

The Causal Effect of Studying on Academic Performance

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- Paper looks at role of effort in determining grade performance in college

Motivation

- Why should we care about grade performance?
 1. Grades are related to how much a student is learning
 2. Grades are related to other outcomes of interest (e.g. educational attainment)

Motivation (continued)

- Why should we care about the role of effort in determining grade performance?
- Importance of effort relative to academic preparation/ability important for policy
 1. At what ages should education dollars be spent?
 2. What types of students should be admitted to colleges?
 3. How should students be counselled?

Literature

- Why is so little known about the role of effort?

1. Information about study effort not typically collected in standard surveys

2. Establishing causal link between studying and grades is difficult

- In this paper we take advantage of new data that allows us to deal with these difficulties

Berea Panel Study

- The survey takes place at Berea College
 - Berea College: Located in Central Kentucky provides education to students of “great promise but limited economic resources”
- Objective of understanding outcomes of students from low income families
- Students surveyed 10-12 times each year
- Baseline survey collected at time of college entrance
- Substantial surveys collected at beginning and end of each subsequent semester
- Students followed after they leave school
- Time-use information collected approximately eight times each year

Question A on the survey asks that you carefully fill out a time diary which is a list of activities during the past 24 hours. In order to complete the time diary on the actual survey form on page 3, do the following:

- 1) Please put an arrow (→) next to the time that it is right now. Label this arrow with the words **YESTERDAY** and **START**.
- 2) Now start with the box next to which you put the arrow (→). Place in this box the activity you were doing during that time period yesterday.

For example, if it is now 7 p.m., you would put an arrow (→) next to the box labeled "7:00PM".
 Next to 7:00PM, you should write what you were doing from 7:00 to 7:20 **yesterday**.
 Next to 7:20PM, you should write what you were doing from 7:20 to 7:40 **yesterday**.
 Next to 7:40PM, you should write what you were doing from 7:40 to 8:00, and so forth.

As you proceed, you should work down the column below your arrow (→) and then move to the top of the other column. Complete this other column and then move back to the top of the column where you started and finish filling in until you reach the arrow(→).

When you begin to fill in the time period boxes, you will be writing your activities from yesterday until you reach the box labeled 12:00 midnight. From then on, you will be writing about your activities earlier today.

A sample completed time diary

Time Period	What were you doing?	Time Period	What were you doing?
MORNING		EVENING	
6:00 AM	SLEEPING	6:00 PM	EATING
6:20 AM		6:20 PM	
6:40 AM	PERSONAL	6:40 PM	SHOPPING
7:00 AM	EATING	7:00 PM	
7:20 AM		7:20 PM	
7:40 AM	IN CLASS	7:40 PM	
8:00 AM		8:00 PM	
8:20 AM		8:20 PM	
8:40 AM	WORKING (Labor)	8:40 PM	
9:00 AM		9:00 PM	
9:20 AM		9:20 PM	
9:40 AM	IN CLASS	9:40 PM	STUDYING
10:00 AM		10:00 PM	
10:20 AM		10:20 PM	
10:40 AM	WORKING (Labor)	10:40 PM	RECREATION AND STUDYING
11:00 AM		11:00 PM	
11:20 AM		11:20 PM	
11:40 AM	AFTERNOON	11:40 PM	STUDYING
12:00 noon		NIGHT	
12:20 PM		12:00 midnight	
12:40 PM	EATING	12:20 AM	
1:00 PM	IN CLASS	12:40 AM	
1:20 PM		1:00 AM	
1:40 PM		1:20 AM	
2:00 PM	EXERCISING	1:40 AM	
2:20 PM		2:00 AM	
2:40 PM		2:20 AM	
3:00 PM	STUDYING	2:40 AM	SLEEPING
3:20 PM		3:00 AM	
3:40 PM		3:20 AM	
4:00 PM	IN CLASS	3:40 AM	
4:20 PM		4:00 AM	
4:40 PM		4:20 AM	
5:00 PM		4:40 AM	
5:20 PM		5:00 AM	
5:40 PM		5:20 AM	
		5:40 AM	

Note(1): The activities will be chosen from the 13 words in **BOLD** which are listed on page 3 to the right of the time diary form that you will complete

START
 ←
 YESTERDAY

Note(2): Notice in the example that the brace symbol (}) is used when an activity continues through several time periods.

