Early Intervention of Undergraduate Tutorial System and Improvement of Students' Performance: An Empirical Study based on Nudges Theory

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Abstract

Based on the undergraduate tutorial system which has been implemented for many years, the effect of early teaching intervention in microeconomics course in colleges and universities is studied. At the end of first six weeks of the second semester, if freshman' scores below the threshold (70), he or she will be referred to the tutor for additional tutoring, including selective help in course content, as well as training in time management and learning skills. In the study, Regression discontinuity design (RDD) method was used to find that early intervention improved students' scores on common problems in final exam by 5.1% to 8.9%. Students with lower than average math scores in the college entrance examination, especially girls, the effect is more obvious. The results show that low-cost early mild intervention may significantly affect students' academic performance.

Keywords: Nudges theory; early intervention; tutorial system; academic performance

1. Introduction

Higher education is a key tool to increase productivity, promote innovation and reduce inequality (George et al., 2018) [1]. The graduation rate of college students is one of the most concerned issues among university managers and educational authorities, and it is an important index to measure the teaching quality and the success of students' learning in colleges and universities. For many college students, the progress of first-year courses is particularly important for continuing and graduating. In the United States, 54.8% of the students need six years to complete the four-year undergraduate course, and as high as 30% of the students drop out of school in Europe and United States. Relatively speaking, the dropout rate is very low in Chinese college system. However, in recent years, there have been frequent news that some colleges and universities have ordered students to drop out of school, and the proportion of dropouts has also drawn the attention of all parties. The Circular of the Ministry of Education on the implementation of the Spirit of the National Conference on undergraduate Education in Colleges and Universities in the New era (2018) proposes that it is necessary to earnestly strengthen the assessment of learning process, increase the proportion of process assessment in the total achievements of the curriculum, strictly discipline the examination, strictly control the exit from graduation, resolutely abolish the "No examination" system, and change the situation of strict entry and leniency in the past. Students are dropped out of school because of their busy part-time work, volunteering and other extracurricular life, as well as indulging in online games, mental illness and family factors. As the carrier of education, colleges and teachers have an unshirkable responsibility to discover and eliminate the obstacles on the road of educating people.

Based on the multi-year undergraduate tutorial system in many universities in China, the paper further analyzes the effect of early teaching intervention on the academic performance of the core curriculum of economics. In order to help student to improve the course performance of "microeconomics" and the passing rate of the examination, the students at the beginning of the second semester of the first year are referred to the undergraduate tutors, for additional guidance, as well as training on time management and learning skills. In the study, Regression discontinuity design (RDD) method was used to set a critical value for students' performance, and the influence of teaching intervention on students' future performance was estimated. By comparing the students' grades in referrals with those in final exams, the paper analyzes whether the students who are just below the referrals standard do better than those have just exceeded the cut-off point. RDD method can be used to analyze the causality when the intervention is not clear whether random and non-observational variables cannot be ruled out. The students' scores were measured by the correct rate of 20 same questions in the final exam. The results showed that for the students close to the referrals threshold, the early intervention significantly improved their scores, indicating that the referrals had an obvious effect. Second, it is also effective to provide only the form of teaching service information.

Third, students with poor basic knowledge have gained more from the intervention, among which the relevant basic knowledge is measured by the math achievement of the college entrance examination. The result is a useful supplement to the relevant literature, and it is also convenient for university administrators to determine the most important group of students who need to study and to provide effective early intervention. The study will be carried out from the following aspects: the second part introduces the background literature, the third part describes the data, the fourth part is the empirical method, the fifth part carries on the false test, and finally draws the conclusion.

2. Literature review and research background

Studies in various countries have confirmed that teachers have a significant impact on students' academic and lifelong achievement (Chetty et al., 2014) [2]. Colleges and universities are also increasingly implementing student development services and educational support aimed at helping students with poor basic knowledge or learning skills to succeed in universities. Some studies have tried to determine the effectiveness of intervention and promotion services for college students' learning and further study, including tutoring, counseling, skills transfer and early warning teaching monitoring, etc., but there is still little evidence of the effectiveness of these measures, and the conclusions are inconsistent (Becker et al., 2016) [3].

