

Supplementary Appendices

Appendix A – Treatment Messages in the Field Experiment

We present the treatment messages in both English and mandarin Chinese in Table A1 below. The original treatment messages were written in Mandarin Chinese, and the English translation was cross-validated by several bilingual speakers to ensure accuracy.

Table A1. Treatment Messages in English and Mandarin Chinese

<i>Group</i>	<i>Treatment Message (English)</i>	<i>Treatment Message (Mandarin Chinese)</i>
Simple CTA /Control group	Dear, The course assignments have been released. Please finish the assignment as soon as possible! <i>Xuetangx.com</i>	亲, 课程作业已发放, 尽快完成课程作业吧! 学堂在线
Deadline reminder	Dear, The course assignments have been released. Please finish the assignment as soon as possible (due March 27)! Prevent work from piling up! <i>Xuetangx.com</i>	亲, 课程作业已发放, 尽快完成课程作业吧 (3月27日之前)! 才不会事情越积越多哦! 学堂在线
High descriptive norm	Dear, The course assignments have been released. About 69% of the course participants have finished the assignment! Please finish the assignment as soon as possible! <i>Xuetangx.com</i>	亲, 课程作业已发放, 有超过 69% 的同学已经完成了课程作业, 尽快完成课程作业吧! 学堂在线
Low descriptive norm	Dear, The course assignments have been released. About 31% of the course participants have finished the assignment! Please finish the assignment as soon as possible! <i>Xuetangx.com</i>	亲, 课程作业已发放, 有超过 31% 的同学已经完成了课程作业, 尽快完成课程作业吧! 学堂在线
Financial incentive	Dear, The course assignments have been released. Please finish the assignment as soon as possible to enter money sweepstakes! <i>Xuetangx.com</i>	亲, 课程作业已发放, 尽快完成课程作业可以参加金钱抽奖哦! 学堂在线
Hold-out group	N/A	--

Appendix B – Further Details of the Courses

**Table B1. Further Details of the Logic Course
(Syllabus for the First Three Chapters & Examples of Assignments)**

<i>Table of Contents (English)</i>	<i>Table of Contents (Mandarin Chinese)</i>
<p>Chapter 1: What is Logic?</p> <ul style="list-style-type: none"> • Logic and the study of Logic • Inference and modus of inference • Effective modus of inference • Characteristics of Logic • Basic principles of Logic • How Logic relates to other disciplines • About this course "Introduction to Logic" <p>→ Chapter 1 Assignments</p> <p>– Chapter 1 Sample Question: "Economic development has its internal logic. Once it violates its internal logic, the economy will have big problems. For more than 30 years since the reform and opening, China's economic development has been following the investment-driven, resource-consuming and cheap labor-intensive logic, and thus a miracle of rapid economic growth has been created. However, this logic might result in unsustainable economic development. China is now a diversified, complex and gigantic economy. Only by correctly identifying the new logic of economic development in the future and actively adapting to it can the Chinese economy maintain steady and healthy development." The terms "logic" in the above paragraph and the "logic" in the Logic course are:</p> <p>A: Exactly the same B: Closely related C: Completely unrelated</p>	<p>第一章: 什么是逻辑学</p> <ul style="list-style-type: none"> • 逻辑和逻辑学 • 推理和推理形式 • 有效推理形式 • 逻辑学的特点 • 逻辑学的基本准则 • 逻辑学和其他学科的关系 • 关于本课程《逻辑学概论》 <p>→ 第一章作业</p> <p>– 第一章例题: “经济发展有其内在的逻辑, 一旦违背其内在逻辑, 经济就要出大问题。改革开放以来的三十多年, 中国经济发展的逻辑是投资驱动、资源消耗和廉价劳动力, 从而创造了经济高速增长的奇迹。但这是不可持续的经济发展逻辑。现在的中国是一个多元、复杂而庞大的经济体, 必须找准其未来经济发展的新逻辑, 积极适应, 才能够让中国经济保持平稳而健康的发展。” 以上这段文字中的“逻辑”与逻辑学中的“逻辑:”</p> <p>A: 完全一致 B: 有密切关系 C: 没什么关系</p>
<p>Chapter 2: The Emergence and Development of Logic</p> <ul style="list-style-type: none"> • Ancient Chinese logic thought (I) • Ancient Chinese logic thought (II) • Ancient Chinese logic thought (III) • Ancient Indian logic • Ancient Greek and Medieval logic 	<p>第二章: 逻辑学的产生和发展</p> <ul style="list-style-type: none"> • 中国古代逻辑思想 (上) • 中国古代逻辑思想 (中) • 中国古代逻辑思想 (下) • 印度古代逻辑 • 古希腊和中世纪逻辑