Note(3): If you are involved in two activities during the same time period(s), please list both activities and circle the activity you spent more time on.

Studying (outside of class)

includes studying for your classes, preparation for class, studying for an exam, doing take-home exams, homework, writing essays and papers, optional study sessions, any other work done outside of class time for your classes.

Question A.

Reminders: Be sure to put an arrow (→) next to the time that it is right now. And label this arrow with the words **YESTERDAY** and **START**.

Beginning with the **What were you doing** box next to the arrow, fill in your activities starting 24 hours ago (yesterday) and ending right before you began completing this survey.

Please use the 13 words listed in **BOLD** on the right of this page to describe your activities.

Time Period	What were you doing?	Time Period	What were you doing?
MORNING		EVENING	
6:00 AM		6:00 PM	
6:20 AM		6:20 PM	
6:40 AM		6:40 PM	
7:00 AM		7:00 PM	
7:20 AM		7:20 PM	
7:40 AM		7:40 PM	
8:00 AM		8:00 PM	
8:20 AM		8:20 PM	
8:40 AM		8:40 PM	
9:00 AM		9:00 PM	
9:20 AM		9:20 PM	
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10:00 AM		10:00 PM	
10:20 AM		10:20 PM	
10:40 AM		10:40 PM	
11:00 AM		11:00 PM	
11:20 AM		11:20 PM	
11:40 AM		11:40 PM	
AFTERNOON		NIGHT	
12:00 noon		12:00 midnight	
12:20 PM		12:20 AM	
12:40 PM		12:40 AM	
1:00 PM		1:00 AM	
1:20 PM		1:20 AM	
1:40 PM		1:40 AM	
2:00 PM		2:00 AM	
2:20 PM		2:20 AM	
2:40 PM		2:40 AM	
3:00 PM		3:00 AM	
3:20 PM		3:20 AM	
3:40 PM		3:40 AM	
4:00 PM		4:00 AM	
4:20 PM		4:20 AM	
4:40 PM		4:40 AM	
5:00 PM		5:00 AM	
5:20 PM		5:20 AM	
5:40 PM		5:40 AM	

LIST OF WORDS in bold

In Class

Attending class, attending labs, attending required class sessions

Studying (Outside of class time)

(refer to pg 2 for more details)

Athletics

(Intercollegiate or Intramural - games or practice)

Clubs

Exercising

Recreation

(reading which is unrelated to courses, listening to music, watching movie, spending time with friends, etc.)

Shopping

Eating

Sleeping

Partying

Personal

Working (in Labor position)

Other

(Please describe on your sheet)

Sample for this paper

- Sample consists of 210 students who entered Berea in Fall of 2001 and were randomly assigned roommates
 - Proportion Male: .45
 - Average family income: \$27,000
 - Average score on American College Test (ACT): 23
 - Average hours of study per day: 3.4
 - Average first semester Berea grade point average: 3.0

Approach for identifying causal effect

- Ideal:** random experiment

- A. Randomly divide students into two groups

- ⇒ Two groups are identical in terms of academic ability, preparation, motivation etc.

- B. Force students in one group to study one more hour per day than students in other group

- C. Make sure everything else that influences grade performance stays same between groups (class attendance, sleep behavior, etc.)

