AEA Papers and Proceedings 2023, 113: 514–518
https://doi.org/10.1257/pandp.20231048

Messages That Foster a Sense of Belonging Improve Learning and Satisfaction: An Experiment in an Online Environment†

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The literature in pedagogy has shown that having a sense of belonging affects learning (Walton and Cohen 2011). Like engagement, belonging can be fostered through learner-to-learner, learner-to-content, or learner-to-instructor interactions. However, the most critical interaction for belonging is that between the professor and the student (Martin et al. 2019).

This paper shows the result of a communication experiment in an online environment. For five consecutive terms ($N = 143$), the instructor taught Introduction to Statistics using a set of learning strategies: retrieval practice, alignment of objectives, and a well-organized course. The instructor added a more direct communication strategy during two of those five terms ($n = 58$). She used weekly communications that linked course material with current events discussed by students the previous week and a personal message tailored to each student. This intervention was meant to communicate to students that they are being heard and are valued and respected. The messages contributed to solving cognitive challenges identified in the literature of teaching economics: student mental mindset and student fear and mistrust (Chew and Cerbin 2021).

The difference-in-difference analysis resulted in improved learning, measured by better grades in exams and discussions, and more enjoyment of the course, measured by student comments. The result is most significant for weaker students. Presumably, more vulnerable students increased the amount of effort invested in statistics as a result of the messages, as suggested by Allgood and McGoldrick (2020). This experiment took place in the summer of 2020, fall of 2020, spring of 2021, summer of 2021, and fall of 2021 during the COVID-19 pandemic.

I. Teaching Online Economics

Decades of research and practice in online learning had a tremendous use due to COVID. The course where this experiment takes place was designed to be online from its origins. This course is not a live stream of an in-person lecture. The course fulfills the characteristics of excellence in online learning as described by Martin et al. (2019). The course is aligned by learning outcomes (Allgood and Bayer 2017), utilizes retrieval practice (Agarwal, Nunes, and Blunt 2021),[1] and uses a systematic design process (Martin et al. 2019).

Communication when teaching online is of particular importance since the format requires intentional and directed notifications via messages, videos, or other electronic means. The main strategies to strengthen the learner to instructor engagement are suggested to be regular messages (emails, texts, announcements) and instructor feedback on assignments (Martin et al. 2019). The treatment that the instructor uses in this experiment improves the regular weekly messages and directly affects learner-instructor engagement. Depending on the message and the student preferences and characteristics, it can also affect learner-to-content engagement.

Finally, the literature in teaching economics has "opened a black box," in the words of Allgood and McGoldrick (2020, 41), by dissecting a cognitive framework that allows

* University of Colorado Boulder (email: sara.avila@colorado.edu). I thank Alpna Bhatia for her support and aid keeping the data safe; Karen Gebhardt and Francisca Antman for their support in addressing the IRB Review; Rimjhim Saxena for the tips on tables; and the EDUCATE team for their support: KimMarie McGoldrick, Gail Hoyt, and Tisha Emerson in particular. Thank you to Tin-Chun Lin and Steve Schmidt for their comments on previous drafts. I am, of course, responsible for any remaining errors.

† Go to https://doi.org/10.1257/pandp.20231048 to visit the article page for additional materials and author disclosure statement.

[1] Retrieval practice is the strategy of trying to remember concepts or perform skills instead of passively reading or listening about them.

economic educators to understand the learning process. Chew and Cerbin (2021) identify nine cognitive challenges and, by doing so, provide clarity on the "black box," the way learning happens. Students face several cognitive challenges; "fear and mistrust" is the third challenge. A student who feels out of place or afraid is less likely to thrive in the learning process. Few efforts have been conducted in the economics literature to promote inclusion and diversity strategies. Al-Bahrani (2022) and Bayer et al. (2020) claim that establishing a supporting class climate that builds a sense of belonging is the first principle to foster diversity and inclusion in the economics classroom. The instrument presented in this paper attends to the challenge of fear and mistrust and fosters inclusion in the classroom.

II. The Experiment

Starting from the first day of classes, every Monday, the instructor sends a message to students to tell them about the material covered each week and remind them to complete the assignments.

The weekly message delivered during the control periods follows the format below (all names are hypothetical to preserve students' privacy):

Hello Class,

This week you are introduced to three new concepts: sampling, experiments, and ethics in the use of data. Here is the list of assignments for this week:

By Thursday at 11:59 *PM:*

- *Complete Problem Set* 5
- *Post a Comment on the Discussion*

By Sunday at 11:59 *PM:*

- *Complete Quiz* 6
- *Respond to a peer in the Discussion*

I am here in case you need me. Professor.

The treated weekly message had a different format:

Hello Class,

Sometimes we just get it. We do our readings and exercises, watch videos, solve the quizzes, and get things done.

