

# Effects of Group Work on Attitudes, Trust, and Performance

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## Abstract

Given the critical role that groups play in many educational settings, it is crucial to understand how students form their attitudes towards group work. Using an in-class field experiment, we study how being in a team affects attitudes towards group work, trust, and performance. We randomly assign students to complete quizzes alone or in a group, and find that (i) taking quizzes in teams leads to more positive attitudes towards group work and higher levels of trust (ii) students perform better on quizzes if they work in groups (iii) working in groups does not significantly help or hinder performance on subsequent individual exams. The positive impact of group quizzes on performance is particularly pronounced for below median students who are matched with above median students. Our results suggest that there are benefits to placing students in randomly assigned teams.

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# 1 Introduction

Students working in groups is an important part of many educational settings (Nilson, 2016). Although there are concerns that group performance might suffer from free riding problem (Holmström, 1982), there are many potential benefits of teams, such as brainstorming, knowledge transfer (Maciejovsky, Sutter, Budescu and Bernau, 2013; Cooper, Saral and Villeval, 2021), and satisfaction (Wellins, Byham and Dixon, 1994) that can improve group performance.<sup>1</sup> Previous research compares group performance to individual performance in a variety of contexts (for reviews, see Kerr and Tindale (2004) and Charness and Sutter (2012)), yet there is relatively little known about how being a group member affects trust and attitudes towards group work. If students who are assigned to work in groups learn not only how to work better in groups but also to appreciate group work more and trust others more, they may be more likely to seek out productive opportunities to collaborate in both their educational and professional careers.

To investigate how working in groups affects attitudes towards group work, trust levels, and performance, we design a classroom experiment with college students in an intermediate microeconomics class. At the beginning of the semester, we measure students' baseline knowledge of microeconomics with a test, assess their personality traits and attitudes towards group work through a survey, and collect their demographic information. Students are then randomly assigned by section to take the weekly in-class quizzes either individually or in groups of two or three. After each set of four quizzes, students take an exam individually. The group members are assigned randomly and reshuffled after every exam. At the end of the semester, we re-assess students' attitudes towards group work and measure their trust levels using an incentivized trust game.

We find that students who took the quizzes in groups have better attitudes towards group work and higher levels of trust compared to students who took the quizzes individually. Using the survey we created based on the contextualized version of Volet (2001)'s general SAGA (Students' Appraisals of Group Assignments) instrument, we find that taking quizzes in

<sup>1</sup>Throughout the text, we use the words "group" and "team" interchangeably.

groups improves students' attitudes towards group work by 0.50 sd. This effect is especially pronounced for motivation related attitudes towards group work. Using an incentivized trust game (Berg, Dickhaut and McCabe, 1995), we show that group quizzes increase trust towards students within the same section, the pool whence their group members were drawn. Students who took the quizzes in groups send approximately 25% more money to their within-section trust game partners compared to students who took the quizzes individually.

These positive effects on attitudes towards group work and levels of trust are not at the expense of students' quiz or exam performance. Theoretically, the direction of the effect of taking quizzes in groups on *quiz performance* is not clear. On the one hand, a well functioning group can make use of the comparative advantages of group members and provide an answer that is at least as good as the maximum of individual answers. On the other hand, in a poorly functioning group, students might confuse each other or reject a correct answer in favor of an incorrect one. In our setting, we find that performance is higher in team quizzes compared to individual quizzes. This finding is in line with the majority of the literature which shows group performance is better than individual performance.

Theoretically, the effect of working on quizzes in groups on subsequent *exam performance* is not obvious either. Working in groups might allow weaker students to learn from stronger students they were assigned to work with. Further, stronger students might learn better by being forced to explain how to solve a problem (Cooper, Saral and Villeval, 2021) to their group. However, working in groups may incentivize some students to free-ride and not learn the material as well. In our setting, neither of these effects appears to dominate the other one, as we are unable to reject the equality of exam performance between the individual quiz takers and group quiz takers.

How to best form well functioning groups is an important question for educators. To address this question, we explore the effects of team composition on performance based on initial knowledge and gender. Our heterogeneity analysis shows that students who have below median scores from the baseline knowledge test are the ones who benefit from group quizzes. Compared to below-median students who are taking the quizzes individually, below

median students who take the quizzes in groups have the highest quiz scores if they are matched with an above-median partner. However, this is not necessary for group work to be beneficial as below-median students also have higher quiz scores if they are partnered with other below-median students. Furthermore, below-median students have higher exam scores if they are matched with an above-median partner rather than a below-median partner. We also find that gender composition has an effect on group performance. Students in team quizzes have higher exam scores if they are partnered with a female student. This effect is especially prominent for male students, as male students who are partnered with female students perform better in exams compared to male students partnered with other male students.

Overall, the results of our experiment point to significant advantages of group work in educational settings. Completing quizzes in groups increases performance over completing quizzes individually. The students who worked in groups did not perform significantly differently on subsequent individual assessments, suggesting that there was no loss of learning from free-riding.

Moreover, working in groups makes students feel more favorably towards group work and trust their classmates more. This last result, which is the main novel contribution of this paper, argues that there are spillover benefits to assigning students to work in groups in circumstances where group work is not a necessity – by learning to appreciate working in groups and to trust others in their group, students may learn to embrace collaborative work when it is required later in their educational career or afterward.

## 2 Related Literature

Our paper primarily contributes to the literature on group work. Previous papers in this literature investigate which characteristics make individuals successful group members (Weidmann and Deming, 2020; Yang and Weng, 2021), how team performance differs from individual performance (for reviews, see Kerr and Tindale (2004) and Charness and Sutter (2012)), how being a part of a team affects future performance (Maciejovsky, Sutter, Budescu

and Bernau, 2013; Cooper, Saral and Villeval, 2021), and how team composition affects performance (Fischer et al., 2020). We add to this literature by documenting the effects of working in teams on soft skills – in our case, trust and attitudes towards group work – in addition to the effects on current and subsequent performance. While it is known that soft skills are important both in educational settings and in the labor market, there is a scant literature on the formation of these skills. Adhvaryu et al. (2018) shows that a soft skills training program improves communication skills in a work environment in India and Zarate (2019) shows that peer interactions (in the form of randomly assigned dormitory neighbors) have impacts on social skills in an educational setting in Peru. Our paper contributes to this literature by showing that students’ soft skills can also be improved by exposing them to group work.

Our work also contributes to the literature studying peer effects in academic settings. Previous studies in this area find mixed results. Although most evidence suggests that having higher ability peers is better for a variety of outcomes (Hoxby and Weingarth, 2005; Carrell, Sacerdote and West, 2013; Oosterbeek and van Ewijk, 2014; Humlum and Thorsager, 2021), there is also evidence of negative peer effects for some subgroups of students (Antecol, Eren and Ozbeklik, 2016; Feld and Zolitz, 2017; Fischer, 2017; Thiemann, 2018). Our finding that below-median students who were partnered with above-median students improved the most is in line with the findings of Kimbrough, McGee and Shigeoka (2020) and Kamei and Ashworth (2021). In a laboratory experiment, Kimbrough, McGee and Shigeoka (2020) find that peer-to-peer teaching improves learning among low-ability subjects, but only if high-ability peers are present to teach them. In a classroom experiment, Kamei and Ashworth (2021) find that students in heterogenous peer groups in terms academic ability improve more compared to students in more homogenous peer groups and the effects are more prominent for lower-achieving students.<sup>2</sup>

<sup>2</sup>Relatedly, Li, Han, Zhang and Rozelle (2014) find that seating low and high achievement students together in an elementary school setting (combined with a monetary incentive for the top performing groups) improves the exam scores of low achieving students without harming high-achieving students.

Our paper also adds to the growing literature on the causal effects of peers' genders. In school settings, it is found that having a higher proportion of female students in the classroom increases test scores of both male and female students (Hoxby, 2000; Lavy and Schlosser, 2011; Gong, Lu and Song, 2021).<sup>3</sup> These papers show that positive effects of female students are primarily due to higher levels of discipline and improved teacher effectiveness. Our results are driven by a different mechanism, as we find that students *within the same class* have higher performance if they are assigned to female partners compared to male partners. This result is most closely related to Lu and Anderson (2015) which also studies peer effects within sub-classroom groups by exploiting random seat assignments in a Chinese middle school. Authors find that being surrounded by five female students rather than five male students increases female students' test scores but has no effect on males' test scores. In contrast, in our setting, having a female group member primarily increases male students' performance.