<ul style="list-style-type: none"> • Modern Western logic • The introduction and implementation of mathematical logic • The development of mathematical logic <p>→ Chapter 2 Assignments</p> <p>– Chapter 2 Sample Question: “The person who conducted the representative work of classical logical propositional calculus and predicate calculus is:”</p> <p>A: Leibniz B: Boole C: De Morgan D: Frege E: Russell and Whitehead</p>	<ul style="list-style-type: none"> • 近代西方逻辑 • 数理逻辑的提出和实现 • 数理逻辑的发展 <p>→ 第二章作业</p> <p>– 第二章例题: “作出经典逻辑命题演算和谓词演算代表性工作的是:”</p> <p>A: 莱布尼茨 B: 布尔 C: 德·摩根 D: 弗雷格 E: 罗素和怀特海</p>
<p>Chapter 3: Propositional Conjunction and Basic Forms of Inference</p> <ul style="list-style-type: none"> • Inference and proposition • Basic proposition and compound proposition • Common propositional conjunction and basic forms of inference (1) • Common propositional conjunction and basic forms of inference (2) • Common propositional conjunction and basic forms of inference (3) • Common propositional conjunction and basic forms of inference (4) • Common propositional conjunction and basic forms of inference (5) • Common propositional conjunction and basic forms of inference (6) • Common propositional conjunction and basic forms of inference (7) <p>→ Chapter 3 Assignments</p> <p>– Chapter 3 Sample Question: “Propositions may be expressed in statements, but statements do not necessarily express propositions. Which of the following statements does not usually express propositions directly:”</p> <p>A: Declarative sentence B: Exclamatory sentence C: Interrogative sentence D: Rhetorical sentences</p>	<p>第三章: 命题联结词及其基本推理形式</p> <ul style="list-style-type: none"> • 推理和命题 • 基本命题和复合命题 • 常用命题联结词及其基本推理形式 (1) • 常用命题联结词及其基本推理形式 (2) • 常用命题联结词及其基本推理形式 (3) • 常用命题联结词及其基本推理形式 (4) • 常用命题联结词及其基本推理形式 (5) • 常用命题联结词及其基本推理形式 (6) • 常用命题联结词及其基本推理形式 (7) <p>→ 第三章作业</p> <p>– 第三章例题: “命题可用语句表达, 但语句不一定表达命题。以下哪种语句通常不能直接表达命题:”</p> <p>A: 陈述句 B: 感叹句 C: 疑问句 D: 反问句</p>

Notes: The Logic course contains twelve chapters of content in total. The field experiment covers the first three chapters of the Logic course. Thus, the above table presents the list of content and sample assignment questions in the first three chapters of the Logic course.

**Table B2. Further Details of the Psychology Course
(Syllabus for the First Three Chapters & Examples of Assignments)**

<i>Table of Contents (English)</i>	<i>Table of Contents (Mandarin Chinese)</i>
<p>Chapter 1: Introduction</p> <ul style="list-style-type: none"> • What is not Psychology? • Field of Psychological research • What is Psychology? • Experimental method of Psychology • Social approval and data collection • Experimental study design • Ethical issues <p>→ Chapter 1: Introduction – Exercises</p> <p>– Chapter 1 Sample Question: “Which of the following statements belong to psychological research (multiple choices):”</p> <p>A: The skull of a railroad worker named Gage was recently seen in a museum. Looking at its history, it turns out that he encountered an explosion accident during the construction process. A piece of iron passed through his skull from his left eye and pierced his brain, but then he came back to life. His temper greatly changed, and he became unable to control himself. Next to the computer are some of his recent 3D brains restored by computers.</p> <p>B: I heard Mr. Ming next door is a single older male who usually accompanied by mice in a small room in a tall building. His daily life is to randomly divide the experimental mice into two groups, one being drugged and the other not being drugged but fed with some powder similar to drugs. Then he let the mouse go to a maze. He was said to have taken notes of how long the mouse had walked.</p> <p>C: Mr. Wang likes to go to other people’s weddings recently. He did not give red envelopes (monetary gift) at the wedding, but let the married people see red: Before and after the wedding, the bride and groom and the bride and couple’s parents are drawn blood. It is said to study what is called oxytocin. It's strange that the groom, his father, and father-in-law have any oxytocin, as they don’t give birth.</p> <p>D: Recently I found out that a classmate has a special skill: palm reading. He can</p>	<p>第一章: 绪论</p> <ul style="list-style-type: none"> • 心理学不是什么 • 心理学研究领域 • 心理学是什么 • 心理学实验方法 • 社会赞许及数据采集 • 实验研究设计 • 伦理问题 <p>→ 第一章: 绪论 – 习题</p> <p>– 第一章例题: “下列说法中, 哪些事情属于心理学研究 (多选):”</p> <p>A: 最近在博物馆看到一个叫盖奇铁路工人的头骨。看了看历史, 发现他是在施工过程中遇到了爆炸事故, 一根铁钎从他的左眼穿过颅骨, 刺穿其大脑。但之后他居然活过来了, 就是性情大变, 变得不能自控。旁边电脑上最近的一些人用计算机还原的他的3D 大脑。</p> <p>B: 听说隔壁的小明是一位大龄单身男屌丝, 平时在一栋高大建筑的某个小房间里与老鼠为伴。他的日常生活就是将一批培养出来的老鼠随机分成两组, 一组磕药, 一组不磕药但也吃一些类似于药物的粉末; 然后把老鼠让到迷宫里走, 据说还拿表记老鼠走了多长时间。</p> <p>C: 老王这个人最近喜欢往别人婚礼上跑。去婚礼上也不送红包, 反而让结婚的人见红: 婚礼前和婚礼后分别给新郎新娘以及新郎新娘的父母抽血。据说是为了研究叫什么催产素的东西。真奇怪, 新郎和他老爸、岳父哪有什么催产素呀, 他们又不产。</p> <p>D: 最近发现有个同学会一个特殊的技能: 看手相。TA 能根据手相看出以前的情感经历, 预测以后的事业发展。还可以判断人的健康状况。别的不太</p>

