and progressed the completion agenda nationally.   That said successfully navigating a pathway through an often extended sequence of developmental education classes continues to be a significant challenge for many students who find themselves placed into remediation. (Complete College America 2012)

Co-requisite Remediation as An Avenue to Completion

It is not surprising with the individualistic nature of society in the United States that remedial education comes in many forms and flavors. Traditional, semester-long, intensive or skill-specific course modules, delivered to individuals or cohorts on–ground and on-line are delivery mechanisms have been and are still popular approaches. Despite efforts to improve the developmental curriculum, however, results of the traditional pre-requisite approach remained staggering. In Tennessee, 60 percent of incoming community college students in 2012 were placed in developmental math, reading or writing skills, yet only 12 percent of those placed in math remediation finished a credit-

bearing math course within an academic year and only about 30 percent completed their first credit bearing English class.

In the Fall of 2013 the Tennessee Board of Regents began work to improve the effectiveness of its system-wide approach to developmental education in community colleges, when success was viewed from the perspective of students completing a credit-bearing math, writing or reading-intensive class within an academic year.

In an effort to increase these success rates, TBR community colleges and universities piloted a co-requisite approach to remediation during the academic year 2014-15. In co-requisite remediation model, students were enrolled directly into their credit bearing math or writing class, but were also enrolled in a required semester-long supplemental learning experience that was aligned with the college-level credit bearing course. The supplemental course was focused on helping students with the requisite skills and conceptual understanding to complete the credit bearing gateway course.

The gateway course outcomes revealed substantially higher pass rates for all students enrolled in the co-requisite remediation approach, but gains were especially pronounced for low-income, adult, and minority students (Denley 2015). As a result, in 2015, the model was implemented at every university and community college for every student identified for remediation in the state enrolled at an institution within the TBR system. Students were identified as needing remediation based on their ACT mathematics, reading or writing subscores: a score below 19 in mathematics or reading, and below 18 in writing designated that student as needing remediation in that subject area.

In its first year, 55 percent of co-requisite remediation math students passed their credit-bearing math class in the fall semester—compared to the 12 percent who previously managed that in a full year. In English, the 30 percent number leapt to more than 60 percent. More students completed credit-bearing classes than previously completed just the remedial courses, and students at every preparation level were significantly more successful than they were using the previous "pre-requisite" model (Denley 2016). Furthermore, students who did not pass their first semester end remediation still ended up earning more credits than they would have under the old model (Smith, 2016).

The new co-requisite model was also significantly more cost effective than the former approach (Belfield, Jenkins, & Lahr, 2016).

Possible Mediators of Student Success

The question of how to make the co-requisite remediation model a better fit for all students raises the question of how might a student's own narrative of success play into the effectiveness of the co-requisite remediation model. The failure of the previous remediation approaches which in effect told students they didn't belong at college as demonstrated by not allowing them to enroll in the credit bearing courses until they completed pre-college work may have resulted in affirming their fears or beliefs that they actually didn't belong. This potential interpretation mandated an examination of possible mediators or moderators to student success and the entire completion agenda for the Tennessee Board of Regents.

Simply overlaying state laws with institutional policy and practice on post-secondary student, without attending to the 'experiencing' of the education process, ignores the complexity of learning for a multifaceted student body in the name of the completion agenda nationally. Research (Pascarella, 2006; Pascarella & Terenzini, 2005) demonstrates that the total involvement in the college experience in academic, interpersonal and extracurricular engagement is mutually reinforcing and provides the greatest impact towards a student's retention, matriculation and completion. Colleges and universities generally provide multiple resources and supports to help students transition into college. They have actively engaged in identifying students who struggle with adjusting academically to the rigors of college in an attempt to boost retention rates. Decades of research show a powerful relationship between non-cognitive factors, specifically motivation, mindset and achievement, with academic persistence and success. Many students struggle to "fit" or belong and make friends. During this transition, they perform worse than anticipated increasing the possibility of dropping out (Stinebrickner & Stinebrickner, 2014).   Students' beliefs about their intelligence and learning capability in differing domains , the environment in which they study, and what it takes to intellectually succeed can impact their motivation and as a result their performance (Bandura,

1986; Bandura, 2005; Dweck & Leggett, 1988; Weiner, 2000). Students' beliefs impact their studying and help-seeking behaviors in response to both challenges and setbacks. Tenacity and good strategies promote "productive persistence" which manifests itself in the mindsets and skills essential to look beyond the immediate to longer-term or higher-order goals and to persevere through various challenges towards achieving these goals. The primary drivers of productive persistence include 1) students believing they are capable of learning, 2) students feel socially tied to peers, faculty and the course, 3) students believe the course has value, 4) students have skills, habits and know-how to succeed in a college setting, and 5) the faculty and college support students' skills and mindset (Carnegie Foundation for the Advancement of Teaching, n.d.).