### 3 Experimental Design

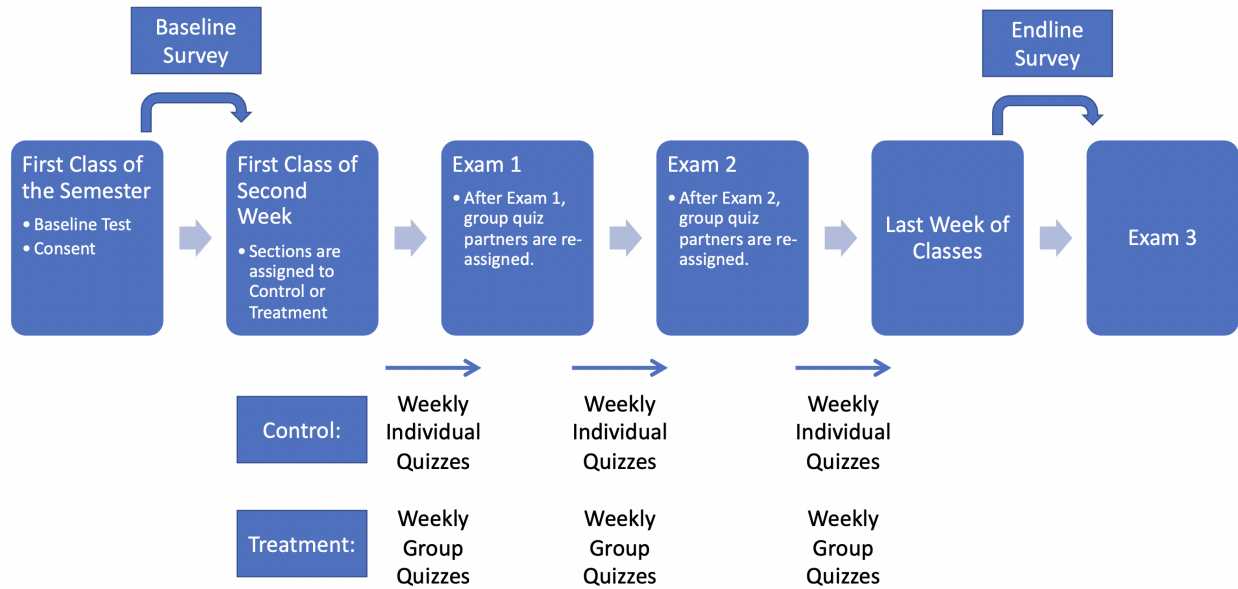
The experiment took place over 2019-2020 academic year (3 sections each semester) of Intermediate Microeconomics at Loyola Marymount University (LMU), a selective Jesuit university in an urban setting.<sup>4</sup> All students were invited to participate in a research study which, from their perspective, consisted of completing one survey at the beginning of the semester, one survey at the end of the semester, and allowing the investigators to use their class performance data. Students were incentivized to participate by being awarded with a 2% bonus on their final grade if they completed both surveys.<sup>5</sup>

<sup>3</sup>Relatedly, in a laboratory experiment, Keck and Tang (2018) show that teams with at least one female member perform better at answering general knowledge questions compared to all-male teams since the existence of the females in the team encourages more information sharing.

<sup>4</sup>The course is a one-semester, four-credit class that follows a standard outline for calculus based Intermediate Microeconomics, primarily focused on constrained optimization, competitive and non-competitive markets, game theory, and general equilibrium. The vast majority of students enrolled in the class plan to complete an Economics major.

<sup>5</sup>LMU uses a grade point system, so a 2% bonus is not directly seen in a student's final grade, but is very likely to bump them up one letter subgrade (e.g. B- to B). The end-of-semester survey included a trust game with a small monetary incentive. Students were not informed that there was a potential for a monetary award prior to enrolling to be part of the experiment.

Figure 1: Experiment Timeline



The course consisted of 3 non-cumulative exams (each worth 20%), weekly problem sets (graded for effort/completion only, worth 20% total), weekly quizzes (worth 15% total) and attendance/participation (worth 5% total). All students registered for Intermediate Microeconomics, regardless whether they signed up for the experiment, were required to complete a baseline knowledge test to assess their preparation for the course.

Sections were randomly assigned to take their weekly quizzes individually or in groups of two or three. Students were not told whether they would be writing quizzes in groups or individually prior to the second week of class, after the add-drop period ended. Groups were assigned randomly and reshuffled after each exam for a total of three groupings per student.<sup>6</sup> A student could not be matched with the same student twice during the semester. Figure 1 summarizes the experimental timeline.

<sup>6</sup>When LMU switched to the online education at the end of March 2020 due to the COVID 19 pandemic, we could no longer continue the group quizzes. Hence, there were only two groupings in Spring 2020.

### 3.1 Baseline Test

To assess students' initial knowledge, students were given a test that evaluated their knowledge of calculus and the microeconomics component of introductory economics, which are the prerequisites for the intermediate microeconomics course.<sup>7</sup> The test was implemented on Qualtrics during the first class.<sup>8</sup> Each student received thirty multiple choice microeconomics questions (equally divided among easy, medium, and hard categories) and five multiple choice math questions. These questions are randomly chosen from a test bank consisting of 130 multiple choice microeconomics questions and 20 multiple choice math questions and shown to students in a random order. Students were given 45 minutes to complete the test. Students were told to take the test seriously and answer the questions as well as they can since it will allow them and the instructor to better evaluate their initial knowledge. We also tell students that students with a proper preparation for the class should get at least one third of the questions correctly and that students who scored below this threshold were required to retake the test and to set up a meeting with their instructor.

### 3.2 Baseline Survey

Students took the baseline survey at home during the first week of class. The first set of questions in the survey asked about students' attitudes about group work. To do so, we create a survey based on the contextualized version of Volet (2001) general SAGA (Students' Appraisals of Group Assignments) instrument. We use only 10 items instead of the original 41 items and slightly modify the language used in some items (see Table 1). The survey consists of subscales, designed to measure cognitive benefits, motivating influence, affect, and management. Students indicate their level of agreement with each item on a 4-point Likert scale, ranging from strongly disagree to strongly agree. In addition to the attitudes towards group work, we also ask students to evaluate how strong they are at academics in general and at economics specifically and how much they enjoy studying economics.

<sup>7</sup>In order to register for Intermediate Microeconomics, students are required to achieve a B- or above in Introductory Economics (a course that covers both microeconomics and macroeconomics) and a C or above or a B- or above on a calculus course (the B- requirement is for a less advanced calculus class). Thus the students in the class are selected to have some aptitude for economics and math.

<sup>8</sup>Students who were not in class during the first day of class took the baseline test at home.



Table 1: SAGA instrument

Statement	Subscale
Group assignments provide me with the opportunity to get feedback on my understanding.	Cognitive
Group assignments give me a chance to learn from my peers' knowledge.	Cognitive
Group assignments give me a valuable opportunity to rethink my own ideas.	Cognitive
It is highly motivating for me to work on assignments with a group of peers.	Motivational
My motivation for the group assignments generally decrease because of the peers.	Motivational
I am happy to work on assignments with a group of peers.	Affect
I am unhappy when assignments need to be completed in a group situation.	Affect
Doing assignments as a group is less time consuming than doing them by myself.	Management
Finding a time to meet for group assignments is difficult.	Management
Finding an effective way to communicate with peers while working on group assignments is challenging.	Management

These statements are based on the contextualized version of [Volet \(2001\)](#) general SAGA (Students' Appraisals of Group Assignments) instrument. Students indicate their level of agreement with each statement on a 4-point Likert scale (ranging from strongly disagree to strongly agree).

The second set of questions in the baseline survey is about personality traits. In particular, we assess participants' growth mindset ([Paunesku, Walton, Romero, Smith, Yeager and Dweck, 2015](#)), locus of control ([Rotter, 1966](#)), big five personality traits ([Rammstedt and John, 2007](#)), self control ([Tangney, Baumeister and Boone, 2004](#)), and grit ([Duckworth, 2016](#)). The Growth Mindset Survey consists of 8 statements with a 6-item Likert scale (answer choices range from "Disagree a lot" to "Agree a lot"). It asks students' beliefs and goals regarding ability and performance. The Locus of Control Survey asks questions about students' beliefs on how luck affects certain outcomes. It consists of 8 statement pairs and students need to choose the statement they believe more strongly from each pair. The Big Five Personality Traits Survey consists of 10 statements with a 5-item Likert scale (answer choices range from "Strongly disagree" to "Strongly agree"). Personality traits measured are extroversion, agreeableness, conscientiousness, neuroticism, and openness. The Self Control Survey contains 13 statements which students rate based on how much the statements apply to them (on a 5-item Likert scale, ranges from "Not at all" to "Very much"). The survey measures how much self control students have. The Grit Survey consists of 8 statements with a 5-item Likert scale (answer choices range from "Very much like me" to "Not like me at all") and measures passion and perseverance for long-term goals. Items from all surveys were presented in a random order.

The third part of the survey asked questions about study habits and academic background. We ask students how many hours per week they spend studying, how many hours per week they plan to spend on studying for the intermediate microeconomics course, what percentage of their study time they spend with others, what percentage of their study time they expect to spend with others for the intermediate microeconomics course, and how often they cram for a test or an assignment.