<p>read previous emotional experiences based on the palm of hands and predict future career development. It is also possible to judge the health of a person. I don't know more, but this skill is so effective for striking up a conversation with people!</p>	<p>清楚，但这个技能用来搭讪简直太有效了！</p>
<p>Chapter 2: History of Psychology</p> <ul style="list-style-type: none"> • History of psychology <p>→ Chapter 2: History of psychology – Exercises</p> <p>– Chapter 2 Sample Question: “The history of psychology begins with:”</p> <p>A: The establishment of Plato's philosophical thought</p> <p>B: The establishment of Wundt's psychology laboratory at the university of Leipzig</p> <p>C: The establishment of Spinoza's theory of mind-body unity</p> <p>D: The Locke's theory of tabula rasa</p>	<p>第二章: 心理学历史</p> <ul style="list-style-type: none"> • 心理学的历史 <p>→ 第二章: 心理学历史 – 习题</p> <p>– 第二章例题: “心理学的历史起始于:”</p> <p>A: 柏拉图理念论心理学思想的创立</p> <p>B: 冯特在莱比锡大学建立心理学实验室</p> <p>C: 斯宾诺莎心身统一论的创立</p> <p>D: 洛克白板说的出现</p>
<p>Chapter 3: Sensation and Perception</p> <ul style="list-style-type: none"> • What is sensation? • The role of sensation • The nature of perception (1) • The nature of perception (2) <p>→ Chapter 3: Sensation and Perception – Exercises</p> <p>– Chapter 3 Sample Question: “Which of the following statements about the relationship between sensation and perception are true? (multiple choices):”</p> <p>A: The object of sensation is the individual attribute of things, and the object of perception is the whole attribute of things.</p> <p>B: The object of sensation is the whole attribute of things, and the object of perception is the individual attribute of things.</p> <p>C: Sensation is more subjective, and perception is more objective.</p> <p>D: Sensation is more objective, and perception is more subjective.</p>	<p>第三章: 感觉与知觉</p> <ul style="list-style-type: none"> • 感觉是什么 • 感觉的作用 • 知觉的特性 (1) • 知觉的特性 (2) <p>→ 第三章: 感觉与知觉 – 习题</p> <p>– 第三章例题: “以下关于感觉和知觉关系的说法哪些是对的? (多选):”</p> <p>A: 感觉的对象是事物的个别属性, 知觉的对象是事物的整体属性</p> <p>B: 感觉的对象是事物的整体属性, 知觉的对象是事物的个别属性</p> <p>C: 感觉更主观, 知觉更客观</p> <p>D: 感觉更客观, 知觉更主观</p>

Notes: The Psychology course contains a total of twelve chapters. The field experiment covers the first three chapters of the Psychology course. Thus, the above table presents the list of content and sample assignment questions in the first three chapters of the Psychology course.

Appendix C – Randomization Check

We performed the randomization checks to assess the validity of the randomization procedure. Specifically, we test for the mean differences across observable user demographics, including gender, age, location, education, occupation, and available information on users' behavior on the platform, such as user tenure and number of prior courses. As reported in Table C1 and C2, the randomization checks show no significant differences between any pair of groups in all observable aspects, suggesting that the randomization of the treatment groups is properly achieved.