As the completion agenda has gained momentum nationally, higher education institutions and policy makers have turned their attention to a range of what are loosely termed non-cognitive factors" or "soft skills" in explaining academic and employment outcomes. Non-cognitive factors can be categorized into five broad groups: *judgment, persistence, self-efficacy, social intelligence,* and *mindset*. To elaborate, *judgment* generally includes aspects of character development including integrity, open-mindedness and curiosity. Academic behaviors such as going to class, doing homework, and participating in class are posited by Nagaoka, Farrington, Roderick, Allensworth, Keyes et al. (2013) as critical non-cognitive aspects. *Persistence* or *perseverance* includes "Grit", tenacity, self-control, effort, and delayed gratification (Duckworth, 2011; Duckworth, Peterson, Matthews, & Kelly, 2007).). Learning strategies (e.g., metacognitive strategies, study skills, self- regulated learning, goal setting) are potential influences on persistence (Nagaoka et al., 2013). *Self-efficacy* focuses on a student's belief in his or her own capabilities to produce a certain result. What we believe determines how we feel, think and motivate ourselves to behave thus influencing the goals we set for ourselves and how we learn (Bandura, 1994) and strongly relates to adjustment to college and performance (Chemers, Huong & Garcia, 2001) and college persistence and GPA (Vuong, Brown-Welty & Tracz , 2010). *Social intelligence*, the awareness and ability to identify and manage one's own emotions, to be aware of the emotions of others, and to apply that knowledge to thinking and problem solving

(Goleman, 1997) traditionally includes appreciation, gratitude, and connectedness or belonging. Social skills such as interpersonal skills, empathy, cooperation, assertion, and responsibility are critical skills (Nagaoka et al., 2013) which may play a role in how social intelligence potentially relates to the student academic experience.

Lastly, *mindset* is the attitude or lens that each individual uniquely adopts to view and understand day-to-day experiences, the world around them, and the information they use to determine subsequent actions. *Academic mindset* is the range of beliefs and attitudes about oneself specifically in relation to academic work. Mindset aligns theoretically with attribution theory, implicit theories of ability, expectancy –value theory, stereotype threat, locus of control and self-affirmation theory (Dweck, Chiu & Hong, 1995; Nagaoka, 2013).

Mindset is frequently presented as the dichotomous "lens" or belief systems of fixed and growth mindset. Fixed mindset refers to the belief that intelligence is immutable. Praising children for being "smart" creates a fixed mindset (Mueller & Dweck, 1998) by promoting a view that "looking smart" (i.e., performing for others or having a performance goal such as high grades, awards, money, etc.) is more important than learning for the sake of learning (i.e., mastery goal such as knowledge and self-improvement). Performance goals, at least initially, are associated with higher academic achievement in college and middle school, especially when paired with high efficacy and may be adaptive for certain outcomes or in certain contexts (i.e., highly competitive situations, performance-driven cultures) (Elliot, McGregor & Gable, 1999; Harachiewicz, Barron, Pintrich, Elliot, & Thrash, 2002; Hidi & Harackiewicz, 2000; Linnenbrink, 2005; Marshik, Korttenkamp, Cerbin, & Dixon, 2015). Having a fixed mindset promotes the likelihood of making judgements concerning success based on fewer data points, i.e., based on in a single experience, and thus increasing the likelihood of being quickly discouraged (Chiu, Hong, & Dweck, 1997). In contrast, growth mindset refers to the belief that intelligence can be grown and obstacles can be overcome through effort, help from others, and use of improved strategies leading to higher achievement levels (Paunesku, Walton, Romero, Smith, Yeager, & Dweck, 2015). Mindset changes, however, are not achieved simply by getting students to try harder.

It is misleading to conceptualize mindset as a purely dichotomous concept. Dweck's seminal work posited not just growth and fixed mindsets but that a portion of individuals (15% of the original participants) do not fall into a single mindset but rather vary by domain. For example, students may excel in writing possessing what could be categorized as a growth mindset yet see themselves as void of math skills and thus possess a "fixed" mindset in the math domain. When students are praised for their intelligence, they often believe that they cannot nurture intelligence, i.e., "either you have it or you don't", and display a further fixed mindset. Praising the process versus the ability of doing something allows for more growth mindset, resilient students.