2.1 Early Teaching intervention will affect students' Achievement

Cobb et al. (2018) studied the influencing factors of academic achievement with 1400 students in two semesters [4], and found that the teaching intervention in economics course greatly improved the achievement. Teaching interventions can often be divided into two categories: providing tips such as information about the ranking of course grades, or giving additional support services. Chen and Okediji (2014) adopted regression discontinuity method [5]. It was found that simply reminding students the grade of the course could improve the final exam score by 13%. Smith et al. (2018) [6] adopted random experiment to remind students of their usual homework scores and improve the grades by 4%. Measures such as peer counselling under the Carolina Covenant aid program have increased students' credits in the first three years and have a positive impact on graduation rates (Clotfelter et al.,2018) [7]. A study of more than 300 college students shows that there is a close relationship between self-control ability and academic achievement, interpersonal relationship, etc. (Tangney et al., 2004) [8]. Tang Renwu et al. (2018) comprehensively analyzed three key non-cognitive behavioral factors related to educational decision-making: self-control, self-efficacy and social identity, and how to influence the results of educational decision-making by shaping endogenous preferences [9].

2.2 Nudges and support services can change students' behavior

The concept of "nudge" of Thaler and Sundstein (2008) is "heuristic" [10]. The nudge theory holds that the design of choice should be based on people's actual thinking and decision, not on the leader and authority. Nudges is based on indirect encouragement and ability to avoid direct instructions or enforcement. The essence of nudge in classroom is that teachers help students to make classroom behavior that meets the requirements of classroom by means of classroom behavior option intervention (Long Baoxin, 2018) [11]. Li Zheng, and Xu Guoqing (2019) criticized the "buffet" mode of American community college [12], and pointed out that the direction of teaching reform is to guide the process of students' decision-making under the premise of protecting students' free choice, and to provide students with "default option" and "active choice".

In the case of promoting student support services, the comparative study shows that tutoring (including peer mentor) can improve students' performance (Cobb et al.,2018; Arco-Tirado et al.,2011) [4,13]. The results of the positive impact of development services on university achievements and persistence are similar to those of Bettinger and Baker (2014) [14]. Paloyo et al. (2016) found that an hour after a peer-assisted course at an Australian university, the score had a standard deviation of 0.065, but it had little statistical significance. Other studies have shown that nudges increase students' use of services, but does not necessarily improve performance. For example, Pugatch and Wilson (2018) [16] used random experiments to promote peer counseling services to students through postcards, and found that attendance increased by about 7%, but grades remained unchanged. A study of math courses in community colleges yielded similar results (Butcher and Visher, 2013) [17].

2.3 Heterogeneity effect of nudges

The impact of intervention on the individual was different, Damgaard and Nielsen (2018) [18] systematically reviewed the literature of educational nudge, and concluded that the "There are few interventions that have a positive impact on everyone, some of which may even have a negative impact". A number of British universities provide last term test feedback (Bandiera et al., 2015) [19] before the students prepare for the next test, finding that almost all of the students' scores are positively affected by the feedback information. Carrell et al. (2013) [20] found that peer tutoring has a positive effect on students with medium ability and negative effect on students with poor learning ability, although this group of students is the most in need of intervention and help.

A similar negative effect appeared in a random distribution natural experiment on MOOC (Rogers, Feller, 2016) [21]. Dobronyi et al. (2017) [22] failed to find the obvious effect of intervention in a goal-setting study of Canadian economics majors. The reason may be that the lack of motivation weakens the effectiveness of the nudges policy (Grüne-Yanoff, Hertwig, 2016) [23].