The last set of questions asks about demographics. We ask students their gender, age, ethnicity, father's and mother's highest level of education, monthly expenditure, and annual family income.<sup>9</sup>

### 3.3 Treatment Assignment: Group vs Individual Quizzes

Students in all sections need to complete weekly in-class quizzes at the beginning of the class.<sup>10</sup> Each quiz consisted of one calculation-based question which is a variation of a question on the problem set due the same day.<sup>11</sup> Students were allowed to use their answers to problem sets as a “cheat sheet” while taking the quiz and had 10 to 15 minutes to complete the quizzes. To get consistent grades, we set up a detailed grading rubric for each quiz and made the quizzes sufficiently similar across semesters so that the rubric still applied.

Sections of the course are assigned either to a control group or a treatment group. Students in the control group worked on their quizzes alone. Students in the treatment group worked on their quizzes in pairs and submitted one set of answers per group.<sup>12</sup> Students were not told that other sections took their quizzes under different conditions or that this was part of the experiment, but given the small size of the economics program, the students may have figured this out. In treatment sections, pairs were randomly determined at the beginning of the second week of classes. Students were randomly re-assigned to new pairs after the first

<sup>9</sup>Baseline survey can be accessed through [http://mylmu.col.qualtrics.com/jfe/form/SV\\_daFakEw3qyii56K](http://mylmu.col.qualtrics.com/jfe/form/SV_daFakEw3qyii56K). Screenshots of all the questions are in the Appendix 1.3.

<sup>10</sup>There are 12 weekly quizzes in a 15 week semester. There are no quizzes during the first week of class and weeks were skipped because of exams or holidays.

<sup>11</sup>Students did not know in advance which problem set question the quiz would be based on. A sample problem set and a sample quiz are included in the Appendix 1.2.

<sup>12</sup>If there is an odd number of students in the class, one of the groups have three members instead of two.

and second exams, but were not allowed to be assigned to the same partner twice. If one of the students in the pair was absent, the partner was assigned to another group for that day. If a student dropped the class, their partner was re-assigned to another group. Students in the same groups sit next to each other during the quiz but were free to move to a different location once the quiz was completed.

The two authors were Intermediate Microeconomics instructors throughout the experiment. In each semester, one instructor taught one section and the other taught two sections. The section of the instructor who taught only one section in a given semester was designated as a treatment group. One section of the instructor who taught two sections in a given semester was randomly assigned to be a treatment group and the remaining section was assigned to be a control group. See Table 2 for details. Students learn about the in-class quizzes on the first day of classes but they are not told whether they will be taking them in groups until the add-drop period is over.<sup>13</sup> Hence, there should not have been selection into the sections based on treatment assignment.<sup>14</sup>

Table 2: Section Details

Section	Term	Time	Instructor	Treatment Assignment	# of Students
01	Fall 19	T Th 9:40AM-11:10AM	1	Control	24
02	Fall 19	T Th 11:20AM-12:50PM	1	Treatment	23
03	Fall 19	T Th 2:40PM-4:10PM	2	Treatment	22
01	Spring 20	M W 12:40PM-2:10PM	2	Treatment	16
02	Spring 20	M W 2:20PM-3:50PM	2	Control	12
03	Spring 20	T Th 11:20AM-12:50PM	1	Treatment	22

### 3.4 Endline Survey

In the endline survey, we repeated the survey that measures students’ attitudes about group work (Volet, 2001). In the treatment group, we also specifically ask students their

<sup>13</sup>We did not bring up the possibility of group quizzes until the period was over, and when we did, we did not tell the treatment or control sections that other sections took their quizzes under different conditions.

<sup>14</sup>We ran the experiment for 2 semesters, so we do not anticipate that students had time to figure out that registering for a section with an instructor teaching only one section of Intermediate Microeconomics was a way of ensuring they would get to take the quizzes in groups.

attitudes about the group quizzes. We re-assess all participants' growth mindset ([Paunesku, Walton, Romero, Smith, Yeager and Dweck \(2015\)](#)) and grit ([Duckworth \(2016\)](#)). We ask all students how many hours per week they spent on studying for their classes this semester, how many hours per week they spent on studying for the Intermediate microeconomics Course, what percentage of their study time they spent with others for their classes, what percentage of their study time they spent with others for the Intermediate Microeconomics course, and how often they crammed for a test or an assignment. We also ask whether they studied with their peers outside of the classroom for problem sets, quizzes, exams, etc. In addition to these questions, students in the treatment group answer four other questions for each partner they had. In particular, these questions ask whether they know their partners before the quiz assignment, whether they worked with their partner for a class other than Intermediate Microeconomics, and whether they think they are similar with their partners in term of personality and in terms of academic level.

### 3.5 Trust and Reciprocity game

During the endline survey, students played an incentivized game that measures trust and reciprocity.<sup>15</sup> There are two players in this game: Player 1 and Player 2. Both players are given \$2 to start with. First, Player 1 decides how much of \$2 to send to Player 2 (options are \$0, \$0.5, \$1, \$1.5, \$2). The amount Player 1 decides to send to Player 2 is then tripled. Then, Player 2 states how much money to send back to Player 1 in response to each of five possible actions of Player 1. The amount Player 1 sends measures trust since they are relying on Player 2 to send back enough of the tripled money to compensate them for the money they sent. The amounts Player 2 chooses to send measures reciprocity, as they are responding to generosity on the part of Player 1 despite the fact that it reduces their payout. Each student answers the questions for both roles of Player 1 and Player 2 and for both being partnered with someone within their section and outside of their section. One of the four questions is randomly chosen for payment and an appropriate pairing is made. Students

<sup>15</sup>This game is from [Berg, Dickhaut and McCabe \(1995\)](#) except that we use the strategy method so we can measure trust and reciprocity for all of the players.

can earn between \$0 and \$8 from this game based on their answers, their pairings, and which question was chosen for payment. The payments are sent through Amazon Gift Cards.

## 4 Summary Statistics and Balance

Table 3 presents summary statistics. Column (1) shows the mean values of the baseline test scores and an additional 18 variables that were collected in the baseline survey<sup>16</sup>. 71% of the students are male and 54% of them are white. Mothers of 80% of the students and fathers of 74% have a college degree. The average annual household income is around \$267K and the students spent approximately \$500 on their monthly expenses.

We reject tests of equality of treatment and control groups for 4 of the 19 variables at the 10% level, which is a bit higher than expected by chance. Students in the control group are more likely to be white, have higher high school GPAs and more educated mothers, and have higher extroversion scores compared students in the treatment group. To address this, we present the findings with and without controls in Section 5 to check the robustness of the results.

Out of 119 students who took the baseline survey and baseline test, 112 students took the endline survey. Hence, the attrition rate is 5.8%. Out of 7 students who left the experiment, two of these students withdrew from the class and another two did not enter the final exam and failed the class.<sup>17</sup> To learn more about who leaves the experiment, we regress each control variable on a dummy variable which is equal to 1 if the student did not take the endline survey and is equal to zero otherwise. Students who left have higher openness and lower agreeableness scores.

<sup>16</sup>Ten students did not provide consent to be a part of the research study and did not participate in the surveys. We exclude these students from the analysis. Their data was not included as partner characteristics either.

<sup>17</sup>Out of 7 students who did not take the endline survey, one was from the control group and six were from the treatment group. We exclude these students from the analysis but their data was included as partner characteristics.

Table 3: Summary Statistics and Balance

	Sample Mean	Control Mean	Treatment Mean	p-value (Control=Treatment)
<i>Demographic Controls:</i>				
Male	.712	.629	.747	.198
White	.542	.686	.482	.043
Age	20.161	20.286	20.108	.559
<i>Education Controls:</i>				
High School GPA	3.657	3.723	3.629	.09
College GPA	3.288	3.329	3.271	.492
Baseline above-median test score	.504	.417	.542	.212
Mother is college graduate	.797	.914	.747	.039
Father is college graduate	.737	.771	.723	.588
<i>Personality Controls:</i>				
Grit	25.924	25.771	25.988	.715
Locus of Control	3.286	3.167	3.337	.578
Extroversion	5.916	6.444	5.687	.037
Agreeableness	6.983	6.972	6.988	.957
Conscientiousness	7.353	7.333	7.361	.928
Neuroticism	6.227	6.167	6.253	.81
Openness	7.134	7.25	7.084	.587
Self Control	36.277	36.306	36.265	.979
Growth Mindset	31.303	30.861	31.494	.473
<i>Other Controls:</i>				
Monthly Expenditure	501.271	505	499.699	.963
Annual Household Income	267247.2	282999.4	260414.9	.623
Subjects	119	36	83	

The Grit Survey (Duckworth, 2016) consists of 8 statements with a 5-item Likert scale (answer choices range from “Very much like me” to “Not like me at all”) and measures passion and perseverance for long-term goals. The Locus of Control Survey (Rotter, 1966) asks questions about students’ beliefs on how luck affects certain outcomes. It consists of 8 statement pairs and students need to choose the statement they believe more strongly from each pair. The Big Five Personality Traits Survey (Rammstedt and John, 2007) consists of 10 statements with a 5-item Likert scale (answer choices range from “Strongly disagree” to “Strongly agree”). Personality traits measured are extroversion, agreeableness, conscientiousness, neuroticism, and openness. The Self Control Survey (Tangney, Baumeister and Boone, 2004) measures how much self control students have and contains 13 statements which students rate based on how much the statements apply to them (on a 5-item Likert scale, ranges from “Not at all” to “Very much”). The Growth Mindset Survey (Paunesku, Walton, Romero, Smith, Yeager and Dweck, 2015) consists of 8 statements with a 6-item Likert scale (answer choices range from “Disagree a lot” to “Agree a lot”). It asks students’ beliefs and goals regarding ability and performance.