Understanding Today's Students

In the summer of 2015, the Tennessee Board of Regents Office of Academic Affairs launched a Think Tank of research faculty drawn from universities across the System to begin a dialogue on that factors which impact student success beyond the cognitive ones traditionally explored. The Think Tank wrestled with numerous questions: What are the best measures of student success? What factors are critical in promoting student success? Is a growth mindset associated with greater student success? What student profiles are associated with greater student success? Do students who are more success oriented/ exposed to a growth mindset change majors fewer times? Will fostering belonging/inclusion among community college students increase their receptiveness to effective feedback and improve student success? Can a student success mindset be developed and, if so, how? What impact will the Tennessee Promise have on building a student success academic mindset? What is the "natural" developmental trajectory of academic mindset? What is the "natural" developmental trajectory to career planning? Is academic success best understood as properties of individual students or products of student' contexts (e.g., family, faculty, campus)?

A baseline assessment, using a convenience sample of all students enrolled in classes employing the co-requisite remediation model, was conducted using an 80 item survey. The students were queried on their future career goals, self-confidence, degree major choices and the factors influencing their choices completing a series of psycho-

logical measures: 8 item *Openness to Experience* and 11 item Likert-like *GRIT Scale* (*GRIT*: Duckworth et al., 2007); 4 item Likert-like scale *Fixed/Growth Mindset* (PERTS, n.d.), 8 item Likert-like *New General Self-* Efficacy Scale (NGES: Chen, Gully, & Eden, 2001), 11 item Likert-like drawn from the Course Self-Efficacy and Social Self-Efficacy subscales of the College Self-Efficacy Instrument (CSEI: Solberg, O'Brien, Villareal, Kennel, & Davis,1993), 8 item Likert-like Sense of Community (SOC: Peterson, Speer, & McMillan, 2008); Career Behaviors Change Inventory (CBCI: Hammond, *in press*) aligned to the non-cognitive factors plus demographics and influences for deciding the current major. The survey instrument was introduced to students by their faculty of record for the co-requisite course in which they were enrolled and delivered as a web survey during the first three weeks of the fall 2015 semester.   A total of 6553 students completed the survey within the first 3 weeks of classes. The majority of the students were given class time to complete the survey. No extra credit was awarded for participation. Of that group, 4947 unique students (75.5% of the initial pool) were paired with their institutional BANNER ID and formed the final participant pool for the study. (The instrument is available on our website: https://www.tbr.edu/academics/academic-mindset.) This assessment served as the foundation of a longitudinal study of psycho-social aspects of student success within TBR institutions. It was hoped that having a better grasp of our students' non-cognitive attributes would allow us to develop teaching and learning approaches to assist faculty in the support of student success on a small scale for Spring 2016/Fall 2016 with larger-scale interventions in Fall 2017. The initial survey established a profile of students enrolled in co-requisite remediation courses in the fall 2015. Eighty percent of the students queried agreed or strongly agreed that that they felt they had enrolled in the correct major or foci area. A quarter of the students had high uncertainty as to whether they belonged at their institution with another 10% expressing moderate uncertainty. Significantly more male students questioned whether they belonged. In general, the students self-described as having a growth mindset but 23% viewed themselves as more fixed, with minority students viewing themselves as significantly more fixed. No attempt was made to have them scale the concept as a continuum. Disturbingly, almost half of the students participating did not see their academic

work as directly relevant to their chosen career field and, as such, a waste of their time. Significantly more male students did not connect classes to their career paths.

The survey findings suggest that a potential causal connection may exist to student success and ultimately, success in the workforce. Research supports that non-cognitive factors are more powerful and critical in student success that the traditional measures of grades, intelligence, and test scores (Duckworth, 2011; Pappano, 2013; Perkins-Gough, 2013). Motivation, socio-emotional regulation, time preference, personality factors and the ability to work with others are additionally important facets of student success (Goleman, 1997; Heckman, 2008) The role of interest, competence, performance and recognition as non-cognitive elements in identity development (Cribbs, Hazari, Sonnert, & 2014) and the uncertainty about belonging and feeling authentically included in a new social and academic setting complicates the development of a student identity negatively impacting student retention and success (Walton & Cohen, 2007; Walton & Cohen, 2011).