Table C1. Randomization Check for Logic Course

Pairwise <i>t</i> -Tests	User Demographics					User Platform Behavior			
	Gend.	Age	Loca.	Educa.	Occupa.	Tenure	Ln(Tenure)	Prior Cours.	Ln(Pr. Cours.)
Deadline reminder vs. Simple CTA	0.950	1.000	1.000	0.998	1.000	0.993	1.000	0.998	0.766
High desc. norm vs. Simple CTA	0.699	0.921	0.991	0.973	1.000	0.965	0.905	1.000	1.000
Low desc. norm vs. Simple CTA	0.890	0.922	1.000	0.953	0.997	0.937	0.986	0.984	1.000
Financial incentive vs. Simple CTA	0.917	1.000	0.971	1.000	0.994	1.000	0.997	0.807	1.000
Hold-out vs. Simple CTA	0.828	1.000	1.000	0.997	0.979	1.000	0.970	0.998	0.525
High desc. norm vs. Deadline reminder	0.989	0.961	0.996	0.834	1.000	1.000	0.887	0.991	0.769
Low desc. norm vs. Deadline reminder	1.000	0.961	1.000	0.997	0.989	0.999	0.981	0.867	0.901
Financial incentive vs. Deadline reminder	1.000	1.000	0.951	0.998	0.998	0.995	0.998	0.526	0.732
Hold-out vs. Deadline reminder	0.999	1.000	1.000	1.000	0.952	0.995	0.962	1.000	0.999
Low desc. Norm vs. High desc. norm	0.999	1.000	0.991	0.576	1.000	1.000	0.999	0.995	1.000
Financial incentive vs. High desc. norm	0.997	0.912	0.741	0.971	0.978	0.970	0.647	0.877	1.000
Hold-out vs. High desc. norm	1.000	0.870	0.994	0.832	0.993	0.971	1.000	0.993	0.528
Financial incentive vs. Low desc. norm	1.000	0.914	0.972	0.948	0.900	0.945	0.859	0.993	0.999
Hold-out vs. Low desc. norm	1.000	0.872	1.000	0.999	1.000	0.947	1.000	0.875	0.710
Hold-out vs. Financial incentive	1.000	1.000	0.964	0.997	0.788	1.000	0.800	0.539	0.486

Notes: The Tukey's HSD pairwise test statistics are reported in the table.

Table C2. Randomization Check for Psychology Course

Pairwise <i>t</i> -Tests	User Demographics					User Platform Behavior			
	Gend.	Age	Loca.	Educa.	Occupa.	Tenure	Ln(Tenure)	Prior Cours.	Ln(Pr. Cours.)
Deadline reminder vs. Simple CTA	1.000	0.856	0.219	1.000	0.165	0.889	0.934	0.838	1.000
High desc. norm vs. Simple CTA	0.798	0.681	1.000	1.000	0.492	1.000	1.000	1.000	0.928
Low desc. norm vs. Simple CTA	0.994	1.000	1.000	0.993	0.975	1.000	0.999	0.957	1.000
Financial incentive vs. Simple CTA	1.000	0.735	1.000	0.982	0.998	0.835	0.846	0.977	0.999
Hold-out vs. Simple CTA	1.000	0.967	1.000	0.849	0.277	0.973	0.958	0.992	0.982
High desc. norm vs. Deadline reminder	0.683	0.999	0.331	1.000	0.998	0.772	0.961	0.920	0.934
Low desc. norm vs. Deadline reminder	0.999	0.724	0.193	0.994	0.583	0.970	0.990	0.999	1.000
Financial incentive vs. Deadline reminder	1.000	1.000	0.392	0.970	0.345	1.000	1.000	0.998	0.999
Hold-out vs. Deadline reminder	1.000	0.999	0.224	0.789	1.000	1.000	1.000	0.990	0.984
Low desc. Norm vs. High desc. norm	0.459	0.523	1.000	0.990	0.898	0.995	1.000	0.987	0.972
Financial incentive vs. High desc. norm	0.864	1.000	1.000	0.982	0.730	0.699	0.894	0.995	0.990
Hold-out vs. High desc. norm	0.696	0.975	1.000	0.842	1.000	0.916	0.978	0.999	1.000
Financial incentive vs. Low desc. norm	0.983	0.578	0.999	0.788	0.999	0.945	0.959	1.000	1.000
Hold-out vs. Low desc. norm	0.999	0.897	1.000	0.481	0.725	0.997	0.996	1.000	0.996
Hold-out vs. Financial incentive	1.000	0.988	1.000	0.996	0.496	0.998	0.999	1.000	0.999

Notes: The Tukey's HSD pairwise test statistics are reported in the table.

