

**Experimental Evidence that Wide-Brush Nudging Does Not Help At-Risk First-Year  
College Students' Academic Outcomes**

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## **Background/Context**

Nudging can be a low-cost treatment to modify student behavior (Castleman, et al., 2017). Nudging has been widely adopted in education settings in recent years; since 2016, 57 studies have been published about academic nudging interventions (Damgaard & Nielsen, 2018). Our study is influenced by the growing research that examines how higher-education institutions communicate with students (Castleman et al., 2014a) and the understanding that lower-to-moderate SES college students need an increased number of institutional supports (Goldrick-Rab, 2016).

## **Objective**

We designed an intervention to nudge at-risk freshmen to engage specific campus resources at times in the academic year when those resources would be useful. Our treatment joins other experimental evidence for wide-brush nudges that failed to benefit students (see Gurantz, et al., 2019) on academic outcomes. Our key questions were:

1. Will an intervention that encourages uptake of a variety of campus supports impact at-risk, first-year student academic performance/persistence?
2. Does the intervention influence students' pre-to-post experience non-cognitive attributes?

## **Setting**

This study was conducted at Western Michigan University (WMU), an urban-placed, research intensive regional public institution. The Fall 2018 student body at WMU was predominantly White (68%) and male (51%), had an incoming high school GPA of 3.36, and flowed to the institution from neighborhoods with average adjusted gross income of \$72,000. This study was funded by a Department of Education First in the World Grant and we have IRB approval to identify the institution.

## **Sample**

A high-school's free-and-reduced price lunch (FRL) percentage indicates a combined degree of economic and academic (dis)advantage (Domina, et al., 2018). At WMU, students from schools with higher shares of students eligible for FRL experience more academic challenges than their peers. The average FRL of incoming students is 24%; with every increase of 19 percentage points, students are at 13 times higher odds of experiencing an academic probation, 7 times higher odds of dismissal, and less than one-fifth the odds of earning a degree (Authors, 2019a). In Fall 2018, we identified all WMU freshmen from high schools with at least 50% FRL (U.S. Department of Education, 2018), providing us  $N=568$  students, 13% of the incoming student population.

## **Treatment Design**

We tailored nudges to help students make use of already-available but under-utilized services on campus (e.g., Invisible Need and food pantries, academic units), and to influence time-sensitive behaviors like re-filing a FAFSA. This study tests two communications media - email and texting - versus no communications, and against each other. Communications for the email treatment were pushed to students via the Director of Research Initiatives for Success at WMU's campus email, and for text-messages via Remind by the same person. This administrator was an already-known point of contact for incoming students via an overarching campus-wide

initiative. We employed a predictable nudging schedule - communications were pushed bi-weekly, Tuesday mornings at 10 a.m. with the same subject line ‘CRICPE - Additional Campus Communications’. The first message was pushed to students October 16<sup>th</sup> and nudges continued until the end of the Spring 2019 semester. When nudging students to visit on-campus supports, active website links were embedded in the email and text messages. See Appendix A3 for message content and schedule.

## **Research Design**

External evaluators from Abt Associates randomly assigned students (at the individual level) into three groups: Email communications (n=189), Text communications (n=193), and Control (n=186). Each group is statistically similar across demographic and other observable characteristics (see Appendix Table A1 for balance tests).

## **Data Sources and Analysis**

Via institutional research we accessed students’ demographic and high school performance data. Using external databases, we joined urbanicity percentages and average adjusted gross income to permanent resident zip codes, and high school FRL%. We surveyed students in both fall and spring on nine non-cognitive constructs: amotivation, conscientiousness, cognitive engagement, peer-group interaction, faculty interaction, staff interaction, financial stress, psychological distress, and food insecurity. See Appendix Table A2 for IR variables, database joins and citations, and survey scales with study alphas.

We calculated intent-to-treat (ITT) differences between the control and treatment arms, and combined treatment arms and the treatment-on-treated (TOT) for the text message group. TOT was not calculated for the email group as university emails were used to communicate and the research team was unable to tabulate who may have marked emails as spam. In contrast, students had to join the remind texting group (68% joined). Due to low post-experience survey participation we used multivariate imputation via chained equations as described by van Buren et al. (2006) to conduct multiple imputation (10 copies of the overall dataset) and used Rubin’s (1987) rules to combine estimates to properly account for variance due to imputation. See Table 3 for more methods notes.

## **Findings**

Our intervention produced results statistically indistinguishable from no effect on all student performance and persistence outcomes and on almost all post-experience non-cognitive measurements. The email treatment helped students become more food secure by nearly half a category (see Appendix Table A1, Note 3 for categories). However, due to the multiple comparisons involved, and the use of imputed data, this finding should be treated as encouraging but exploratory – requiring follow-up confirmatory testing.