The survey was redistributed to the same group of students via student email accounts in the last three weeks of the 2015 fall semester. At the time of the second administration, students had completed the requirements for the co-requisite remediation course. Due to the timing of the email notification, the survey remained available for completion for the first three weeks of the spring semester. Less than 4 percent (182 students) of the original sample participated in the second round. No attempt was made to determine of the percentage of students who failed to respond to the second administration had left their institutions. Since all of the students were enrolled in some form of co-requisite remediation, success in the credit bearing portion of their co-requisite pair was examined in relation to several standard metrics: (Semester GPA, Fall to Spring Retention, Earned hour percentage) to demonstrate the impact of the mindset traits. In this paper we will restrict our analysis to the data from community college students. Analysis of the university student data will be forthcoming.

Six of the variables showed significant impact on the success rates of students in their mathematics or writing classes as well as on the other metrics. These were
• *GRIT* (GRIT: Duckworth et al., 2007)

• *Growth and Fixed Mindset* (PERTS, n.d.)

• *Course Self-Efficacy Subscale* of the *College Self-Efficacy Instrument* (CSEI: Solberg et al., 1993)*, item Confidence in an ability to keep up to date with course work,*

 • *Social Self-Efficacy Subscale* of the *College Self Efficacy Instrument* (CSEI: Solberg et al., 1993), item *Confidence in interacting with college faculty and staff*

• *Perceived purpose and utility of coursework* (Part of Academic Work and Careers Inventory)

• *Sense of Community* (SOC: Petersen, et al., 2008)

Mindset Metric Distributions

Variables related to mindset and academic success were analyzed for students with various levels of academic preparedness. As Tennessee is an ACT state, it was natural to use ACT composite score as a measure of preparation. All the students in the survey had one or more ACT sub-score in a range that placed them into developmental education. However their composite scores ranged from 5 to 34 as plotted on the vertical axis of Figure 1. In the mindset measure as depicted in on the horizontal axis, a lower score shows more growth oriented mindset while a higher the score more strongly demonstrates a fixed mindset.
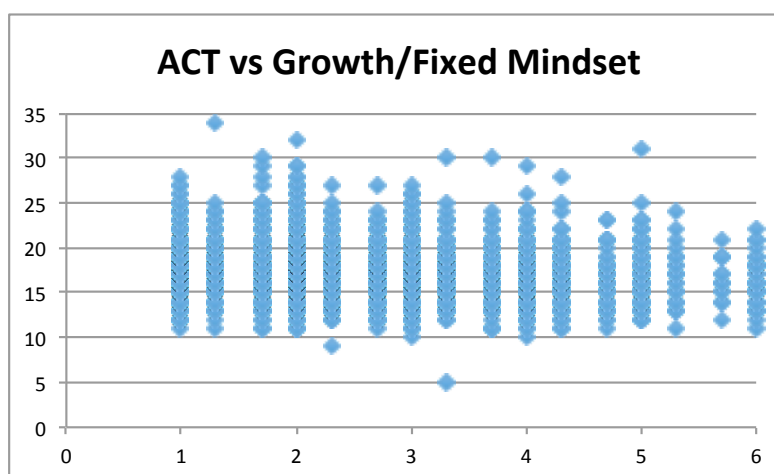

Figure 1. ACT versus Growth/Fixed Mindset

Figure 2 presents ACT scores again but in relation to students' confidence in the *ability to keep up to date* item as measured by the *Course Self-Efficacy Subscale* of the *College Self-Efficacy Instrument* (Solberg et al., 1993). The higher the score represented on the vertical access, the higher the confidence the self-efficacy in relation to keeping up in the course. Other items reflected in this subscale include items such as confidence in relation to *managing time effectively, researching a term paper, doing well on exams, asking a professor a question, taking good class notes, understanding the text books,* and *writing course papers.*

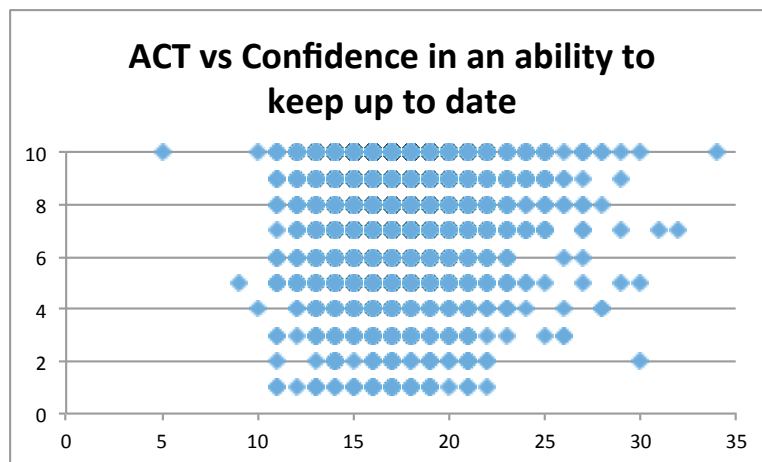**ACT vs Confidence in an ability to keep up to date**

Figure 2. ACT versus Confidence in the Ability to Keep Up to Date

The literature suggested that we would find a weak connection between these mindset characteristics and preparation and our survey confirms those earlier findings. As we analyzed the connections between student success metrics and mindset facets we also carried out this analysis controlling for preparation level as measured by ACT score or subscore. While we will not give the full details of that analysis here, we found that the effect sizes and success metric differences held true even when we controlled for preparation level.