Appendix D – Treatment Validation

After the field experiment, the firm performed treatment validation using interviews and surveys. Six undergraduate students from a reputable research university in China, who are also users of *Xuetangx.com*, were recruited for the interviews. The interviews were conducted on *WeChat*, a popular messaging application in China. In the interviews, the interviewer presented the three treatment messages in sequence (i.e., deadline reminder, descriptive norm, and financial incentive), under a hypothetical scenario, and then asked a series of questions to gauge the students' perceptions of the treatments, such as whether the message would make them attentive to the deadline, and interested in planning ahead, whether they would perceive pressure to conform to the descriptive norm, or whether they would anticipate the financial reward, and how they felt each message would influence their behavior in terms of finishing an assignment quickly.

Upon reading the treatment message with the deadline reminder, the interviewees expressed that the message would make them feel that they had ample time to finish the assignment, and they could therefore afford to finish the assignment after some delay, just before the deadline. Interestingly, the interviewees also revealed that they did *not* feel the need to begin the assignment right away, and that it would be fine, as long as they began the assignment before the deadline. It is important to note here that, as part of the hypothetical scenario, students were not asked to imagine any outside course load. Given this, it is perhaps unsurprising that the students reacted with a sense of complacency when presented with the deadline information (the dominant behavior in response to our treatment, as revealed in our heterogeneity analyses).

When presented with the message containing the descriptive norm information, the interviewees reported that the message would make them aware that other students had finished the assignment already, and they would feel the need to also finish the assignment soon as a result.¹ In addition, the interviewees conveyed the feeling that they would want to catch up with their peers. Moreover, they

¹ We primarily used the high descriptive norm message in the manipulation check, considering that both high and low descriptive norm framings generate similar effects in the experiment without statistically significant differences.

reported a likely belief that if their peers could successfully complete the assignment, they would likely be able to do so as well. Finally, when presented with the treatment message about a financial incentive, the interviewees confirmed that the message would make them feel they might receive a financial reward from finishing the assignment as soon as or as early as possible. In conclusion, these interview-based manipulation checks suggest that the wordings employed in the treatment messages would be perceived the way we intended them.

Based on our qualitative findings from the interviews, we next conducted two debriefing surveys as further manipulation checks. The first survey employed a within-subjects design and was conducted with a sample of 147 active users of *Xuetangx.com*. The second survey used a between-subjects design and recruited another sample of 110 active users of the platform. There were no overlapping of users between the two surveys because i) the time gap between the two surveys are more than a year, ii) the high turnover of active users on *Xuetangx.com*, and iii) the users who had participated first survey were asked not to participate in the second survey. Except for the number of treatment messages a user encounters, both surveys contain the same measurement items and procedure.

We began the survey by presenting a preamble that asked the users to recall their most recent learning scenarios on *Xuetangx.com*, about which they would receive the notification message(s). After reading each notification message,² the users were asked to indicate their agreement with a series of statements on a 5-point Likert-type scale, ranging from strongly disagree, somewhat disagree, neutral, somewhat agree, to strongly agree. The survey included items (statements) reflecting the elements of temporal motivation theory and the users' responses from the interviews. We report the full list of survey items, in both English and mandarin Chinese, in Table D1. Since the survey participants were users of *Xuetangx.com* in China, the survey statements were originally written in mandarin Chinese. The English translation of the statements was also verified by multiple bilingual speakers to ensure precision.

² In the survey with a within-subjects design, the notification messages were presented in a random sequence to the users to control for the potential sequence effects. In the survey with a between-subjects design, each user was randomly assigned to read only one notification message in the survey.

Table D1. Survey Statements in English and Mandarin Chinese

<i>Statement No.</i>	<i>Survey Statement (English)</i>	<i>Survey Statement (Mandarin Chinese)</i>
A1-3	This message makes me feel that I still have time to finish the assignment.	这条消息让我觉得我还有时间完成作业。
B1-3	This message makes me feel that I don't have to finish the assignment right away.	这条消息让我觉得暂时不需要马上完成作业。
C1-3	This message makes me feel that I can plan to finish the assignment right before the deadline.	这条消息让我觉得可以计划在作业快要截止前完成作业。
D1-3	This message makes me feel that it will be fine as long as I finish the assignment before the deadline.	这条消息让我觉得截止日期之前完成作业就好了。
E1-3	This message makes me feel that the other students have finished the assignment.	这条消息让我觉得有其他同学完成作业了。
F1-3	This message makes me realize that the other students have finished the assignment, and I also need to finish the assignment soon.	这条消息让我意识到其他同学已经完成了作业，我也得赶紧去做了。
G1-3	This message makes me feel that I can also finish the assignment, just like the students who have finished the assignment.	这条消息让我觉得的我也可以和其他同学一样完成作业。
H1-3	This message makes me feel that I want to catch up with the students who have finished the assignment.	这条消息让我觉得我想追赶完成作业的同学。
I1-3	This message makes me feel that I might receive a financial reward from finishing the assignment.	这条消息让我觉得完成作业可能得到金钱奖励。
J1-3	This message makes me feel that I might receive a financial reward from finishing the assignment as soon as possible.	这条消息让我觉得尽快完成可能得到金钱奖励。
K1-3	This message makes me feel that I might receive a financial reward from finishing the assignment as early as possible.	这条消息让我觉得提早完成作业可能得到金钱奖励。

Notes: The full list of statements was presented after each of the three treatment messages. As a result, each statement was shown three times in the survey, e.g., A1, A2 and A3 in sequence.