However, sometimes we struggle because R did not get installed correctly (*Jason*)*, or because we are traveling to the other side of the world* (*Sophia*)*, or because we had a birthday to celebrate* (*Roan*)*, or we are working a lot* (*Jeff and Brian*)*, you name it. This week is like no other; you are introduced to three new concepts:* 1) *Sampling,* 2) *Experiments,* 3) *Biases in sampling and experiments.*

Given what you discussed in the past two weeks, I think you might be interested in learning a bit more about Behavioral Economics, biases, and how it's related to statistics.

Here is the list of assignments for this week:

By Thursday at 11:59 *PM:*

- *Complete Problem Set* 5
- *Post a Comment on the Discussion*

By Sunday at 11:59 *PM:*

- *Complete Quiz* 6
- *Respond to a peer in the Discussion*

Thank you for inspiring the topic of biases. I am here in case you need me. Professor.

The treatment message has three main features. (i) A record is kept to ensure that every student is mentioned in the general announcements by name at least once. (ii) The professor uses the comments from the previous week to steer the direction of the examples and discussions in the following week. Therefore, the dialogue is current and tailored to this particular cohort. (iii) Finally, the professor allows herself to enjoy the conversation; she "speaks" to students and believes they listen.

In the treated group, there is also a personalized message that is sent as soon as the midterm is graded.

Hello Cooper,

It is refreshing to have your opinion through the discussion posts! This message is to reach out to you as we head to the second part of the course.

You have turned in most assignments on time, and your current grade is a B−. I like your strategy of consistently solving quizzes. To further improve, try solving all the exercises as well; even if you don't succeed 100%*, they still count and allow you to practice. Also, review the videos where I solve problem sets because those videos match up closely with the content on quizzes.*

If you struggle with the weekly work or just want to check in, visit me during office hours, and we can discuss your questions.

Table 1—Covariates, Treated versus Control

Variable	Combined	Control	Treated	*p*-value
Female	0.146	0.117	0.189	0.35
	(0.03)	(0.03)	(0.05)	
International	0.349	0.341	0.362	0.79
	(0.04)	(0.05)	(0.06)	
White	0.58	0.6	0.55	0.56
	(0.04)	(0.05)	(0.06)	
African American	0.013	0.012	0.017	0.78
	(0.009)	(0.12)	(0.017)	
Hispanic	0.055	0.023	0.103	0.06
	(0.02)	(0.02)	(0.04)	
Observations	143	85	85	

Notes: *p*-value evaluates Ho: Treated − Control > 0. Standard errors in parentheses.

I may not often reach out to you directly, but know that I am paying attention to you. Professor.

Each student in the treated group received one personalized message, while the control group did not. The main features of the personalized message are that the professor is trying to see who the students are and that she gives a practical strategy to improve the grade. The essential message is "I see who you are, and I value and respect you, and I want to share this learning experience with you."

III. Data

As shown in Table 1, the population served by this online course is primarily male (86 percent), with 21 females out of 143 students. The racial composition in this course is 58 percent White. Thirty-five percent are international students, some from Europe (2), New Zealand (1), and Latin America (3), but mostly from Asia (44). There was only one African American in the control group and one in the treatment group.

Motivational and behavioral processes explain which students are more likely to select online courses instead of face-to-face. This self-selection responds to competing responsibilities such as family or work. However, our students are all younger than 24, mostly men, and mostly full-time students. The demographic composition of online students in this particular university has been consistent since 2019 and is likely influenced by the COVID pandemic. The treatment and control groups hold statistically equal demographics.

The content and materials of the course were designed from the beginning and were not modified during the time of the study. The final exam contained 30 questions randomly chosen from a test bank that covers all the course material. Each question was randomly chosen from among five possibilities of similar questions.

IV. Econometric Specification

This equation tests the effect of the treatment on student *i*'s cumulative final exam score:

$$(1)\quad Final_i = \gamma_0 + \gamma_1 Treated_i + \gamma_2 Summer_i + X_i'\beta + \epsilon_i,$$

where *Final* is the final exam grade, *Treated* is 1 when the student is part of the treatment group, β_i is a vector of parameters to be estimated, and ϵ_i is the error term.

The vector *X* contains elements that control for student ability and also demographics. For lack of a better measurement of skill, the control for student ability is the grade of the first assignment, Exercise 1. The demographic controls are "female," "international," and "White." The treated groups are the spring and summer 2021 terms, while the control groups are summer and fall 2020 and fall 2021. To make sure there is not a learning curve by the professor or students, I add a time trend. Finally, I added controls for the terms that take place during the summer.

The results of this section are shown in Table 2. In all regressions, the treatment coefficient is significant. In column 2, treatment and summer are the coefficients explaining final exam grades, and are both significant. However, none of the other parameters are significant in the rest of the columns. Using the significant results in columns 1 and 2, the effect of the treatment in exam grades is between 5.8 and 6.3 points.

I then explore a difference-in-difference model where I analyze exercises, quizzes, discussions, and exams. I assume that the first exercise, first quiz, first discussion, and midterm are the observations before treatment.