## 5 Findings

In this section, we first explore the effects of taking the quizzes in groups rather than individually on attitudes towards group work, trust levels, quiz performance and exam performance. Then, we look at how the initial knowledge level of the student and the student’s gender interact with these treatment effects. Finally, we look at how the interactions between own characteristics and the partners’ characteristics (initial knowledge level and gender, in particular) mediate the treatment effects.

### 5.1 How do group quizzes affect attitudes towards group work?

In this subsection, we analyze how being assigned to work on quizzes in groups affects attitudes towards group work using the following OLS framework:

$$EndSAGA_i = \alpha_0 + \alpha_1 Treatment_i + \alpha_2 BaseSAGA_i + X_i\Gamma + \epsilon_i$$

where  $EndSAGA_i$  is student  $i$ ’s standardized score from the SAGA survey taken in the endline,  $BaseSAGA_i$  is student  $i$ ’s standardized score from the SAGA survey taken in the baseline,  $Treatment_i$  is equal to 1 if the student  $i$  is assigned to take quizzes in groups and 0 otherwise, and  $X_i$  is a vector of controls.

Table 4 presents the results. Taking quizzes in groups rather than individually positively affects students’ attitudes about group work. In particular, it leads to 0.50 sd increase in students’ attitudes about group work (statistically significant at the 1% level). Results remain the same as we control for an extensive set of observables. Table 5 looks at how the treatment affects different subscales of students’ attitudes towards group work. Treatment affects all the subscales positively, but the effects are most pronounced for the motivational subscale (0.71 sd), followed by the management subscale (0.52 sd), the affect subscale (.42 sd), and the cognitive subscale (0.33 sd).

Table 4: Effect of Treatment on SAGA

	Overall Post SAGA scores (standardized)				
	(1)	(2)	(3)	(4)	(5)
Treatment	0.501*** (0.136)	0.498*** (0.136)	0.541*** (0.145)	0.605*** (0.150)	0.606*** (0.148)
Pre SAGA overall (std)	0.623*** (0.0851)	0.653*** (0.0847)	0.615*** (0.0900)	0.626*** (0.0955)	0.630*** (0.0917)
Constant	-0.331*** (0.0995)	-0.329 (0.845)	-0.338 (1.976)	-0.193 (2.706)	0.519 (2.722)
Demographic Controls	No	Yes	Yes	Yes	Yes
Education Controls	No	No	Yes	Yes	Yes
Personality Controls	No	No	No	Yes	Yes
Other Controls	No	No	No	No	Yes
<i>N</i>	112	112	112	112	112

Dependent variable is the standardized version of the overall score obtained in the SAGA questionnaire in the endline survey. Treatment is equal to 1 if the student is assigned to take quizzes in groups and 0 otherwise. Pre SAGA overall (std) is the standardized version of the overall score obtained in the SAGA questionnaire in the baseline survey. Demographic controls include male dummy, white dummy, and age. Education controls include high school GPA, current college GPA, baseline above-median test score, whether mother is a college graduate and whether father is a college graduate. Personality controls include scores on grit, locus of control, self control, growth mindset, and big 5 personality traits (extraversion agreeableness conscientiousness neuroticism openness) obtained in the baseline survey. Other controls include monthly expenditure and annual household income. Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## 5.2 How do group quizzes affect trust?

Next, we analyze how being assigned to group quizzes rather than individual quizzes affects trust. As a measure of trust, we use the amount of money students choose to send in the trust game if they are Player 1. We use the following specification to measure how treatment affects trust:

$$AmountSent_i = \alpha_0 + \alpha_1 Treatment_i + X_i \Gamma + \epsilon_i$$

where  $AmountSent_i$  is the amount student  $i$  chooses to send to Player 2 (a randomly assigned student who is either within the same section or in another section) when student  $i$  plays the role of Player 1,  $Treatment_i$  is equal to 1 if student  $i$  is assigned to take quizzes in groups and 0 otherwise, and  $X_i$  is a vector of controls.



Table 5: Effect of Treatment on SAGA subscales

	Post SAGA scores (standardized)			
	Cognitive (1)	Motivational (2)	Affect (3)	Management (4)
Treatment	0.334* (0.192)	0.712*** (0.183)	0.424** (0.169)	0.518*** (0.191)
Pre SAGA Cognitive (std)	0.473*** (0.113)			
Pre SAGA Motivational (std)		0.281*** (0.102)		
Pre SAGA Affect (std)			0.559*** (0.0884)	
Pre SAGA Management (std)				0.437*** (0.101)
Constant	1.892 (2.729)	3.493 (2.694)	1.345 (2.684)	-2.067 (3.159)
All Controls	Yes	Yes	Yes	Yes
<i>N</i>	112	112	112	112

Dependent variable is the standardized score obtained in a particular subscale of the SAGA questionnaire in the endline survey. Treatment is equal to 1 if the student is assigned to take quizzes in groups and 0 otherwise. Pre SAGA (std) is the standardized score obtained in a particular subscale of the the SAGA questionnaire in the baseline survey. All Controls include all the controls listed in Table 4. Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

As Table 6 Panel A shows, taking quizzes in groups rather than individually increases students' trust towards other students within their section. Students in the control group send \$1.17 (on average) to their partners if the partner is within the same section. Compared to the control group, students in the treatment group are willing to send 23 cents more (statistically significant at the 10% level.) This coefficient increases to 28.5 cents and becomes statistically significant at the 5% level as we control for an extensive set of observables. However, we are unable to reject that treatment has no effect on the trust levels towards partners in another section (Table 6 Panel B). These results suggest that group work increases the level of trust within that classroom, but that this trust does not spillover outside the classroom.

Table 6: Effect of Treatment on Trust

	(1)	(2)	(3)	(4)	(5)
<b>Panel A:</b> Amount Player 1 sends to a within-section Player 2					
Treatment	0.231*	0.245*	0.254*	0.283**	0.285**
	(0.136)	(0.140)	(0.140)	(0.140)	(0.140)
Constant	1.171***	-0.317	-2.888**	-3.601**	-3.368**
	(0.117)	(0.660)	(1.248)	(1.607)	(1.677)
<b>Panel B:</b> Amount Player 1 sends to an outside-of-section Player 2					
Treatment	0.0623	0.0637	0.0274	0.0534	0.0546
	(0.141)	(0.143)	(0.145)	(0.151)	(0.151)
Constant	1.100***	-1.062*	-2.634**	-3.933**	-3.624*
	(0.119)	(0.635)	(1.279)	(1.799)	(1.869)
Demographic Controls	No	Yes	Yes	Yes	Yes
Education Controls	No	No	Yes	Yes	Yes
Personality Controls	No	No	No	Yes	Yes
Other Controls	No	No	No	No	Yes
<i>N</i>	112	112	112	112	112

Dependent variable in Panel A is the amount of money Player 1 sends to a randomly assigned Player 2 who is someone in the same section of the intermediate microeconomics class and the dependent variable in Panel B is the amount of money Player 1 sends to a randomly assigned Player 2 who is in a different section of the intermediate microeconomics class. Treatment is equal to 1 if the student is assigned to take quizzes in groups and 0 otherwise. Demographic controls include male dummy, white dummy, and age. Education controls include high school GPA, current college GPA, baseline above-median test score, whether mother is a college graduate and whether father is a college graduate. Personality controls include scores on grit, locus of control, self control, growth mindset, and big 5 personality traits (extraversion agreeableness conscientiousness neuroticism openness) obtained in the baseline survey. Other controls include monthly expenditure and annual household income. Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

### 5.3 How do group quizzes affect performance?

Next, we analyze how being assigned to group quizzes rather than individual quizzes affect performance in quizzes and exams. To do so, we run the following specification,

$$AverageScore_i = \alpha_0 + \alpha_1 Treatment_i + X_i \Gamma + \epsilon_i$$

where  $AverageScore_i$  is the average score student  $i$  received in the quizzes or the exams,  $Treatment_i$  is equal to 1 if the student  $i$  is assigned to take quizzes in groups and 0 otherwise, and  $X_i$  is a vector of controls.