Bollinger et al. (2006) [24] found that the attitudes of different genders towards the curriculum were very different, and the learning attitude of girls to the principles of economics was much more negative than that of boys. A large number of studies have shown that when standardized examinations are used to measure the learning results of economics courses, boys outperform girls, while when visual, auditory, writing and other standards are used, girls outperform boys in (Sabiston et al., 2017) [25]. Angrist et al. (2009) [26] designs an experiment to evaluate the effectiveness of teaching support, by instructing freshmen to learn skills and providing financial incentives for good performance, or a combination of the two. The results showed that girls had a high rate of learning skills and performed better at the end of the first school year.

Previous studies have shown that if the cost of interventions is too high, it is difficult to expand the scope of application. Teaching intervention measures are generally effective for students with strong self-control ability, especially in the early stage of providing feedback information and spiritual rewards. In order to explore whether intervention measures with lower strength and cost are also beneficial to students, and to learn more about the mechanisms for obtaining academic assistance during the university, more research is needed to reveal the different effects of such teaching interventions at different stages.

3. Data Source and Research Design

The main data of this study are from the 16-week teaching record of microeconomics from 2018 to 2019 in the Department of Economics, a business school in Zhejiang Province, China. The teacher evaluates the classroom tests and after-school assignments in the first six weeks. At the end of six weeks, students whose assessment scores are below the threshold (70) will referred to undergraduate mentors for more special support. Mentors (including good-performance peer tutors) will organize face-to-face discussions, analyze "Economics Mindset", to explore learning and time management strategies, help develop action plans, and provide support services such as tutoring and skills research. And remind students about the relationship between current behavior and long-term consequences, and encourage students to adopt more positive and optimistic attitude in the face of setbacks or challenges through psychological intervention.

At the end of the semester, microeconomics teachers take the final closed-paper exam and choose 20 questions as the common questions of the test paper (all the other questions are different), focusing on the basic concepts, including multiple choice questions, judgment questions, noun interpretation and so on. Then the scores of each student on the common test questions are calculated and matched with their usual scores in the first six weeks. Since the core economics concepts measured by the 20 questions run through all parts of the curriculum, even if a teacher gives pre-exam tutoring, it will not affect the evaluation of the effectiveness of the intervention (Card et al., 2016) [27].

Subsequently, the usual scores and final exam scores will match the personal characteristics of all students in the economics department, including place of origin, gender and math scores of the college entrance examination (such as Chen et al., 2014) [28]. Microeconomics is a compulsory course for all freshmen in business school, but because of the different hours required by the syllabus for different majors, only the teaching progress of the three classes in the economics department is synchronous, and only the demographic information of the registered students in the economics department, so the preliminary analysis is limited to the students in the economics department (such as Damgaard et al., 2018) [18]. However, the subsequent inclusion of business school students in an analysis without covariables was also robust.

Table 1 reports brief statistics on a sample of 96 economics students and 34 students approaching a break. Of these, 15% scored below the cut-off point in the first six weeks (70 points). The average score for the first six weeks was 84, while the average for the final exam was 79. Girls accounted for 76% of the total sample, while 43% of the students were not students in Zhejiang Province. The average math score of college entrance examination is 68.21 (converting 150 points system to 100 points system), which is slightly higher than the passing score of percentage system (60 points).

Table1 Descriptive Variables

	Whole Sample		Discontinuity Sample	
	Mean	SD	Mean	SD
Referred Performance	0.15	0.39	0.31	0.50
Common Final Questions	79.00	0.13	75.00	0.14
Performance (6 weeks)	84.00	0.14	73.00	0.08
Girls	0.76	0.60	0.74	0.58
Non-Zhejiang provenance	0.43	0.64	0.45	0.69
Math scores of college entrance examination	68.21	2.74	64.70	2.40
N	96		34	

Among economics students, 15% scored below the cut-off point in 6 weeks (70). The average score for the first four weeks was 84, while the average for the general final exam was 79. Girls accounted for 76% of the total sample, while non-Zhejiang students accounted for 43%. The average math score of college entrance examination is 68.21 (150 points system is converted to 100 points system), which is slightly higher than the reference value of passing points.