Although the number of surveys at the end of the semester was small, it was sufficiently large to confirm that in the absence of some intervention, the academic mindset

related variables in this study do not drift appreciably over the course of the first fresh-man semester. As shown in Table 1, little change in any of the characteristics associated with mindset was observed over the course of one semester. For measures such a *Non-Cognitive GRIT* and *Growth and Fixed Mindset*, little variation across the semester was anticipated, since no broad-scale intervention to effect such a change was conducted. However, that there was also minimal change throughout the semester for the remaining measures seems more surprising. It is easy to imagine that a new student who likely knows few of the other students might question their community place, or be initially concerned about interacting with faculty. Yet we would have hoped that having made some friends, and actually having spoken with faculty by the end of the semester we would see movement in these measures. However, this change is absent from the data set. Indeed it is perhaps even more surprising, since the responses compare the larger group to the students who filled out the end-of semester survey and presumably by that action demonstrate themselves to be atypically engaged. Perhaps differences would have been more substantial over time. Continuing to measure these variables longitudinally may allow for the time need to changes significantly. Future quantitative and qualitative measurement may bear out significance.

Variables	Average at Start of Semester	Average at End of Semester	Difference	Standard Deviation of Data
GRIT	3.67	3.73	-0.07	0.59
GROWTH/FIXED	2.40	2.53	-0.12	1.14
Courses Self-Efficacy as measured by item "Confidence in keeping up to date with schoolwork"	8.22	8.01	0.21	2.21
Social Self Efficacy as measured by item "Confidence talking with faculty"	7.19	7.67	-0.49	2.47
Perceived Purpose of Coursework	2.54	2.59	-0.05	1.34
Sense of Community	3.74	3.74	0.00	0.71

Table 1. Variation in Mindset Variables from Beginning to End of Semester

Looking further into the data, however, reveals that each mindset characteristic individually has a strong interdependence with various student success metrics substantially.

Beginning with the issue of tenacity, or GRIT, Table 2 clearly shows showed marked variation in the student success metrics, when examined by GRIT level. When a high-low split of GRIT was applied, all the characteristics with the exception of retention showed statistically significant differences.

	Low N-NCGRIT (<=2.9)	High NCGRIT (=>3.5)	Difference	Effect size	p-value
Math Co- Requisite Success Rate	57.4%	66.7%	9.3pp	2.79	0.003
Writing Co- Requisite Success Rate	63.6%	70.6%	7pp	2.49	0.006
Semester GPA	1.82	2.11	0.3	3.87	0.00005
Earned Hour %	59.3%	66.5%	7.2pp	4.20	0.00001
Fall to Spring Retention Rate	73.7%	76.6%	2.9pp	1.32	0.09

Table 2. Student Success Metrics Categorized by Tenacity as Measured by Non-Cognitive GRIT Scores

Table 3 shows the same success measures categorized by Growth and Fixed Mindset. While the differences are significant for writing co-remediation and semester GPA, those for math co-remediation success, proportion of hours earned and the retention rate were not significant.

	Fixed Mind-set (>=4)	Growth Mindset (<=2.3)	Difference	Effect size	p-value
Math Co-Requisite Success Rate	62	65.4%	2.5pp	0.71	0.2
Writing Co-Requisite Success Rate	63	69.3%	5.9pp	2.17	0.02
Semester GPA	1.98	2.12	0.1	2.33	0.01
Earned Hour%	68	70.7%	2.5pp	1.47	0.07

Fall to Spring Retention Rate	75	75.3%	0.1pp	0.04	0.48

Table 3. Student Success Metrics Categorized by Fixed/Growth Mindset

Table 4 shows there were significant differences in the writing co- requisite success rates but not in math or semester GPA occurred based on a perception of belonging. Significance was evident as well in the percentage of hours earned and retention but at a far lesser level of significance. Examining the SOC (Petersen et al, 2008) dimensions of needs fulfillment, group membership, influence and shared emotional connection which support a factor structure and subscales correlated with community participation, psychological empowerment, mental health and depression brings further question into how to interpret these findings.