Panel A of Table 7 shows that taking quizzes in groups rather than individually increases students' quiz scores. Students in the control group have an average score of 83.29 out of 100. According to Column (1), students in the treatment group have a score of 88.57, which is 6 percent higher than the control group. This result is statistically significant at the 5% level and remains qualitatively the same as we control for observables.

Panel B of Table 7 depicts how taking quizzes in groups affect individual performance on exams. Students in the control group have an average score of 76.39 out of 100. Coefficients for the treatment variable are small and insignificant in all specifications. Hence, we are unable to reject that treatment has no effect on individual performance of the students. One potential explanation of this finding is that treatment only had an effect on quiz scores and it does not have an effect on study behavior. Another potential explanation is that learning benefits of group quizzes are cancelled out by the free-riding cost of group quizzes. In Section 5.4, we explore these explanations.

Table 7: Effect of Treatment on Performance

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A:	Average Score in the Quizzes					
Treatment	5.285** (2.428)	4.613** (2.233)	4.985** (2.216)	5.225** (2.017)	4.569** (1.947)	4.550** (1.960)
Baseline Above-Median Test Score		5.618*** (1.659)	5.065*** (1.557)	3.148* (1.794)	2.202 (1.914)	2.093 (1.998)
Constant	83.29*** (2.278)	81.04*** (2.490)	120.2*** (16.88)	92.18*** (27.12)	91.52*** (26.93)	92.76*** (27.36)
Panel B:	Average Score in the Exams					
Treatment	-0.391 (2.625)	-1.483 (2.397)	-1.544 (2.438)	-0.950 (2.282)	-1.510 (2.408)	-1.524 (2.412)
Baseline Above-Median Test Score		9.138*** (2.094)	8.777*** (2.000)	5.411*** (1.910)	5.250** (2.215)	5.181** (2.258)
Constant	76.39*** (2.274)	72.73*** (2.421)	111.0*** (15.85)	52.44* (28.79)	23.92 (28.55)	19.39 (30.24)
Demographic Controls	No	No	Yes	Yes	Yes	Yes
Education Controls	No	No	No	Yes	Yes	Yes
Personality Controls	No	No	No	No	Yes	Yes
Other Controls	No	No	No	No	No	Yes
<i>N</i>	112	112	112	112	112	112

Dependent variable is the average quiz scores in Panel A and the average exam scores in Panel B. Both scores are out of 100. Treatment is equal to 1 if the student is assigned to take quizzes in groups and 0 otherwise. Demographic controls include male dummy, white dummy, and age. Education controls include high school GPA, current college GPA, baseline above-median test score, whether mother is a college graduate and whether father is a college graduate. Baseline Above-Median Test Score is equal to 1 if the student is among the more higher scoring half of students based on the baseline microeconomics and calculus test and 0 otherwise. Personality controls include scores on grit, locus of control, self control, growth mindset, and big 5 personality traits (extraversion agreeableness conscientiousness neuroticism openness) obtained in the baseline survey. Other controls include monthly expenditure and annual household income. Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## 5.4 Heterogeneity

In this subsection, we analyze whether the treatment effects are heterogenous based on baseline knowledge and gender.

Table 8 analyzes heterogeneity among students (as opposed to heterogeneity among students' group members). In Panel A, we look at whether there is treatment heterogeneity based on baseline test scores. As Column (4) shows, the effect of completing the quiz in groups is positive and statistically significant at the 1% level for students who are initially below the median. The treatment effect for above-median students is significantly (at the 5% level) smaller than below-median students and not statistically distinguishable from 0.<sup>18</sup> Hence, students with lower levels of baseline economics and calculus knowledge seem to benefit from the team quizzes the most. We are unable to detect any treatment heterogeneity for other dependent variables. This is particularly relevant for the exam scores variable. It does not appear that weaker students are deferring to stronger students in the quizzes in a way that harms their understanding of the material and hurts their individual exam scores. Hence, we do not find any evidence for the free-riding hypothesis for the weaker students.

Table 8 Panel B explores treatment heterogeneity based on gender. We are unable to detect any treatment heterogeneity based on students' gender.

Table 9 analyzes heterogeneity among group members. Since the groups were reshuffled after each exam, students have 2-4 different group members over the course of the semester.<sup>19</sup> For the end of semester variables in columns (1)-(3), we use indicator variables that take a value of 1 if a student worked with at least one above-median student or one female student in any of their groups. Columns (4) and (5) show group specific dependent variables: the score on quizzes taken with a particular group or the score on an exam based on material on quizzes taken with a particular group. For these variables, we change the unit of analysis from student to student-group so that each student appears in the data set two or three

<sup>18</sup>We observe similar findings if we use the continuous measure of baseline scores instead of a dummy variable.

<sup>19</sup>If a student was in a group of three, they had two group members for that grouping. No student was in a group of three more than once, hence students have at most four group members during the study. During Spring 2020, there were only two groupings due to the switch to online education during COVID19 pandemic.

Table 8: Heterogeneity based on own characteristics

	(1) Post SAGA	(2) Trust (within)	(3) Trust (outside)	(4) Quiz Score	(5) Exam Score
Panel A:					
Treatment	0.621*** (0.217)	0.173 (0.188)	-0.0557 (0.188)	8.809*** (2.976)	1.083 (3.697)
Baseline Above-Median Test Score	-0.255 (0.246)	-0.0437 (0.257)	0.0602 (0.283)	8.411** (3.837)	9.048** (4.346)
Treatment* Above median	-0.0327 (0.313)	0.235 (0.278)	0.233 (0.306)	-8.984** (4.098)	-5.498 (5.012)
Panel B:					
Treatment	0.690*** (0.175)	0.362* (0.185)	0.0504 (0.200)	4.898* (2.624)	-2.843 (2.600)
Female	0.423* (0.241)	0.119 (0.241)	-0.0705 (0.258)	2.292 (3.264)	-1.370 (4.426)
Treatment*Female	-0.258 (0.323)	-0.236 (0.288)	0.0127 (0.318)	-1.056 (3.464)	4.008 (5.066)
All controls	Yes	Yes	Yes	Yes	Yes
<i>N</i>	112	112	112	112	112

Baseline Above-Median Test Score is equal to 1 if the student is among the more higher scoring half of students based on the baseline microeconomics and calculus test and 0 otherwise. All controls include demographic, education, personality, and other controls listed in Table 7. The regressions in Panel B also include the standardized Baseline Test Scores. Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

times and we use indicator variables that take a value of 1 if a student worked with an above-median or a female group member for that period of the course.<sup>20</sup>

In Table 9 Panel A, we look at whether there is heterogeneity based on the baseline test scores of group members. We find that being assigned to a group member who is at the top half of distribution on the baseline test leads to a 4.18 points increase (statistically significant at the 1% level) in quiz scores compared to having a partner who is at the bottom half (Column (4)). We also observe a positive effect on exam scores of having a partner who is among the more knowledgeable (2.56 points), but this is not statistically significant. This

<sup>20</sup>If a student is in a triplet, indicator variables are equal to one if at least one of the group members is above median or female. If a student is in a group of two with a group member who did not consent to participate in the study, we exclude that student-group from the analysis of Table 9.

evidence suggests that students learn from stronger peers. In Panel B, we look at whether there is treatment heterogeneity based on the gender of group members. We find that being assigned to a female group member increases the exam scores by 3.89 points (statistically significant at the 5% level) (Column (5)).

Table 9: Heterogeneity based on group members' characteristics

	(1)	(2)	(3)	(4)	(5)
	Post SAGA	Trust (within)	Trust (outside)	Quiz Score	Exam Score
Panel A:					
At least one above-median group member	-0.102 (0.292)	0.272 (0.179)	0.180 (0.187)		
Above-median group member				4.177*** (1.260)	2.562 (1.729)
Panel B:					
At least one female group member	-0.130 (0.216)	0.0975 (0.165)	-0.0586 (0.186)		
Female group member				0.974 (1.310)	3.894** (1.752)
All controls	Yes	Yes	Yes	Yes	Yes
<i>N</i>	77	77	77	187	185
Subjects	77	77	77	77	77