## **Conclusion**

Given emergent trends further highlighted here (see Bird, et al., 2019; Oreopoulos, et al., 2019), we caution stakeholders against creating new nudging protocols that encourage students to take actions across multiple domains. Instead, nudging seems more likely to show results if stakeholders (a) use nudging protocols about a single topic that have been previously validated as effective, or (b) develop and test a nudging protocol that has multiple messages focused on a single activity or outcome, modeled on validated instruments. Still, the programmatic details of

an effective nudging intervention are not yet settled. Stakeholders interested in developing nudges should temper expectations of shifting global performance/persistence outcomes, instead embracing nudges as a tool for shifting narrowly-defined student behaviors.

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Table 1 – Intent-to-Treat (ITT) estimates, adjusting for covariates

Outcome	Control			Email Treatment				Text Treatment				Combined Treatment			
	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>p</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>p</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>p</i>
Fall GPA	2.65	1.11	186	2.71	1.10	192	.579	2.72	1.06	188	.482	2.72	1.08	380	.434
Spring GPA	2.57	1.14	165	2.65	1.22	161	.510	2.62	1.14	176	.672	2.64	1.18	337	.501
Overall GPA	2.71	0.99	165	2.84	0.94	161	.186	2.76	0.95	176	.632	2.80	0.94	337	.275
Persist to Spring semester	0.89	0.32	186	0.83	0.37	193	.122	0.93	0.25	189	.167	0.88	0.32	382	.802
Enrollment past Spring	0.60	0.49	186	0.61	0.49	193	.828	0.72	0.45	189	.014	0.67	0.47	382	.124
Probation status ever	0.29	0.46	186	0.29	0.45	192	.994	0.30	0.45	188	.792	0.29	0.45	380	.916
Cumulative WMU credits earned	24.82	9.14	165	25.64	9.08	161	.347	24.18	7.68	176	.426	24.88	8.38	337	.937
Spring credits attempted	13.81	2.20	165	13.71	1.97	161	.644	13.72	2.29	176	.696	13.70	2.14	337	.575

<sup>1</sup>ITT analysis without adjusting for covariates yields the same results – in that the only significant finding remains enrollment past spring between control and the text treatment group ( $p=.012$ ).

Table 2 – Estimates of the effect of treatment on treated (TOT), adjusting for covariates

Outcome	Control			Text Treatment			<i>p</i>
	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	
Fall GPA	2.65	1.11	186	2.74	1.10	192	.573
Spring GPA	2.57	1.14	165	2.69	1.22	161	.503
Overall GPA	2.71	0.99	165	2.90	0.94	161	.180
Persist to Spring semester	0.89	0.32	186	0.80	0.37	193	.117
Enrollment past Spring	0.60	0.49	186	0.62	0.49	193	.825
Probation status ever	0.29	0.46	186	0.29	0.45	192	.994
Cumulative WMU credits earned	24.82	9.14	165	26.06	9.08	161	.339
Spring credits attempted	13.81	2.20	165	13.66	1.97	161	.638
Fall GPA	2.65	1.11	186	2.74	1.10	192	.573

<sup>1</sup> Students must opt into the Remind group, of which N=132 joined (68% of the students randomized into the text communications). The university email system did not allow us to examine who opened emails or if they went to spam folders, limiting our understanding of who may have opted in. Therefore, there is only a TOT for the text treatment group and not the email treatment group.

Table 3 – Linear Regressions Estimating Students’ Post-Experience Non-Cognitive Factors