After receiving the survey responses, we performed principle component analysis (PCA) with varimax rotation to test the dimensionality of the statements. The results of the principle component analyses suggest that the statements consistently load into three main components for each treatment message, with high inter-item reliability within each component (Cronbach's $\alpha > .70$). We report the PCA

results from the first survey with a within-subjects design in Tables D2a, b, and c, and the PCA results from the second survey with a between-subjects design in Table D3.

**Table D2a. Principle Component Analysis – Within-Subjects Design
Treatment Message: Deadline reminder**

<i>Statement No.</i>	<i>Component I</i>	<i>Component II</i>	<i>Component III</i>	<i>Cronbach's α</i>
A1	.451			.725
B1	.509			
C1	.491			
D1	.483			
E1		.555		.843
F1		.466		
G1		.545		
H1		.387		
I1			.551	.960
J1			.561	
K1			.553	

Notes: Varimax rotation method; Loadings > .35 are reported in the table.

**Table D2b. Principle Component Analysis – Within-Subjects Design
Treatment Message: Descriptive Norms**

<i>Statement No.</i>	<i>Component I</i>	<i>Component II</i>	<i>Component III</i>	<i>Cronbach's α</i>
A2	.439			.812
B2	.475			
C2	.494			
D2	.451			
E2		.475		.702
F2		.500		
G2		.563		
H2		.437		
I2			.546	.937
J2			.563	
K2			.555	

Notes: Varimax rotation method; Loadings > .35 are reported in the table.

**Table D2c. Principle Component Analysis – Within-Subjects Design
Treatment Message: Financial Incentive**

<i>Statement No.</i>	<i>Component I</i>	<i>Component II</i>	<i>Component III</i>	<i>Cronbach's α</i>
A3	.401			.775
B3	.535			
C3	.502			
D3	.512			
E3		.499		.852
F3		.527		
G3		.462		
H3		.464		
I3			.538	.772
J3			.604	
K3			.578	

Notes: Varimax rotation method; Loadings > .35 are reported in the table.

Table D3. Principle Component Analysis – Between-Subjects Design

<i>Statement No.</i>	<i>Component I</i>	<i>Component II</i>	<i>Component III</i>	<i>Cronbach's α</i>
A1-3	0.462			.768
B1-3	0.506			
C1-3	0.495			
D1-3	0.473			
E1-3		0.559		.762
F1-3		0.581		
G1-3		0.422		
H1-3		0.390		
I1-3			0.550	.959
J1-3			0.568	
K1-3			0.552	

Notes: Varimax rotation method; Loadings > .35 are reported in the table.

As shown in the tables above, Component 1 includes the group of items pertaining to the deadline notification and work planning,³ Component 2 includes the group of items concerning descriptive norms,⁴ and Component 3 includes the group of items involving financial incentives.⁵ Given the high convergent validity among the items, we averaged the values of the survey responses to each item within each component, following the standard approach in prior literature (e.g., Hong and Pavlou 2014). As a result, we obtained measures on the respondents' feelings toward the different treatment messages by calculating their average agreement with the survey items in each component.

We then report the results in the form of bar charts, in Figure D1 from the survey with a within-subjects design and Figure D2 from the survey with a between-subjects design. The height of the bars shows the mean value of each component (i.e., items perceiving planning prompt, items perceiving descriptive norms, and items perceiving financial incentive) on 5-point Likert-type scales, indicating the survey respondents' agreement with the supplied statements, after reading each treatment message, namely, the deadline reminder, descriptive norm, and financial incentive. The error bars in the figure depicts the standard errors.

³ (a) This message makes me feel that I still have time to finish the assignment. (b) This message makes me feel that I don't have to finish the assignment right away. (c) This message makes me feel that I can plan to finish the assignment right before the deadline. (d) This message makes me feel that it will be fine as long as I finish the assignment before the deadline.

⁴ (e) This message makes me feel that the other students have finished the assignment. (f) This message makes me realize that the other students have finished the assignment, and I also need to finish the assignment soon. (g) This message makes me feel that I can also finish the assignment, just like the students who have finished the assignment. (h) This message makes me feel that I want to catch up with the students who have finished the assignment.