Above median group member is equal to 1 if a group member is among the higher scoring half of students based on the baseline microeconomics and calculus test and 0 otherwise. At least one above median group member is equal to 1 if the student had at least one group member who is among the higher scoring half of students based on the baseline microeconomics and calculus test and 0 otherwise. All controls include demographic, education, personality, and other controls listed in Table 7. Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Given that there is heterogeneity based on both a student's characteristics and their group members', we further explore how the treatment effects depend on the interactions between these characteristics. First, we look at the interaction between a students' score on the baseline test and their group members' score. We run the following regression:

$$\begin{aligned}
Score_{i,t} = & \beta_0 + \beta_1(BelowMedian_i \times BelowMedian_{-i,t}) + \beta_2(BelowMedian_i \times \\
& AboveMedian_{-i,t}) + \beta_3(AboveMedian_i \times BelowMedian_{-i,t}) + \\
& \beta_4(AboveMedian_i \times AboveMedian_{-i,t}) + \beta_5AboveMedian_i + X_i\Gamma + \epsilon_{i,t}
\end{aligned}$$

where  $BelowMedian_i$  and  $AboveMedian_i$  indicate whether student  $i$  scored above or below the median on the baseline microeconomics test, respectively.  $BelowMedian_{-i,t}$  and  $AboveMedian_{-i,t}$  indicate whether the group member paired with student  $i$  at time  $t$  scored above or below the median on the baseline microeconomics test, respectively. For students who are in the control treatment, we set  $BelowMedian_{-i,t} = AboveMedian_{-i,t} = 0$ .  $Score_{it}$  is the average score student  $i$  received in the quizzes at time  $t$  or on the exam based on those quizzes. We cluster standard errors at the student level.<sup>21</sup>

Results of this specification appears in Table 10 Panel A. Column (1) shows the results for quiz scores. Below median students benefit from group quizzes regardless of the baseline knowledge of the student with whom they are partnered. However, the effect is larger if a below-median student is matched with an above-median group member rather than a below-median group member (the difference is 6.54 points, statistically significant at the 1% level). The effect of working in groups is insignificant for above-median students regardless of the baseline knowledge of their partners, but there is some suggestive evidence that even above-median students have higher quiz scores if they have an above-median partner rather than below-median partner (the difference is 2.53 points, p-value is 0.115).

Column (2) shows the results for exam scores. Although there is no significant effect of the treatment on exam scores for any group composition, exam scores are higher for below-median students who are matched with above-median group members rather than below-median group members (the difference is 6.58 points, p-value is 0.023). This is the

<sup>21</sup>If a student is in a group of three and has at least one group member with an above-median baseline test score, then  $BelowMedian_{-i,t} = 0$  and  $AboveMedian_{-i,t} = 1$ . If a student is in a group of two with a group member who did not consent to participate in the study, we exclude that student-group from the analysis of Table 10.



opposite of what we would expect if weaker students used the group quizzes as a free-riding opportunity.

Panel B of Table 10 shows a similar analysis based on the gender composition of groups, based on the following specification:

$$Score_{i,t} = \gamma_0 + \gamma_1(Male_i \times Male_{-i,t}) + \gamma_2(Male_i \times Female_{-i,t}) + \gamma_3(Female_i \times Male_{-i,t}) + \gamma_4(Female_i \times Female_{-i,t}) + \gamma_5 Female_i + X_i \Gamma + \epsilon_{i,t}$$

where  $Male_i$  and  $Female_i$  indicate whether student  $i$  is male or female, respectively.  $Male_{-i,t}$  and  $Female_{-i,t}$  indicate whether the group member(s) matched with student  $i$  at time  $t$  is male or female, respectively. For students who are in the control treatment, we set  $Male_{-i,t} = Female_{-i,t} = 0$ .  $Score_{it}$  is the average score student  $i$  received in the quizzes at time  $t$  or on the exam based on those quizzes. We cluster standard errors at the student level.<sup>22</sup>

Column (1) of Panel B shows the results for quiz scores. Compared to a male student in the control treatment, a male student who is paired with a female student benefits from the group quizzes the most; the effect size is 6.01 points (statistically significant at the 5% level). A male student also benefits from being paired with another male student (4.13 points, statistically significant at the 10% level). The effect of the treatment on quiz scores for female students is insignificant, regardless of the gender of their group members.

Column (2) presents the results for exam scores. Although there is no significant effect of the treatment on exam scores for any group composition, exam scores are higher for a male student who is matched with a female group member relative to a male student who is matched with a male group member (the difference is 4.32 points, p-value=0.055).

<sup>22</sup>If a student is in a group of three and has at least one female group member, then  $Male_{-i,t} = 0$  and  $Female_{-i,t} = 1$ .

Table 10: Heterogeneity based on group composition

	(1)	(2)
	Quiz Score	Exam Score
Panel A:		
Below median*Below median group member ( $\beta_1$ )	5.249* (2.711)	-2.465 (3.429)
Below median*Above median group member ( $\beta_2$ )	11.79*** (2.958)	4.116 (3.811)
Above median*Below median group member ( $\beta_3$ )	-1.752 (2.355)	-4.255 (2.996)
Above median*Above median group member ( $\beta_4$ )	0.780 (2.554)	-5.296 (3.248)
Above median ( $\beta_5$ )	9.401*** (3.469)	9.065** (3.873)
<i>p-values for</i>		
$\beta_1 = \beta_2$	0.003	0.023
$\beta_3 = \beta_4$	0.115	0.646
Panel B:		
Male*Male group member ( $\gamma_1$ )	4.125* (2.417)	-3.646 (2.541)
Male*Female group member ( $\gamma_2$ )	6.008** (2.562)	0.674 (2.628)
Female*Male group member ( $\gamma_3$ )	3.502 (2.477)	-0.557 (4.565)
Female*Female group member ( $\gamma_4$ )	2.219 (2.841)	0.560 (4.256)
Female ( $\gamma_5$ )	2.715 (2.878)	-1.255 (4.015)
<i>p-values for</i>		
$\gamma_1 = \gamma_2$	0.276	0.055
$\gamma_3 = \gamma_4$	0.623	0.700
All controls	Yes	Yes
<i>N</i>	292	290
Subjects	112	112

Above and below median (and above and below median group member) take a value of 1 if the student (or their group members) is among the higher scoring half of students on the baseline microeconomics and calculus test, respectively. All controls include demographic, education, personality, and other controls listed in Table 7. Standard errors are clustered at the subject level and reported in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Taken together, the heterogeneity results argue that group dynamics are successful. Below median students benefit from taking quizzes in groups, while above median students are not harmed by it. This suggests that weaker students are able to learn from or defer to stronger students and that groups are able to answer quizzes at least as well as the maximum of their individual answers. Further, while this does suggest that stronger students may take a more leading role within the group, this does not hamper the learning of weaker students, as working in a group on quizzes does not reduce scores on subsequent individual exams.

## 5.5 Robustness Checks

Since we switched to the online education at the end of March 2020 due to the COVID19 pandemic, we could not continue with the group quizzes. Hence, the treatment group in Spring 2020 are only partially treated. To analyze how this disruption affected our results, we have run some robustness checks. Appendix Table 1, an alternative specification to Table 7, shows that our results get slightly stronger if we average scores from quiz 1 to quiz 8 instead of averaging all the quiz scores in Panel A and if we average scores from exam 1 and exam 2 instead of averaging all three exam scores in Panel B for students who take the class in Spring 2020. As an additional check, We re-run our entire analysis including students only from Fall 2019.<sup>23</sup> Since this exercise reduces our sample size significantly, some of the results become not significant. Nevertheless, we find statistically significant effects for group attitudes, trust, and quiz performance, quantitatively similar to the ones found in the main analysis.

Throughout our analysis, we have not controlled for instructor fixed effects. As a robustness check, we re-run the analysis including the instructor fixed effects.<sup>24</sup> All of significant results remain significant and the results are quantitatively very similar.

<sup>23</sup>These tables are available upon request.

<sup>24</sup>These tables are available upon request.

## 6 Conclusion

In a semester-long classroom experiment with college students, we investigate how taking weekly quizzes in *groups* instead of *individually* affect students' attitudes towards group work, trust levels, quiz performance, and exam performance. At the beginning of the semester, we measure students' baseline knowledge of microeconomics and calculus and assess their attitudes towards group work. We then randomly assign students to take weekly in-class quizzes either individually or in teams. The groups are also assigned randomly and rotated after every four quizzes. At the end of the semester, we measure students' trust levels using an incentivized trust game and re-assess students' attitudes towards group work through a survey.

We show that taking quizzes in groups rather than individually has positive impacts on students' attitudes towards group work and their trust levels. Hence, assigning group work in college courses could better prepare students' for later life by helping them build trust and embrace positive attitudes towards group work. We also find that quiz performance is higher for students who take the quizzes in groups rather than individually. Below-median students experience the largest gains in quiz performance, particularly if they are matched with above median group members. We do not find that working with groups on quizzes significantly helps or hinders students in their performance on subsequent individual exams.

There are three immediate directions for future research. We study randomly-assigned groups rather than self-selected ones, a task that requires low-intensity collaboration, and small groups of two or three. Future work may analyze whether the findings of this study apply to settings with self-selected teams, to high-intensity tasks<sup>25</sup>, or to larger groups where free-riding concerns may increase.

<sup>25</sup>For example, [Fischer, Rilke and Yurtoglu \(2020\)](#) show that self-selected teams perform worse than randomly assigned teams if the task requires low-intensity collaboration but better than randomly assigned teams if the task requires high-intensity collaboration.