4. Empirical study

4.1 Construction of Regression discontinuity Model

The difficulty in evaluating the impact of teaching nudge on students' performance is that intervened students may perform worse in the course. In order to identify causality, the sharp regression discontinuity method was used in this study. Using the intervention allocation rules, only students with grades below 70 (100 points system) were intervened. The objects compared in the method are students who have just exceeded the threshold ($\geq$ 70) and students who are just below it. The results of this study should be explained as the impact of interventions on performance. Based on experience, the following models are estimated:

$$Score_{ij} = \alpha + \gamma Ref_i + f_r(P_i - 0.7) + f_l(P_i - 0.7)Ref_i + \beta X_i + \mu_j + \varepsilon_i \quad （1）$$

where the dependent variable $Score_{ij}$ is the percent of common questions on the final exam that student i answered correctly, dummy variable $Ref_i = 1$ indicates that the student accepted the intervention, otherwise $Ref_i = 0$. The main concern of this model is the coefficient of intervention variables γ. f_r and f_l are polynomials that are functions of the difference between the student's performance at the time of referral (P_i) and the referral cutoff (percentage system=0.7), that is, the estimated values on the right and left of the threshold points, respectively. The reason why 70 is selected as the threshold is that if students majoring in business schools want to receive scholarships, the scores of any course must reach more than 70. X_i is a vector of individual characteristics, μ_j is a tutor fixed effect and ε_i is a residual term.

The study estimates the model in two steps: the 2nd and 3rd, 4th degree polynomials are used for the full sample. Second, for discontinuity samples, a local linear regression with robust bandwidth selection (Calonico et al., 2017) [29] is used.

4.2 Interpretation of result

The results of full sample Polynomials in Table 2 show the influence of nudges intervention on the final prediction results, in which the coefficient of intervention variables is basically the same in the 2nd and 3rd degree, but the standard error increases with the order of Polynomials. As shown in line 2, the coefficient of intervention variable is between 5.6 and 8.9 percentage points, that is to say, intervention improves the correct rate of 1.3 and 2 of the 20 common questions in the final exam. The positive correlation between math score and predicted score of college entrance examination is higher than that of other predictors. The increase of standard deviation of math score means that the common problem of final exam is about 1.2 percentage points higher than that of other predicted scores. The coefficient of non-Zhejiang students and gender variables are negative value, especially the gender variables are significant. Because they control the scores of the first six weeks, compared with the usual scores of the first six weeks, their final grades are lower than expected.

Table 2 Results of full sample Polynomials

Polynomial Degree	2nd	3rd	4th
Nudges intervention	0.056**	0.089**	0.067
	(0.027)	(0.042)	(0.055)
Math scores of college entrance examination	0.0027***	0.0025**	0.0025**
	(0.002)	(0.002)	(0.002)
Non-Zhejiang provenance	-0.04	-0.04	-0.04
	(0.025)	(0.027)	(0.029)
Girls	-0.025***	0.024***	-0.024**
	(0.008)	(0.008)	(0.008)
N	96	96	96

Notes: All specifications include tutor fixed effects. Values in round brackets show the standard errors. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1 percent level respectively.

Table 3 intermittent sample linear regression results show the results of robust bandwidth and robust bandwidth 3/2 (that is, 1.5X) and 2/3 (0.67X). The robust bandwidth is 11.8 percentage points near the threshold (such as Calonico et al., 2017) [29], and the estimation coefficients of each variable are similar to those of the whole sample. The estimation coefficient of nudge intervention effect is 5.1% to 7.9% (line 2 of Table 3). Only the standard error of robust bandwidth is the smallest (0.67X), and the number of observations (N = 22) is relatively small. The math score estimation coefficient of the college entrance examination is also not significant, that is, for the 34 students whose scores are below the threshold, the math scores of the college entrance examination, as related knowledge, have little effect on their final common test (which are still related to the usual scores in the first six weeks). The results are in line with the expectations of this study and show that the students on both sides of the threshold (70) are similar in ability. The estimation coefficient of non-Zhejiang students is still negative, but it is slightly higher than that of the whole sample, and the Robust is significant, which may be the result of the fact that most of the non-Zhejiang students are relatively poor college entrance examination results. This explanation is confirmed by the data (53.49%) of the non-first voluntary enrollment of non-Zhejiang students.