	Question Belonging (<3)	Affirm Belonging (>4)	Difference	Effect Size	p-value
Math Co-requisite Success rate	66.4%	65.3%	-1.1pp	-0.25	0.4
Writing Co-Requisite Success Rate	64.7%	71.1%	6.4pp	1.83	0.03
Semester GPA	2.08	2.14	0.1	0.83	0.2
Earned Hour%	68.9%	72.3%	3.4pp	1.63	0.05
Fall to Spring Retention Rate	74.0%	78.7%	4.7pp	1.97	0.02

Table 4. Sense of Community

As shown in Table 5, all the success metrics showed strongly statistically significant differences based on student perceptions of their abilities to keep up with their college level work. Students with low self-confidence demonstrated a significantly lower success rate than those with greater confidence levels in both math and writing co-requisite courses. Students with high confidence also showed significantly higher semester GPAs, earned hour percentage and fall-to spring retention than their low-confidence colleagues. In fact this effect remained even when controlling for actual preparation level. For instance when we compared students with ACT Mathematics sub-scores of 11 to 15

to those with sub-scores of 16 to 19, the success rate in the credit bearing math class was higher for those in the 11-15 range with high confidence than those in the 16-19 range with low confidence (55% vs 48%). A similar phenomenon is also true for co-requisite Writing. Indeed, students who felt very confident about their ability to "write course papers" were significantly more likely to pass their co-requisite English Composition I course than their colleagues who were less confidence (high confidence 70.8%, low confidence 60.5%). Furthermore students with ACT Writing sub-scores of 11 to 15 and high confidence had essentially the same success rate as students with ACT Writing sub-scores 16 to 19 but low confidence (70.3% vs 70.2%). These findings have an interesting interplay with the the work of Kruger and Dunning. The Kruger-Dunning effect (Kruger & Dunning, 1999) in which people who are less skilled in a domain, such as math and writing, overestimate their skills and abilities, leading them to think they perform better on a task than they do in reality, is clearly evident in our results. Indeed, roughly half of the surveyed students (48%) expressed high confidence in their ability to write term papers, despite having ACT writing scores that place them into developmental writing. However, despite their overestimate, that confidence appears to lead to superior success rates than their less confident, although perhaps more realistic, colleagues.

	Low Confidence (<=4)	High Confidence (>=7)	Difference	Effect size	p-value
Math Co- Requisite Success Rate	42.1%	68.2%	26.1pp	5.29	0.0000001
Writing Co- requisite success rate	51.4%	70.7%	19.3pp	4.92	0.0000004
Semester GPA	1.57	2.21	0.6	7.98	<0.0000001
Earned Hour %	53.9%	73.2%	19.3pp	8.39	<0.0000001
Fall to Spring Retention Rate	64.5%	77.8%	13.3pp	4.61	0.000002

Table 5. Confidence in keeping up

Table 6 supports the importance of the student faculty relationship to student success. This study shows a significantly greater success rate for students with higher confidence levels regardless of the domain. Higher confidence students also completed more hours and had a higher GPA resulting in a greater retention rate. The effect of "confidence talking with faculty" is statistically significant and strikingly large for each of the studied metrics. It is perhaps worth remarking that the question posed did not distinguish between interactions within and outside the classroom. Consequently this finding may speak to the importance of extracurricular faculty interactions. Smaller, yet still sizable effects for other faculty and staff interactions such as "talking with a staff member", and "asking a faculty member a question" were also found. The effects for minority students and low-come students are strikingly large, but not disproportionately so.

As large as the effects are, still 14% of the surveyed population expressed low confidence (<=4), and 50% had confidence below the high confidence mark at 7. Besides the studied metrics, students with low confidence interacting with faculty and staff were significantly more likely to end the fall semester with a GPA below 0.5.

	Low Confidence (<=4)	High Confidence (>=7)	Difference	Effect Size	p-value
Math **Co- Requisite Success Rate**	59.1%	66%	6.9pp	1.88	0.03
Writing **Co- Requisite Success Rate**	59.6%	70.1%	10.5pp	3.5	0.0002
Semester GPA	1.93	2.15	0.2	3.45	0.0003
Earned Hour%	65.4%	71.7%	6.3pp	3.41	0.0003
Fall to Spring Retention Rate	72.6%	76.8%	4.2pp	1.96	0.025

Table 6. Confidence in Talking with Faculty

There was sufficient data to study the effect of mindset change on success for this mindset facet. These results are shown in Table 7. Of those surveyed 43 students began with confidence below 7, and also provided an end of semester survey. Of these students 21 remained below 7 but 22 moved into the high confidence category.