- In this experiment, two groups are identical in all dimensions except study effort

- ⇒ Can learn about average effect of studying an extra hour by comparing average grade outcomes of two groups

Approach for identifying causal effect (continued)

- **This paper:** natural experiment that partially mimics the ideal experiment

- A. Divide students into two groups based on whether randomly assigned roommate brought a video game to school at beginning of year
 1. Students who have a roommate who brought a video game to school
 2. Students who have a roommate who did not bring a video game to school

⇒ Two groups are identical in terms of academic ability, motivation etc.

- B. See whether presence of video game causes that group to study less, on average, than other group

- C. See whether video game has influenced other things that affect grades (class attendance, sleep behavior, etc.)

- If it can be argued that two groups are plausibly identical in all dimensions except study effort

⇒ Learn about effect of studying by comparing average grade outcomes of two groups (taking into account difference in average study amount between groups)

Identifying Causal Effects

A. Divide students into two groups based on whether randomly assigned roommate brought a video game with him/her at beginning of year

- 53% of males and 24% of females have roommates with video games

Identifying a Causal Effect (continued)

B. See whether presence of video game causes that group to study less than other group

•Separately by sex

Daily Study Hours

	NO VIDEO GAME	VIDEO GAME
MALES (n=95)	3.591	2.924
FEMALES (n=115)	3.693	3.226

•Pooling males and females

In a regression that takes into account other observable characteristics including sex estimated effect (std. error) of video game on studying is $-.565 (.241)$

- Some independent evidence that students are studying less because of games

“In a typical week during the fall semester, how many hours did you spend playing videogames?”

Roommate brings video game: 4.06 Hours per week

Roommate does not bring video game: .79 Hours per week

Identifying a Causal Effect (continued)

C. See whether video game has influenced other things that affect grades

- Survey data from BPS allow us to examine whether differences exist between two groups in
 - a. class attendance?
 - b. sleeping?
 - c. study location?
 - d. studying with TV on?
 - e. drinking?
 - f. academic interactions with roommates?

- We find no evidence of any differences between the two groups

Appendix: Survey questions

Survey Question A.

In the last 7 days (one week), how many times were your classes scheduled to meet? _____
Please count up carefully the number of scheduled class meeting for each one of the seven days and add them together. (If your schedule for a particular day included one math class meeting, one GST class, a biology lab, and a music class you would count 4 for that day. Add together these numbers for each day to get a total for the week.

How many of these classes did you actually attend? _____

Survey Question B.

We are interested in where you studied. For a typical week during the Fall semester, tell us the percentage of your study time that took place in each of the following places.

Note: Numbers on the five lines should add up to 100

- In dorm room (or at home if live off campus) with TV on _____
- In dorm room (or at home if live off campus) without TV on _____
- In library, empty classroom, quiet study lounge, or other quite place _____
- In TV lounge, other (non-quiet) lounges _____
- Other places _____

Identifying a Causal Effect

- Seems plausible that two groups are very similar in all dimensions except study effort
- ⇒ Learn about effect of studying by comparing average grade outcomes of two groups (taking into account difference in average study amount between groups)

- Effects separately by sex

Males

On Average VIDEO GAME group studies .667 less per day than other group

On Average VIDEO GAME group has 1st semester GPA .239 lower than other students

Estimated grade increase from 1 extra hour of study: $.239/.667=.358$

Females

On Average VIDEO GAME group studies .467 less per day than other group

On Average VIDEO GAME group has 1st semester GPA .128 lower than other students

Estimated grade increase from 1 extra hour of study: $.128/.467=.274$

Identifying a Causal Effect

- Instrumental Variable Estimator Pooling Males and Females

Estimated grade increase (std. error) of 1 extra hour of studying per day

.356 (.203)

⇒T-statistic of 1.75 and p-value of .08

- One extra hour of studying per day (2/3 of standard deviation in sample) has same grade effect as a 5.74 increase in ACT (1.21 std. deviations among all ACT test takers)

⇒Effort matters

Conclusions

- Effort seems to matter a lot.