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# Appendix

## 1.1 Tables

Table 1: Effect of Treatment on Performance with COVID correction

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A:	Average Score in the Quizzes					
Treatment	5.844** (2.405)	5.200** (2.226)	5.677** (2.182)	5.849*** (1.975)	5.232*** (1.903)	5.207*** (1.903)
Baseline Above-Median Test Score		5.397*** (1.618)	4.845*** (1.512)	3.274** (1.634)	2.489 (1.740)	2.350 (1.834)
Constant	82.76*** (2.272)	80.60*** (2.484)	118.8*** (16.57)	91.75*** (26.70)	89.77*** (26.37)	89.60*** (27.01)
Panel B:	Average Score in the Exams					
Treatment	-0.800 (2.569)	-1.884 (2.333)	-1.949 (2.355)	-1.297 (2.196)	-1.793 (2.306)	-1.805 (2.310)
Baseline Above-Median Test Score		9.070*** (2.076)	8.600*** (1.990)	5.218*** (1.884)	4.851** (2.177)	4.789** (2.212)
Constant	77.12*** (2.206)	73.49*** (2.353)	114.0*** (16.20)	52.68* (28.39)	32.00 (28.70)	27.68 (30.26)
Demographic Controls	No	No	Yes	Yes	Yes	Yes
Education Controls	No	No	No	Yes	Yes	Yes
Personality Controls	No	No	No	No	Yes	Yes
Other Controls	No	No	No	No	No	Yes
<i>N</i>	112	112	112	112	112	112

Dependent variable is the average quiz scores in Panel A and the average exam scores in Panel B. For Fall 2020, all quiz and exam scores are averaged. For Spring 2020, only quizzes 1-8 and exams 1 and 2 are averaged. Treatment is equal to 1 if the student is assigned to take quizzes in groups and 0 otherwise. Demographic controls include male dummy, white dummy, and age. Education controls include high school GPA, current college GPA, baseline above-median test score, whether mother is a college graduate and whether father is a college graduate. Baseline Above-Median Test Score is equal to 1 if the student is among the more higher scoring half of students based on the baseline microeconomics and calculus test and 0 otherwise. Personality controls include scores on grit, locus of control, self control, growth mindset, and big 5 personality traits (extraversion agreeableness conscientiousness neuroticism openness) obtained in the baseline survey. Other controls include monthly expenditure and annual household income. Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## 1.2 Course Materials

Problem Set 4

1. The Calculus of Demand (Cobb-Douglas Utility Function)

Suzie purchases two goods, food and clothing. She has the utility function  $U(X, Y) = 2XY$ , where  $X$  denotes the amount of food consumed and  $Y$  the amount of clothing. Hint: You may find it easier to begin by solving a Lagrangian for generic  $I$ ,  $P_X$ , and  $P_Y$ .

- Use a Lagrangian to find an expression for her demand curve for clothing when  $I = 200$  and  $P_X = 2$ . Does this satisfy the law of demand?
- Use a Lagrangian to find an expression for her Engel Curve for clothing when  $P_X = 2$ ,  $P_Y = 2$ . Is clothing normal or inferior?

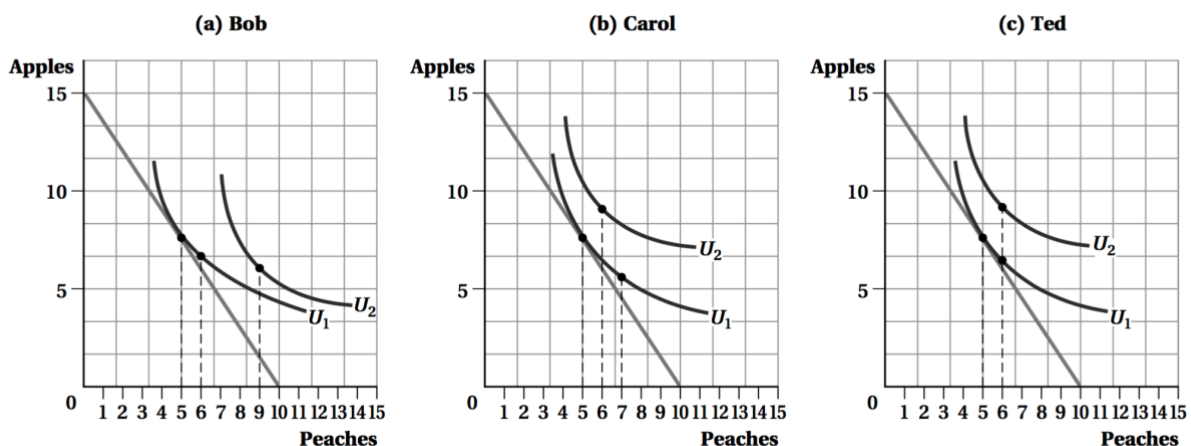
2. The Calculus of Demand (Special Utility Functions)

Refer to Q3 of Problem set 3.

- Find Josiah's demand curve for carving knives if he has \$100 to spend and the price of antique books is \$10.
- Find Charlie's demand curve for carving knives if he has \$100 to spend and the price of antique books is \$10.

3. Income and Substitution Effects

Consider the following three graphs, which illustrate the preferences of three consumers (Bob, Carol, and Ted) regarding two goods, apples and peaches. Each consumer has an income of \$30, and each consumer pays \$2 for apples and \$3 for peaches. (There are some extra graphs at the end of the problem set if you need.)



- a. Suppose that the price of peaches falls to \$2. Draw a new budget line for each consumer and find the new optimal bundle of apples and peaches each would buy. How does the new quantity of peaches compare to the original quantity? Indicate the change in the first column of the table below (an increase of 1 unit might be denoted as a +1).
- b. For each consumer, determine the substitution effect of the price change.

Hint: Draw a hypothetical budget line with the same slope as your new budget line, but just tangent to the consumer's original indifference curve. Indicate that change in the second column of the table below.

- c. Now add the income effect. Compare each consumer's peach consumption in (b) to his or her final peach consumption in (a). Indicate the difference in column 3 of the table below.
- d. Do Bob, Carol, and Ted consider peaches normal or inferior?

	Total Effect of Price Change	Substitution Effect of Price Change	Income Effect of Price Change
Bob			
Carol			
Ted			

#### 4. Deriving Market Demand

Three students have different demands for doughnuts. André's demand is given by  $Q = 5 - P$ ; Carlene's demand is given by  $Q = 6 - 2P$ ; Cooper's demand is given by  $Q = 4 - 0.5P$ .

- a. Derive the market demand curve for doughnuts algebraically.
- b. Graph the market demand curve for doughnuts. Pay special attention to any kinks in the market demand!

**Quiz 4**  
**Duration: 10 minutes**  
**(Please show all your work!)**

NAME:

Sally consumes two goods, housing ( $X$ ) and food ( $Y$ ). Her utility function is  $U(X, Y) = 3Y\sqrt{X}$ . The prices of housing and food are  $p_x = 2$  and  $p_y = 3$ .

- a) Set up a Lagrangian optimization problem.
- b) Take the three partial derivatives necessary to solve the Lagrangian.
- c) Find the Engel curve for  $X$ .
- d) Show whether  $X$  is normal or inferior.

### 1.3 Experimental materials

*We add comments for the reader in italics.*

## Loyola Marymount University Informed Consent Form

- TITLE:** Beattie and Ersoy Research Study
- INVESTIGATOR:** Dr. Graham Beattie (310 258 87 59) and Dr. Fulya Ersoy (310 338 7372), ECONOMICS, BCLA
- PURPOSE:** You are being asked to participate in a research project that seeks to investigate determinants of academic achievement. For the purposes of this project, we will use your attendance, homework, quiz, and exam data (including the exam you took at the beginning of the semester) for ECON 3100. You will be asked to complete an online survey about your demographics and attitudes at the beginning of the class and an online survey about your attitudes and study habits at the end of the class. Each of these surveys will take approximately 15 minutes to complete and should not take more than 30 minutes. If you permit, we will also obtain data about you (gender, race, age) and your academic performance (high school GPA, SAT/ACT scores, college GPA, your grades) from the registrar's office.
- RISKS:** There are no foreseeable risks associated with this study.
- BENEFITS:** This research will benefit overall research society by investigating determinants of academic achievement of students.
- INCENTIVES:** You will receive 2 *extra* points (for your overall course grade) for completing these surveys. **You will also earn between \$0-\$8 in the form of Amazon Gift Cards based on your actions in a game you will play during the survey at the end of the class.** Participation in the project will require no monetary cost to you. If you choose not to participate, there are no penalties to you.
- CONFIDENTIALITY:** In this study, your name and your demographic information will be collected. Your name will never be used in any public dissemination of these data (publications, presentations, etc.). All research materials and consent forms will be stored in locked cabinets and/or password-protected computers. Only the investigators will have access to the data. When the research study ends, any identifying information will be removed from the data, or it will be destroyed. All of the information you provide will be kept confidential.
- RIGHT TO WITHDRAW:** Your participation in this study is *voluntary*. You may withdraw your consent to participate at any time without penalty. Your withdrawal will not influence any other services to which you may be otherwise entitled, your class standing or relationship with Loyola Marymount University.