⁵ (i) This message makes me feel that I might receive a financial reward from finishing the assignment. (j) This message makes me feel that I might receive a financial reward from finishing the assignment as soon as possible. (k) This message makes me feel that I might receive a financial reward from finishing the assignment as early as possible.

Figure D1. Survey Results – Within-Subjects Design

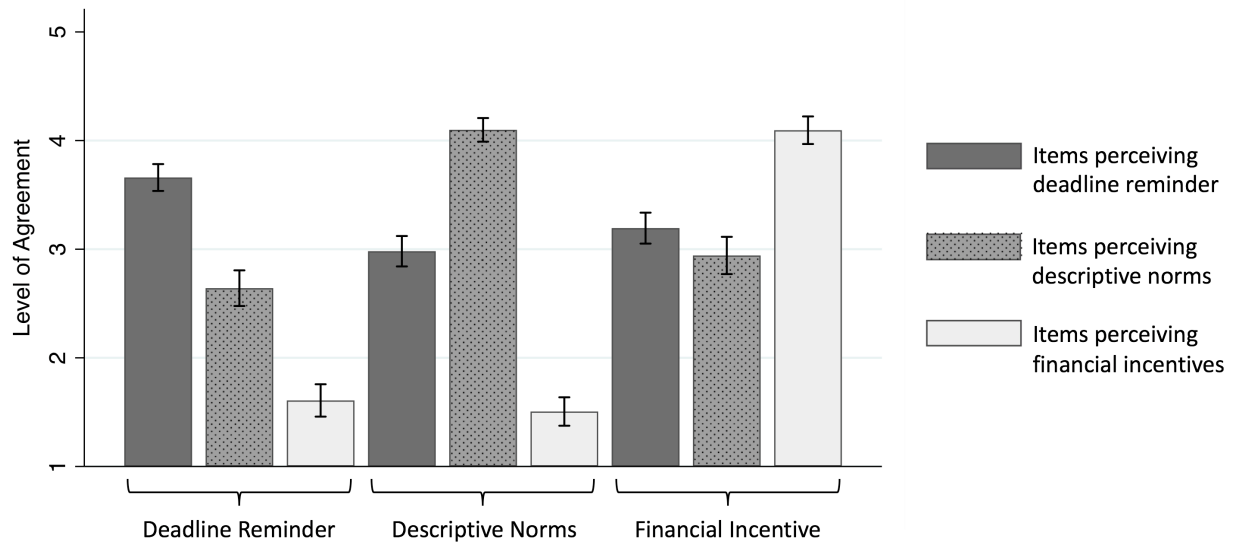
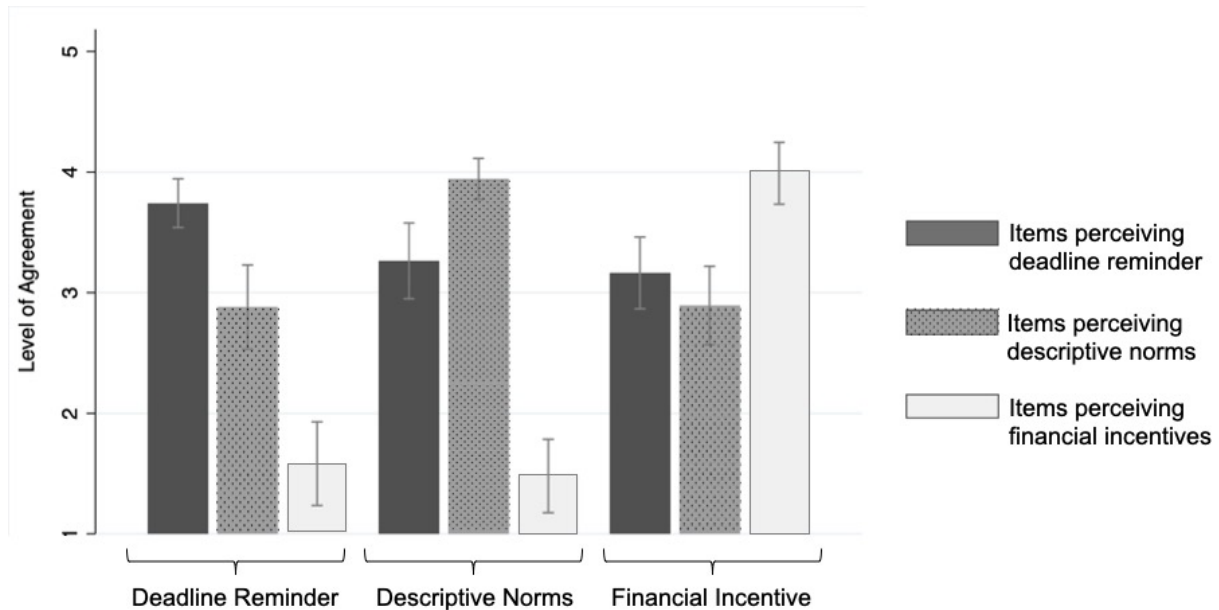