Table 3 Intermittent sample linear regression

Bandwidth	Robust	1.5X	0.67X
Nudges intervention	0.079**	0.051**	0.068
	(0.036)	(0.029)	(0.048)
Math scores of college entrance examination	0.002	0.003	0.002
	(0.003)	(0.002)	(0.003)
Non-Zhejiang provenance	-0.08*	-0.058	-0.08
	(0.036)	(0.031)	(0.043)
Girls	-0.03*	0.027*	-0.04*
	(0.174)	(0.015)	(0.023)
N	34	52	22

Notes: All specifications include tutor fixed effects. Values in round brackets show the standard errors. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1 percent level respectively.

4.3 Further Analysis according to the Mathematical scores of the College entrance examination

In view of the literature in section 2, it has been shown that the nudge may have a heterogeneous effect and that a group subject to certain behavior is more likely to benefit from the nudge intervention (Damgaard et al., 2018) [18]. In this study, 34 students of the intermittent sample were divided into two groups which were higher than the average (20) and below the average (14) according to the math scores of college entrance examination, and the effect of the teaching intervention on the students were also investigated. The math scores are used to measure the index of the freshmen's ability, because it is the necessary analytical tool of economics. Table 4 shows the results of the intermittent linear regression of the two groups. Among them, the intervention effect is only 3.1% for the above-average students (Table 4, line 2), while the intervention effect below the average level is up to 18.4%, that is, the intervention can improve the correct rate of the four questions in the 20 common examination questions of the final exam. Students with poor knowledge of economics have the greatest benefits. the estimation coefficients of the mathematical scores and the girls (rows 4 and 8 of table 4) are statistically significant, indicating that in the intermittent samples, especially for girls with higher math scores than the average of the group, The math scores of the college entrance examination have a great influence on the scores of the final examination of the micro-economic course.

Table 4 Grouping according to Math scores of college entrance examination

	Below Average	Above Average
Nudges intervention	0.184***	0.031
	(0.049)	(0.047)
Math score of college entrance examination	-0.008	0.011**
	(0.006)	(0.006)
Non-Zhejiang provenance	-0.058	-0.053
	(0.088)	(0.051)
Girls	-0.027	0.045**
	(0.035)	(0.035)
N	14	20

Notes: All specifications include tutor fixed effects. Values in round brackets show the standard errors. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1 percent level respectively.

5. Falsification tests

In the regression discontinuity model, the threshold (70) itself may have an impact on the degree of effort of students. For example, if a student with a score of slightly less than 70 decides to study hard, while a student with a score of just over 70 does not, the intervention variable may mistakenly attribute this effort to nudges intervention. Therefore, even without intervention, students below the threshold may study harder than those above the threshold. In this study, we used a group of students who had never received teaching intervention, that is, economics students who had taken microeconomics courses last semester. Using the 2017 spring semester and 2018 spring semester tutoring data, because there are no 20 common questions of final exam, so use the final exam score as the result variable. Six weeks later, a score was built to facilitate the comparison of intervention. Due to the lack of individual characteristics of these students and the data of math scores of college entrance examination, the regression model without covariance is used to analyze.

Table 5 shows the regression results of full sample and intermittent sample. Overall, the intervention effect was smaller than the estimated results of the previous analysis, and there was no statistical significance. There is no obvious evidence that among the sophomores who studied microeconomics last semester, the final grades of the sophomores who usually scored slightly below the threshold were better than those who scored slightly below the threshold (≥ 70). Of course, students close to the referrals threshold are likely to try harder to avoid referrals, but since mentoring is entirely voluntary, it is questionable whether students who are unwilling to intervene are aware of the mentoring promotion policy in the sixth week of the course. Therefore, the explanation for the results of this study is that early teaching intervention can improve students' final performance, which is manifested in that they participate more actively in the classroom, complete their homework after class, and accept less the influence of external factors (such as part-time work, etc.).