	Conscientiousness	Amotivation	Faculty Interaction	Staff Interaction	Peer Interaction	Cognitive Engagement	Financial Stress	Psych Distress	Food Insecurity
Text	0.02	0.06	-0.01	0.01	-0.0361	0.03	0.06	-0.02	-0.01
Treatment	(0.18)	(0.25)	(-0.09)	(0.09)	(-0.26)	(0.38)	(0.36)	(-0.13)	(-0.14)
Email	-0.03	0.07	-0.04	-0.02	-0.0228	-0.00	0.02	-0.00	-0.44***
Treatment	(-0.26)	(0.32)	(-0.36)	(-0.19)	(-0.17)	(-0.03)	(0.11)	(-0.03)	(-4.15)
Pre-Experience Score	0.50**	0.71**	0.19	0.29	0.466**	0.37	0.52	0.68**	
	(3.55)	(3.40)	(0.54)	(1.30)	(3.20)	(1.56)	(1.93)	(3.46)	
SAT/ACT Z-Score	-0.08	-0.20	-0.01	-0.09	0.0898	0.07	-0.07	0.15	0.06
	(-0.58)	(-1.03)	(-0.06)	(-0.58)	(0.46)	(0.60)	(-0.26)	(0.84)	(1.05)
High School GPA	0.11	0.40	-0.27	-0.24	-0.0462	0.14	-0.03	0.05	-0.27**
	(0.77)	(0.88)	(-1.03)	(-0.90)	(-0.18)	(1.10)	(-0.07)	(0.19)	(-3.13)
Neighborhood AGI	-0.00	0.00	0.00	0.00	-0.00840	-0.01	-0.01	0.00	0.00***
	(-1.73)	(0.27)	(0.55)	(0.09)	(-1.06)	(-2.02)	(-0.85)	(0.21)	(3.75)
Urban Only	-0.01	-0.09	-0.74	-0.79	0.177	0.00	-0.68	-0.12	1.41***
	(-0.03)	(-0.09)	(-1.33)	(-1.39)	(0.25)	(0.01)	(-1.10)	(-0.11)	(8.47)
Mixed Urbanicity	-0.27	0.11	-0.73	-0.84	0.232	-0.18	-0.86	-0.09	0.74***
	(-0.59)	(0.11)	(-2.01)	(-1.84)	(0.33)	(-0.55)	(-1.55)	(-0.09)	(4.51)
Constant	2.00	-0.60	4.36**	4.04**	2.157	2.38*	2.71	1.03	0.90*
	(1.96)	(-0.29)	(3.91)	(3.78)	(1.22)	(2.29)	(1.17)	(0.69)	(2.53)
Observations	485	485	485	485	485	485	485	485	711

<sup>1</sup> *t*-statistics in parentheses

<sup>2</sup> Pre-Experience Score means the score of the Pre-Experience of the DV. If DV is Amotivation, Pre-Experience score is Amotivation

<sup>3</sup> Food Insecurity regression used pre-food insecurity score as a placebo – hence no Pre-Experience Score and unique observation total

<sup>4</sup> We used multivariate imputation via chained equations as described by van Buren et al. (2006) to multiply impute 10 copies of the overall dataset and used Rubin’s (1987) rules to combine estimates to properly account for variance due to imputation.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$



Table A1 – ANOVA: Randomization Balance – IR Variables and External Data

Variable	Group	Mean	SD	N	df	F	p
Residency AGI	Email	\$49,530.00	\$16,090.00	189	2	1.65	
	Control	\$52,170.00	\$21,920.00	186			
	Text	\$48,760.00	\$18,880.00	193			
Urbanity %	Email	85.15	22.63	189	2	1.57	
	Control	89.07	19.35	186			
	Text	86.22	24.17	193			
Female	Email	0.56	0.50	189	2	0.05	
	Control	0.57	0.50	186			
	Text	0.57	0.50	193			
Person of Color	Email	0.59	0.49	184	2	0.30	
	Control	0.56	0.50	182			
	Text	0.60	0.49	192			
Transfer Student	Email	0.30	0.46	189	2	2.08	
	Control	0.22	0.41	186			
	Text	0.30	0.46	193			
ACT	Email	20.28	4.72	65	2	0.04	
	Control	20.10	4.38	48			
	Text	20.34	4.41	59			
SAT	Email	1035.00	136.30	165	2	0.72	
	Control	1032.00	124.80	149			
	Text	1016.00	151.70	136			
HSGPA	Email	3.34	0.54	161	2	0.14	
	Control	3.18	0.61	165			
	Text	3.31	0.76	162			
2018 Fall Registered Credits	Email	13.50	2.30	188	2	0.16	
	Control	13.48	2.21	186			
	Text	13.38	2.27	192			

<sup>1</sup>Once these students from high-FRL schools were identified, an email was sent to their university accounts and text message via Remind to supplied phone numbers for an IRB approved “opt out” communications. The communication informed students if they remained in the study immediate gift-card and a future lottery-style was available. Zero students responded to the opt out in the 3-day timeframe. After the sample was identified, we engaged external consultants at Abt for randomization. Randomized occurred on an individual level (not within groups) based upon gender, race, high school academic achievement measurement (combining GPA and standardized test scores), and high school free-and-reduced lunch percentage.