Figure D2. Survey Results – Between-Subjects Design



We observe significant differences in the respondents' average level of agreement to the groups of items, indicating that the users experience distinct feelings toward each of the differently framed messages. As shown in Figures D1 and D2, the financial incentive treatment message received the highest level of agreement in the group of items about feeling the probability of receiving a financial reward; the

descriptive norm treatment message received the highest level of agreement in the group of statements about perceiving that others have finished the assignment and that the subject would hope to catch up; and the users expressed the highest level of agreement in the group of statements about perceived time delays and deadline distance after reading the deadline reminder treatment message.

Notably, confirming our finding from the interviews, both the within-subjects and the between-subjects designed surveys showed strong agreement to the statements that express the tendency to procrastinate after reading the deadline reminder treatment, i.e., with statements such as “I don’t need to finish the assignment right away,” and “it will be fine as long as I finish the assignment before the deadline.” The users’ agreement with these statements once again helps explain the average detrimental effect of the deadline reminder treatment. Although this intervention makes the users realize the timing of submission and the need to plan, it also makes the users push their completion time towards the deadline, out of complacency, i.e., increased procrastination. Additionally, as before, it is notable that these subjects were faced with a hypothetical scenario in responding to the survey items, with no mention of outside course load. As such, these responses are not entirely unexpected. Overall, the clear convergence of responses in the results of the two surveys suggests that the experimental stimuli delivered the desired manipulations.

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Appendix E – Hazard Model

As a robustness check to the regression analysis on the days to submission, we consider the hazard regression, namely Cox proportional hazards (Cox 1972). Cox regression is a popular method of analyzing data in a survival scenario, to understand the hazard of an event taking place over time, e.g., assignment submission in our case, as a function of other variables (e.g., Finkelstein 1986; Bradburn et al. 2003; Kanat et al. 2018). Equation E.equation1 reflects our hazard model specification, where λ is our final hazard function, which is modeled as a function of an arbitrary baseline hazard, λ_0 , and the exponential of our vector of treatment dummies and controls for student features, X . Assignment fixed effects are implemented through stratification. As before, i indexes students and j indexes assignments.

$$\lambda(t_{ij}) = \lambda_0(t_{ij})e^{\beta^t X_{ij}} \quad (\text{E.equation1})$$

We performed survival analysis with Cox proportional hazard regression, which takes advantage of the longitudinal nature of our data on the timing of users' assignment submissions. The estimated coefficients in the hazard models capture the expected hazard ratios, the risks of failure (submission in our case) over time.⁶ If the estimated hazard ratio associated with a treatment indicator is greater than 1, this implies an increased hazard of submission at any given point in time. On the other hand, if the hazard ratio is less than 1, this implies a reduction in the hazard of submission. Thus, a reduction in the days to assignment submission attributable to our treatments would manifest as a statistically significant coefficient greater than 1 in our regression. We first tested the proportional-hazards assumption, and the results indicated that we cannot reject the proportionality assumption, supporting our use of the Cox hazard model in our analysis ($p > 0.1$). Turning to the regression, we report the results in Table E1. As shown in the results, we observe that the descriptive norm treatments are once again associated with a beneficial effect, in this case an increased hazard of submission, compared to a simple CTA. Also, under this specification, the effect of the financial incentive remains positive and statistically significant.

⁶ http://sphweb.bumc.bu.edu/otlt/MPH-Modules/BS/BS704_Survival/BS704_Survival6.html

Finally, once again, the coefficient associated with the deadline reminder treatment is significant and indicates a detrimental effect, with a coefficient less than 1, suggesting a reduced hazard of submission. The results of the survival analysis are consistent with the previous results, again lending support of our main findings.

Table E1. Hazard Model Results (DV = Days to Submission)

Explanatory Variable	(1)	(2)
	Cox PH	Cox PH
Deadline Reminder	0.761* (0.081)	0.761* (0.081)
High Desc. Norm	1.482*** (0.141)	1.486*** (0.142)
Low Desc. Norm	1.523*** (0.137)	1.540*** (0.138)
Financial Incentive	1.225* (0.118)	1.230* (0.118)
No-CTA	1.093 (0.109)	1.104 (0.110)
Ln(Tenure)	1.122*** (.018)	1.120*** (.019)
Prior Grade	1.029*** (.003)	1.029*** (.003)
Prior Courses	.999 (.001)	.999 (.001)
Assignment FE	No	Yes
Observations	6,392	6,392
Wald Chi ²	261.63*** (8)	431.51*** (29)

Notes: Robust standard errors in parentheses.
 *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

References

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