Table 5 Global Polynomial and Local Linear Results

Polynomial Degree	2nd	3rd	4th
Nudges intervention	0.027	0.015	0.033
	(0.036)	(0.048)	(0.07)
N	58	58	58
Bandwidth	Robust	1.5X	0.67X
Nudges intervention	0.011	0.004	0.007
	(0.046)	(0.038)	(0.058)
N	20	28	13

Notes: All specifications include tutor fixed effects. Standard errors are in brackets. ***, ** and * denote statistical significance at the 0.01, 0.05 and 0.10 levels respectively.

6. Conclusions

Nudges policies do not necessarily lead to better educational results, but these measures do improve students' performance. Good educational decisions are good for both students and society, but higher costs associated with nudges may also be needed, which requires more targeted interventions. This study analyzed the effect of early teaching intervention on freshmen whose scores were below the threshold (70) after six weeks of microeconomics class in the second semester. The teaching intervention is mainly a booster, including the provision of information to inform students of their ranking in the course, and the provision of support services for course-specific tutoring and learning skills and time management.

In this study, the nature of intervention threshold was used for regression discontinuity analysis, and the individual characteristics of students and mathematics scores of college entrance examination were used as control variables to analyze the influence of teaching intervention on students' final examination results, and to explore which type of students benefited the most from intervention. Then, through the similar analysis of the students who studied microeconomics the semester before the intervention, the false test was carried out.

Results of the study suggest that policymakers and researchers need to use nudge policies to carefully consider potential behavioural incentives, including which interventions are targeted and to better predict who an intervention will be effective for. The study found that student who had just fallen below the threshold, that is, those who needed tutoring from undergraduate mentors, had better scores on common issues in the final exam than those who had just exceeded the threshold. In addition, freshmen who lack relevant knowledge of economics benefit the most from intervention. Students with above-average math scores improved 3.1%, while students whose math scores were below average improved 18.4% as a result of intervention, which meant that attention should be focused on some students who did not perform well in their studies. The early nudge intervention raised students' awareness of learning and made them aware of the resources available on campus for learning, help and life skills. Intervention can also improve students' subjective well-being, reduce stress, make them feel more supported, and benefit students' mental health, which is a method that can achieve practical results and is relatively low cost. Although this study focuses on microeconomics courses, the research methods and conclusions are also applicable to other types of professional entry-level courses.

References

George P, Anthony PH. (2018). Returns to Investment in Education: a Decennial Review of the Global Literature. *Education Economics*, 26(5), 445-458.

Chetty R, Friedman JN, Rockoff JE (2014). Measuring the Impacts of Teachers II: Teacher Value-added and Student Outcomes in Adulthood. *American Economic Review*, 104(9), 2633-79.

Becker CM, Rouse CE, Chen MY (2016). Can a Summer Make a Difference? The Impact of the American Economic Association Summer Program on Minority Student Outcomes. *Economics of Education Review*, 53(8), 46–71.

Cobb SL, McPherson MA, Molina DJ, et al. (2018). Teaching Economics to the Masses: The Effects of Student Help Centers on Academic Outcomes. *International Review of Economics Education*, 27(C), 16-23.

Chen Q, Okediji TO (2014). Incentive Matters! The Benefit of Reminding Students About Their Academic Standing in Introductory Economics Courses. *The Journal of Economic Education*, *45*(1), 11-24.

Smith BO, White DR, Kuzyk PC, et al. (2018). Improved grade outcomes with an e-mailed "grade nudge". *The Journal of Economic Education*, *49*(1), 1-7.

Clotfelter, Charles T., Steven W. Hemelt and Helen F. Ladd. (2018). Multifaceted Aid for Low-Income Students and College Outcomes: Evidence from North Carolina. *Economic Inquiry*, 56(1), 278-303.