Table A2 – Data Sources and Survey Constructs

	<b>Institutional Research</b>		<b>Pre-Exp Alpha</b>	<b>Post-Exp Alpha</b>
Race/Ethnicity				
Gender				
Age				
Transfer Status				
High School GPA				
High School Code				
Permanent Residence Zip Code				
	<b>Survey Items<sup>4</sup></b>			
Highest Level of Guardian(s) education <sup>1</sup>				
	<b>Survey Scales</b>			
AMS-C – Amotivation Sub-Scale	4-Item, 7pt Likert	Vallerand, et al. (1992)	.82	.91
BFI-2-S – Conscientiousness	6-item, 5pt Likert	Soto & Oliver (2017)	.77	.76
Cognitive Engagement	10-item, 5pt Likert	Gunuc & Kuzu (2015)	.84	.80
Peer-Group Interaction	7-item, 5pt Likert	Pascarella and Terenzini (1980)	.86	.91
Faculty Interaction	4-item, 5pt Likert	Pascarella and Terenzini (1980)	.82	.77
Staff Interaction <sup>2</sup>	4-item, 5pt Likert		.87	.83
Financial Stress	6-item, 5pt Likert	Lim, et al. (2014)	.86	.85
K6-Kessler Psychological Distress	6-item, 5pt Likert	Kessler, et al. (2002)	.88	.90
Food Security Scale <sup>2</sup>	6-item, Affirmative	USDA (2012)	.83	.84
	<b>Joins from External Databases</b>			
Urbanicity Percentage to Perm Residence Zip Code	Zip Code	Census Bureau (n.d.)		
Neighborhood AGI to Perm Residence Zip Code	Tabulation Area (ZCTA)			
High School FRL% to High School Code	Statistics of Income Database (SOI)	U.S. Internal Revenue Service (n.d.)		
	Common Core of Data (CCD)	U.S. Department of Education (2018)		

<sup>1</sup> For parental education, if neither guardian had a Bachelor’s degree we coded a variable denoting first-generation status.

<sup>2</sup> We modified the 4-item construct replacing “faculty” with “staff” to separately gauge intent to interact with non-faculty.

<sup>3</sup> Scoring is based on the number of affirmative responses, the categorizations are as follows: 0 = High Food Security, 1 = Marginal Security, 2-4 = Low Security, 5-6 = Very Low Food Security.

<sup>4</sup> Fall survey response rates were: (1) Email ( $n=34$ , 18%), (2) Text ( $n=38$ , 20%), and (3) Control ( $n=27$ , 15%). From April to May 2019, we collected post-experience survey data with the following response rates: (1) Email ( $n=21$ , 11%), (2) Text ( $n=34$ , 18%), and (3) Control ( $n=27$ , 15%).

### A3 – Message Schedule

#### 1. Fall

- a. Oct 2<sup>nd</sup> – Registration is soon upon us – click [HERE](#) to see which day you’re eligible to register. Have you met with your academic advisor lately? Make sure to keep in contact with your faculty or staff advisors to ensure you’re on the road to graduation.
- b. Oct 16<sup>th</sup> - Check out the [Writing Center](#)! Strong writing skills are important for your future college and career success. The Writing Center can help you improve your papers for ANY class!
- c. Oct 30<sup>th</sup> - Have you met with your SWMU peer mentor lately? They are helpful guides for finals prep! Also, check out the [supplemental instruction](#) provided by WMU.
- d. Nov 13<sup>th</sup> - Feeling stressed? [Sindecuse Health Center](#) offers massage therapy and wellness workshops. They also offer health education and counseling for all students.
- e. Nov 27<sup>th</sup> – Two weeks to go until finals. Make sure to start studying ahead of time and develop strong self-care habits. If you need help with preparing for finals, please respond.
- f. Dec 10<sup>th</sup> (Finals Week) – Good luck with your finals. If you need any type of assistance, please let us know. Congratulations on finishing strong!

#### 2. Spring

- a. Jan 8<sup>th</sup> – Welcome Back! If you need any assistance regarding academics, finances, health, or socio-emotional support, please let us know by responding to this (text/email) at any time and we will soon respond.
- b. Jan 22<sup>nd</sup> – If you find yourself needing financial or food assistance, please check out [Invisible Need](#), located on campus. Also, don’t forget the FAFSA is due in a few weeks – plan to talk with financial aid about next steps.
- c. Feb 5<sup>th</sup> – Struggling with a subject or class? Need a tutor or refresher? Check out what the [Study Zone](#) offers and the [drop-in tutoring schedule](#). Don’t forget Summer I & II Registration opens Feb 11<sup>th</sup>.
- d. Feb 19<sup>th</sup> - Strong writing skills are important for college and career success. The [Writing Center](#) can help you improve your papers!
- e. Mar 12<sup>th</sup> – Don’t forget Sindecuse [Health Center](#) is here to help you with stress or health-related concerns. Fall 2019 Registration opens March 18<sup>th</sup>!
- f. Mar 26<sup>th</sup> - Don’t forget internships are important experiences – check out the [Career Center](#) for internship openings, interviewing/resume advice, and more.
- g. April 9<sup>th</sup> - Have you met with your peer mentor lately? They are helpful resources for planning your second year. Now is a good time to check in with your academic advisors too! Make sure you’re on the right track.
- h. April 23<sup>rd</sup> (Finals Week) - Good luck with your finals. If you need any type of assistance, please let us know. We wish you an excellent Summer-break.