⇒ Programs which encourage struggling students to work harder may yield important results

- Direct evidence that peers can matter and that effects may come through time-use

- Direct evidence that video games can have important effects

Table 1
Descriptive Statistics

	Male All n=95	Male treatment =0 n=45	Male treatment =1 n=50	Female All n=115	Female treatment =0 n=88	Female treatment =1 n=27
TREATMENT - Roommate brought a video game to school	.526			.235		
STUDY	3.240 (1.688)	3.591 (1.748)	2.924 (1.583)	3.583 (1.573)	3.693 (1.595)	3.226 (1.473)
GPA - First semester Grade Point Average	2.853 (.677)	2.979 (.663)	2.740 (.677)	3.129 (.605)	3.159 (.598)	3.031 (.628)
ACT	22.463 (3.842)	22.155 (3.931)	22.740 (3.779)	24.139 (3.431)	24.205 (3.527)	23.925 (3.149)
BLACK	.189	.200	.180	.157	.159	.148

Table 2
The direct effect of treatment on study hours (column 1) and grades (column 2)

Independent Variable	Dependent Variable STUDY hours per day estimate (std error)	Dependent Variable GPA first semester grades estimate (std error)
CONSTANT	3.912 (.241)*	1.717 (.313)*
TREATMENT	-.564 (.241)*	-.201 (.087)*
MALE	-.211 (.239)	-1.07 (.086)
ACT	-.011 (.034)	.062 (.012)
BLACK	-443 (.329)	-.196 (.119)
	$R^2=.051$	$R^2=.226$

*significant at .10

Table 3a
The effect of treatment on other behaviors

Independent Variable	Dependent Variable PATTEND proportion of classes attended	Dependent Variable CLASSHOURS daily hours in class	Dependent Variable SLEEP daily sleep hours	Dependent Variable BEDTIME time student went to sleep**
	estimate (std. error)	estimate (std. error)	estimate (std. error)	estimate (std. error)
TREATMENT	-.014 (.009)	-.114 (.188)	.275 (.208)	.143 (.199)
MALE	.003 (.009)	.059 (.182)	.209 (.202)	-.276 (.192)
CONSTANT	.962 (.006)	3.444 (.25)*	7.089 (.138)*	.833 (.130)*
	R ² =.012	R ² =.0016	R ² =.019	R ² =.011

*significant at .10

** dependent variable is created so that it is zero at 12:00 midnight. Positive numbers represent hours after midnight. Negative numbers represent hours before midnight.

Table 3b
The effect of treatment on additional behaviors

Independent Variable	Dependent Variable percentage of study time that takes place in dorm room	Dependent Variable percentage of study time that takes place in dorm room with tv on	Dependent Variable hours per week using computer for academic purposes	Dependent Variable daily hours partying
	estimate (std. error)	estimate (std. error)	estimate (std.error)	estimate (std. error)
TREATMENT	-2.111 (4.670)	3.515 (2.933)	.963 (1.069)	.007 (.050)
MALE	-4.677 (4.498)	-3.812 (2.825)	-.254 (1.032)	-.015 (.048)
CONSTANT	61.456 (3.058)*	12.756 (1.921)*	6.820 (.699)*	.125 (.033)*
	R ² =.008	R ² =.008	R ² =.012	R ² =0.011

*significant at .10

Table 4
Estimates of the effect of studying on grade performance

Independent Variable	Ordinary Least Squares	Instrumental Variables	Fixed Effects
	estimate (std. error)	estimate (std. error)	estimate (std. error)
CONSTANT	1.494 (.025)*	.322 (.880)	-.050 (.047)
STUDY	.049 (.025)*	.356 (.203)*	-.043 (.027)*
SEX	-.148 (.083)*	-.031 (.134)	
ACT	.062 (.012)*	.065 (.017)*	
BLACK	-.216 (.120)*	-.354 (.182)*	
	R ² =.221		R ² =.014

*significant at .10