Tangney JP, et al. (2004). High Self-Control Predicts Good Adjustment, Less Pathology, Better Grades, and Interpersonal Success. *Journal of Personality*, 72(2), 271-324.

Tang Renwu, Ma Ning, Liu Yang (2018). Research Progress of Behavioral Education Economics, *Economic Perspectives*, (11), 134-144.

Thaler R, Sunstein C (2015). Nudge: Improving Decisions about Health, Wealth, and Happiness, CITIC Publishing Group Co., Ltd.

Long Baoxin (2018). Nudged Classroom: A New Innovative Path of Classroom Management, *Research in Educational Development*, (18), 37-44.

Li Zheng, Xu Guoqing (2019). Guided Pathway: Profound Reform of Community College in USA, *Studies in Foreign Education*, 46(6), 17-29.

Arco-Tirado JL, Fernández-Martín FD, Fernández-Balboa J-M. (2011). The Impact of a Peer-Tutoring Program on Quality Standards in Higher Education. *Higher Education*, 62 (6), 773-78.

Bettinger EP, Baker RB (2014). The Effects of Student Coaching: An Evaluation of a Randomized Experiment in Student Advising. *Educational Evaluation and Policy Analysis*, 36(1), 3-19.

Paloyo AR, Rogan S, Siminski P (2016). The Effect of Supplemental Instruction on Academic Performance: An Encouragement Design Experiment. *Economics of Education Review*, 55(12), 57–69.

Pugatch T, Wilson N (2018). Nudging Study Habits: A Field Experiment on Peer Tutoring in Higher Education. *Economics of Education Review*, 62(C), 151-161.

Butcher, Kristin F. and Mary G. Visher (2013). The Impact of a Classroom-Based Guidance Program on Student Performance in Community College Math Classes. *Educational Evaluation and Policy Analysis*, 35(3), 298-323.

Damgaard MT, Nielsen HS (2018). Nudging in Education. *Economics of Education Review,* 64(5), 313-342.

Bandiera O, Larcinese V, Rasul I (2015). Blissful Ignorance? A Natural Experiment on the Effect of Feedback on Students' Performance. *Labour Economics*, 34(6), 13–25.

Carrell SE, Sacerdote BI, West JE (2013). From Natural Variation to Optimal Policy? The Importance of Endogenous Peer Group Formation. *Econometrica*, 81(3), 855–882.

Rogers T, Feller A (2016). Discouraged by Peer Excellence: Exposure to Exemplary Peer Performance Causes Quitting. *Psychological Science*, 27(3), 365–374.

Dobronyi CR, Oreopoulos P, Petronijevic U (2017). Goal Setting, Academic Reminders, and College Success: A Large-scale Field Experiment. *NBER Working Paper* No. 23738.

Grüne-Yanoff T, Hertwig R (2016). Nudge Versus Boost: How Coherent are Policy and Theory. *Minds & Machines,* 26(1), 149–183.

Bollinger C, Mitchell H et al. Chicks Don't Dig It: Gender, Attitude and Performance in Principles of Economics Classes (September 14, 2006). Available at SSRN: https://ssrn.com/abstract=931670.

Sabiston D, Leung A, Terrazzano G (2017). Learning Styles and Performance in Principles of Economics: Does the Gender Gap Exist?. *Economics Bulletin*, 37(4), 2935-2944.

Angrist J, Lang D, Oreopoulos P (2009). Incentives and Services for College Achievement: Evidence from a Randomized Trial. *American Economic Journal: Applied Economics*, 1(1), 136-163.

Card, David and Laura Giuliano (2016). Can Tracking Raise the Test Scores of High-ability Minority Students? *American Economic Review*, 106(10), 2783–2816.

Chen Q, Okediji TO (2014). Incentive Matters! The Benefit of Reminding Students about their Academic Standing in Introductory Economics Courses. *The Journal of Economic Education*, 45(1), 11-24.

Calonico S, Cattaneo MD, Farrell MH, et al. (2017). Rdrobust: Software for Regression Discontinuity Designs. *Stata Journal*, 17(2), 372–404.