Then, I assume that the last exercise, last quiz, last discussion, and final exam are the posterior observations. Some of these observations were treated (those in spring and summer 2021) and

Table 2—Effect of Treatment on Final Exam

	(1)	(2)	(3)	(4)	(5)
Treatment	6.362	5.873	9.752	9.630	9.994
	(3.10)	(3.04)	(4.50)	(4.51)	(4.60)
Summer		Yes	Yes	Yes	Yes
Exercise 1			Yes	Yes	Yes
Time			Yes	Yes	Yes
Female				Yes	Yes
International					Yes
White					Yes

Notes: Standard errors in parentheses. $N = 143$. "Yes" means included in regression.

Table 3—Difference-in-Difference Estimation

	Exercises (1)	Quizzes (2)	Exams (3)	Discussions (4)
treated	0.069	0.340	5.029	−0.648
	(0.55)	(0.36)	(2.57)	(0.88)
post	−0.219	−0.52	−2.21	1.27
	(0.48)	(0.352)	(2.76)	(0.84)
treatment	−0.373	−0.215	1.072	2.657
× post	(0.52)	(0.46)	(3.01)	(1.02)
_cons	−0.219	−0.521	−2.211	0.812
	(0.31)	(0.27)	(2.16)	(1.69)

Notes: Standard errors in parentheses. $N = 143$.

some were not (those from summer 2020, fall 2020, and fall 2021).

I run four difference-in-difference estimations that can be algebraically represented as

$$Y_{it} = \alpha + \beta T_i + \gamma\{Post_t\} + \delta(T \times post) + \epsilon_{it}, \quad (2)$$

where Y_{it} is the grade of exercises, quizzes, discussions, and exams, one regression for each item. T_i is the treatment dummy variable, $Post_t = 1$ is if the observation was posterior, and δ measures the treatment effect. The third line of Table 3 shows the coefficient δ for each of those regressions. The treatment had a significant effect only for discussions. There was no effect on quizzes or exercises. The midterm was administered six weeks into the term, so we might assume that it is not really a pretreatment observation. However, the discussions were positively affected by these messages.

V. Results

There is no statistical difference between treated and control groups in demographics or ability. The intervention has a positive impact on exam grades as well as on the student's evaluation of the course.

A. *Quantitative Analysis*

The main regression, reported in Table 2, shows that the effect of the treatment has an impact of 6 out of 100 points in the cumulative final exam grade. Those students who belonged to the cohorts that received personalized, tailored messages had on average six more points on the final exam than their counterparts in the control group.[2]

The term when the course was taken (summer or not) and the student's ability (Exercise 1), gender, racial group, and international status do not affect the final exam grade.

There are several possibilities to explain why students in the treatment group are doing better on the final exam. The messages we used in this experiment lessen the fear and mistrust for the professor and the material (Chew and Cerbin 2021). They also promote a sense of belonging. However, these personalized messages also give practical feedback to help students improve their learning strategies. While we cannot establish which of these mechanisms is at work, we can assume that all of these factors may influence students' behavior. Finally, the experiment is not double-blind. The instructor knows which sections got treated and which didn't.

When being addressed and nudged to study, students put more effort into studying, translating into a better grade on the final exam and richer class discussions. This result is expected since discussions are the forum where human interaction occurs in online asynchronous courses. Discussions are particularly prone to the effect of our intervention since they constitute the public media in which students interact with each other and the instructor.

B. *Qualitative Outcome*

At the end of each term, students comment on the course and the instructor through a teaching

[2]The impact on final course grades is 4 out of 100 (p-value of 0.11).

evaluation. Using the simple average of course evaluations, the treated courses received a higher grade than the control group (see Table 4).

When counting positive and negative comments, the control group has a ratio of 24 positives versus 21 negatives, while the treated group has a ratio of 25 positives versus 13 negatives. Overall, there was slightly higher student satisfaction when messages were delivered. This positive result in teacher evaluation can be because grades are slightly higher with the messages and, thus, students are happier. However, the comments are explicit. For example, students write that "this was a safe, respectful environment" and a "great learning environment" and that "the professor cared for her students."

Table 4—Average Course Evaluation

		Average
Summer 2020	Control	4.00
Fall 2020	Control	3.86
Fall 2021	Control	3.85
Spring 2021	Treated	4.50
Summer 2021	Treated	4.44

VI. Implementation Comments

This experiment was implemented online, where human interaction must be conveyed through intentional messages using electronic means. In a face-to-face format, online messages might have a weaker influence because the professor's behavior in class becomes the most important communication venue between student and instructor. Writing personalized messages can be time-consuming. Having templates for different types of students could improve efficiency: those who are missing homework, those who haven't watched videos, and so on. Private information must never be disclosed in public messages. Finally, while some students may never need these type of messages, here is evidence that explicit kindness does have an impact on satisfaction and learning.

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