	Stayed at Medium or Low Confidence(<7)	Moved to High Confidence (<=2)	Difference	Effect Size	p-value
Math Co- requisite success rate	70%	100%	30pp	2.07	0.02
Writing Co- requisite success rate	75%	100%	25pp	2	0.02
Semester GPA	2.21	2.97	0.8	1.88	0.03
Earned Hour %	73.6%	93.7%	20.1pp	1.73	0.04
Fall to Spring Retention Rate	90.4%	95.5%	5.1pp	0.639	0.261

Table 7. Effect of Mindset Change on Student Success

Although the student sample sizes are small, once again the differences for all but retention are significant. Since these are students who submitted an end-of-semester survey it is not surprising that their fall-to-spring retention is very high. The issue of causality cannot be answered by this work given the non-experimental methods employed, however, this evidence is consistent with increasing confidence in faculty interaction having a causative effect on student success.

One of the key elements that the Carnegie foundation points out for productive persistence is the sense of perceived relevancy of coursework. More than a quarter of the students who responded to the survey were struggling with this issue. As shown in Table 8, there were significant differences between each of the success metrics for

	Low Perception (>=4)	High Perception (<=2)	Difference	t-score	p-value
Math Co- Requisite Success Rate	60.2%	66.5%	6.3pp	2.08	0.02

Writing Co- requisite Success Rate	61.3%	70.8%	9.5pp	3.73	0.0001
Semester GPA	1.91	2.18	0.3	5.11	0.0000002
Earned Hour %	65.1%	72.5%	7.4pp	4.85	0.0000006
Fall to Spring Retention Rate	72.4%	77%	4.6pp	2.62	0.004

Table 8. Perceived purpose and utility of coursework

students who had differing perceptions of the purpose of the courses they were studying.

The Future Course of Action

Our work continues in Tennessee. The results from co-requisite model of remediation continue to improve. The data continues to be gathered and analyzed on the students enrolled in co-requisite remediation with the hopes to track these students through their post-secondary experiences and on into their careers. Whilst hopefully the data from the over 6000 replies will provide significant insights into student attitudes toward their college experience, it does provide an initial window into the effectiveness of this new choice architecture.

In light of the initial survey results and the parallel work of the Carnegie Foundation for the Advancement of Teaching (n.d) on productive persistent, the System dialogue was scaled up in September 2015 to include faculty across the system. Looking at the Carnegie factors in relation to TBR co-requisite remediation students' survey responses, non-cognitive factors were associated with a higher sense of belonging or "fit" to the institution, the college experience, faculty engagement and perceived relevancy of their studies. In the future we will study any interactions between these factors and retention, degree completion and career engagement. Trainings for faculty, administration and student affairs personnel across the institutions continued in 2015-2016 with institutions assessing their organizational need for change in four essential practice areas based on the survey results. The areas included:

- Building self-efficacy in students;

- Building a sense of belonging in the institutions;
- Developing a more growth oriented mindset in students and faculty; and
- Developing a perception of relevancy in coursework.

The challenge is to identify interventions that hold the promise of positively influencing the academic mindset facets identified in the work at scale. That said, there are scientifically grounded techniques which suggest many possibilities. Researchers such as Walton and Yeager and the efforts of the Carnegie Foundation for the Advancement of Teaching's work on Productive Persistence and the Project for Education Research That Scales (PERTS) at Stanford University have broadened the conversation to explore sound classroom interventions which can change a student's perception of their learning experience.   There are brief and inexpensive "mindset" interventions with large and enduring effects in both K-12 and 4-year college settings (Yeager & Walton, 2011) available. Walton and Cohen (2011) demonstrated an intervention as brief as one hour with college freshmen, which was aimed at decreasing their fears about social belonging, that is correlated with improved GPA over the subsequent three years and decreased performance gaps by nearly 80% for African American students who participated in the intervention in comparison to African American non-participants. Global encouragement, substantive feedback including "constructive criticism" and "wise feedback," as well as criticism paired with high standards and assurance, can have a major impact on promoting student success (Yeager, Purdie-Vaughans, Garcia, Apfel, Brzustoski et al., 2013). Paying attention to the nature of information (i.e., "constructive criticism") provided by an individual (e.g., teacher, peer, and parent) regarding aspects of a student's performance or understanding in response to performance has been shown to improve student outcomes (Hattie & Timberley, 2011; Yeager et al., 2013). Yeager et al.'s (2013) research clearly points to the power of instructor feedback with what appears to be an easy application of a social-psychological intervention. Cohen, Garcia, Purdies-Vaughans, Apfel, and Brutoski (2009) and Sparks (2014) propose a number of actions for faculty on how to develop clean interventions with embedded manipulations checks allowing the faculty to determine if the student was aware of what occurred and

receptive to change, if the encouragement level was on target, and since the time for change to occur varies, if the next faculty member sees an effect that is not perceived by the initiating faculty member.

The PERTS at Stanford University offers innumerable resources for faculty interested in trying out mindset in their classes as an avenue to learning. The use of these kinds of interventions requires training and buy-in from teachers and the testing of practices rather than blind adoption. Learning practices shown to be beneficial for K-12 students must be empirically supported in order to demonstrate their actual role in college and university student success. The TBR is compiling a guide to assist in incorporating these interventions, many of which have been used exclusively in K-12 settings, to the higher education classroom.

The focus on the psychology of the student does not devalue the importance of the quality of instruction and subject matter expertise of the faculty or even institutional resources. Lin-Siegler, Ahn, Chen, Fang, and Luna-Lucero (2016) suggest that by having students focus on their abilities while secure in their beliefs, they perceive that they fit in the institution allowing them to get past all the distractions which impede learning. Thus, they can benefit from what the faculty and school have to offer whether minority or majority students. Starting with students' beliefs in their own abilities coupled with the school setting, their sense of fit and belonging, as well as their level of trust in their teachers' respect and understanding of them determines how worthwhile they conceptualize it is to invest in their studies. Stein (2014) and subsequent researchers have shown that when students are encouraged for their efforts, they tend to put forth the effort it takes to rise to the challenge. Shaping students' beliefs about their higher education experience when they begin underprepared, can influence academic motivation and performance. Teach students and having mindful faculty who to ask questions such as "What am I missing?", "Can I try something different?", "This could take a while to figure out but that's okay", "What's plan B?", and "What can I learn from my peer?" can change students' and faculty learning lenses.

While learning is the students' responsibility, the faculty have a responsibility to not only impart their disciplinary knowledge but to help students change their negative

narratives by providing strategies which guide students through a productive learning process in various domains. Fostering growth mindset in African American students has been shown to result in greater enjoyment of the academic process, higher levels of academic engagement, and significantly higher grades even when controlling for SAT scores (Aronson, Fried & Good, 2001). Helping students understand how college differs from high school (e.g., difficulty level, faster timeframe, work outside of class), to value the knowledge, skills and attitudes needed to adapt to post-secondary education including the library writing center and advising system, the ability to follow instructions, think critically, manage time, and the need to become and active learner who engages in assignments and activities is the process to the future (Appleby, 2014). Duckworth , White, Matteucci, Shearer, and Gross (2016) found situation-modification strategies to assist college students who wanted to do well in school but struggled to avoid temptation by the other attractions of college life. Their research identified the gap between student's long range academic goals and their short term actions which get in the way of these goals. The practice of situation-modification strategies when the student was aware of the effectiveness of the strategy was more successful in increasing study time and academic performance.

Given these options, the question remains how faculty might be able to create an environment to support students taking charge of their own learning and ultimately demonstrating progress on the path to completion and reduced time to degree attainment, whilst also bearing in mind that the mindset that faculty bring to the process may also play its part. The halo-effect connection between the way in which a teacher regards their student and that student's performance is well studied. Yet furthermore teachers with a fixed mindset, low achievers will always remain low achievers. Building a growth mindset is not achieved simply by scaffolding interventions. Instead this appears to require a new approach to living and teaching. Indeed it is intriguing to think how many of the mindset facets discussed here are conveyed through the construction of the course syllabus, or even the grading scheme. Can a growth-mindset oriented course have a grade calculated from an equally weighted midterm and final exam? The message of belonging conveyed by an early high-stakes test may be a powerful self fulfilling prophecy. As challenging as this work appears the potential gains suggest that

it is well worth the struggle. The findings also suggest that, in addition to the recent increased emphasis on encouraging student grit and growth mindset, significant impacts on student success might be realized by finding ways to improve student perception of purpose, and their confidence in interacting with faculty. In general, the findings contained in this work seem to suggest that mindset-centric instruction and a deliberate focus on pedagogies and extracurricular strategies that positively impact the non-cognitive factors discussed here hold the promise of enabling much greater academic success for traditionally "at risk" student populations regardless of preparation.

Note: For further information concerning this study or other student success initiatives in the Tennessee Board of Regents contact Dr. Tristan Denley, Vice Chancellor for Academic Affairs, tristan.denley@tbr.edu

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