**SUMMARY OF RESULTS:** A summary of the results of this research will be supplied to you, at no cost, upon request. Please contact Dr. Graham Beattie (310 258 87 59, [graham.beattie@lmu.edu](mailto:graham.beattie@lmu.edu)) and Dr. Fulya Ersoy (310 338 7372, [fulya.ersoy@lmu.edu](mailto:fulya.ersoy@lmu.edu)) Summary of results is expected to be available by January 2022.

**VOLUNTARY CONSENT:** I have read the above statements and understand what is being asked of me. I also understand that my participation is voluntary and that I am free to withdraw my consent at any time, for any reason, without penalty. If the study design or use of the information is changed I will be informed and my consent reobtained. On these terms, I certify that I am willing to participate in this research project.

I understand that if I have any further questions, comments or concerns about the study or the informed consent process, I may contact Dr. David Moffet, Chair, Institutional Review Board, Loyola Marymount University, 1 LMU Drive, Los Angeles, CA 90045-2659 or by email at [David.Moffet@lmu.edu](mailto:David.Moffet@lmu.edu).

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**Participant's Name**

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**Date**

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**Participant's Signature**



**CONSENT TO OBTAIN ADMINISTRATIVE RECORDS:**

I give my permission for the following information about me to be retrieved from the registrar's records, matched with my data and used only for the purposes of this research study: gender, age, race, high school GPA, SAT/ACT scores, cumulative college GPA, GPA for each semester of college, name of the classes I took and will take and my grades from those classes, my year of graduation.

---

**Participant's Name**

---

**Date**

---

**Participant's Email Address**

---

**Participant's Signature**

### 1.3.1 Baseline Survey Questions

How good are you at academic subjects, in general?

- Extremely strong
- Moderately strong
- Slightly strong
- Neither strong nor weak
- Slightly weak
- Moderately weak
- Extremely weak

How good are you at Economics?

- Extremely strong
- Moderately strong
- Slightly strong
- Neither strong nor weak
- Slightly weak
- Moderately weak
- Extremely weak

How much do you enjoy studying Economics?

- Like it a great deal
- Like it a moderate amount
- Like it a little
- Neither like it nor dislike it
- Dislike it a little
- Dislike it a moderate amount
- Dislike it a great deal

*SAGA instrument*

**What do you think about group assignments in general?**

Please choose the answer that best describes your feelings.

	Strongly Disagree	Disagree	Agree	Strongly Agree
Doing assignments as a group is less time consuming than doing them by myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group assignments give me a chance to learn from my peers' knowledge.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group assignments provide me with the opportunity to get feedback on my understanding.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am unhappy when assignments need to be completed in a group situation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Finding a time to meet for group assignments is difficult	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Strongly Disagree	Disagree	Agree	Strongly Agree
It is highly motivating for me to work on assignments with a group of peers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am happy to work on assignments with a group of peers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Finding an effective way to communicate with peers while working on group assignments is challenging	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My motivation for the group assignments generally decrease because of the peers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group assignments give me a valuable opportunity to rethink my own ideas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## *Growth Mindset Survey*

First, you will answer an opinion survey about **beliefs and goals regarding ability and performance.**

It is very important that you give your honest opinion, not what you believe someone else would think best.

Read each statement, decide how much you agree or disagree with the statement.

	Disagree a Lot	Disagree	Disagree a Little	Agree a Little	Agree	Agree a Lot
I like my work best when I can do it really well without too much trouble.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To tell the truth, when I work hard, it makes me feel as though I'm not very smart.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No matter how much intelligence you have, you can always change it a good deal.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When something is hard, it just makes me want to work more on it, not less.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Disagree a Lot	Disagree	Disagree a Little	Agree a Little	Agree	Agree a Lot
You can learn new things, but you cannot really change your basic level of intelligence.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like my work best when I can do it perfectly without any mistakes.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like work that I'll learn from even if I make a lot of mistakes.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like my work best when it makes me think hard.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## *Locus of Control Survey*

Next, you will answer some questions about **your beliefs on how luck affects certain things.**

Please select the one statement from each pair that you believe to be more correct. Be sure to select the one you actually believe to be more true rather than the one you think you should choose or the one you would like to be true. There are no right or wrong answers. In some instances you may discover that you believe both statements or neither one. In such cases, be sure to select the one you more strongly believe to be the case as far as you're concerned.

- |   |   |  |
|---|---|--|
| Many of the unhappy things in people's lives are partly due to bad luck.                            | <input type="radio"/> <input type="radio"/> | People's misfortunes result from the mistakes they make.   |
| One of the major reasons why we have wars is because people don't take enough interest in politics. | <input type="radio"/> <input type="radio"/> | There will always be wars, no matter how hard people try to prevent them.                                      |
| In the case of the well prepared student there is rarely if ever such a thing as an unfair test.    | <input type="radio"/> <input type="radio"/> | Many times exam questions tend to be so unrelated to course work that studying is really useless.              |
| Without the right breaks one cannot be an effective leader.   | <input type="radio"/> <input type="radio"/> | Capable people who fail to become leaders have not taken advantage of their opportunities.                     |
| In the long run people get the respect they deserve in this world.                                  | <input type="radio"/> <input type="radio"/> | Unfortunately, individuals worth often pass unrecognized no matter how hard they try.                          |
| The idea that teachers are unfair to students is nonsense.  | <input type="radio"/> <input type="radio"/> | Most students don't realize the extent to which their grades are influenced by accidental happenings.          |
| No matter how hard you try some people just don't like you.   | <input type="radio"/> <input type="radio"/> | People who can't get others to like them don't understand how to get along with others.                        |
| I have often found that what is going to happen will happen.  | <input type="radio"/> <input type="radio"/> | Trusting to fate has never turned out as well for me as making a decision to take a definite course of action. |

## Personality Traits Survey

Next, you will see a number of sentences that may or may not apply to you. Please answer all questions choosing the option that best describes you.

### I am someone who

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Is generally trusting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is relaxed and handles stress well	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tends to find fault with others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Has few artistic interests	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tends to be lazy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is outgoing and sociable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Has an active imagination	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gets nervous easily	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is reserved	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Does a thorough job	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## *Self Control Survey*

Using the scale provided, please indicate how much each of the following statements reflects you. When responding, please think about how you compare to everyone not just the people you know.

	Very much like me	Mostly like me	Somewhat like me	Not much like me	Not like me at all
Sometimes I can't stop myself from doing something even if I know it is wrong.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I refuse things that are bad for me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have a hard time breaking bad habits.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People would say that I have iron self-discipline.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I wish I had more self-discipline.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Very much like me	Mostly like me	Somewhat like me	Not much like me	Not like me at all
I say inappropriate things.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am able to work effectively toward long-term goals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am good at resisting temptation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often act without thinking through all the alternatives.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have trouble concentrating.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Very much like me	Mostly like me	Somewhat like me	Not much like me	Not like me at all
I am lazy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pleasure and fun sometimes keep me from getting work done.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do certain things that are bad for me if they are fun.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## *Grit Survey*

Here are a number of statements that may or may not apply to you. When responding, please think about how you compare to everyone not just the people you know. There are no right or wrong answers, so just answer honestly!

	Very much like me	Mostly like me	Somewhat like me	Not much like me	Not like me at all
I have been obsessed with a certain idea or project for a short time but later lost interest.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often set a goal but later choose to pursue a different one.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am a hard worker.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Setbacks don't discourage me. I don't give up easily.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Very much like me	Mostly like me	Somewhat like me	Not much like me	Not like me at all
I have difficulty maintaining my focus on projects that take more than a few months to complete.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am diligent. I never give up.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I finish whatever I begin.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
New ideas and projects sometimes distract me from previous ones.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



**How many hours per week, on average, do you spend on studying for all your classes outside of the time you spend in the classroom in a semester?**

[Just type the number of hours you spend. For example, if you spend 20 hours on average, type 20. If you spend 15 hours and 30 minutes, type 15,5. Do not enter any blanks.]

**How many hours per week, on average, are you planning to spend for studying for ECON 3100 outside of the time you will spend in the classroom?**

[Just type the number of hours you spend. For example, if you spend 20 hours on average, type 20. If you spend 15 hours and 30 minutes, type 15,5. Do not enter any blanks.]

100% Alone 0 10 20 30 40 50 60 70 80 90 100 100% With Others

Considering all your classes during a semester, what percentage of your overall studying time (outside of class) do you spend with others (based on the scale above)?



100% Alone 0 10 20 30 40 50 60 70 80 90 100 100% With Others

Considering ECON 3100, what percentage of your overall studying time (outside of class) do you expect to spend with others (based on the scale above)?



Never 0 10 20 30 40 50 60 70 80 90 100 Always

Considering all your classes during a semester, how much do you cram for exams or do an assignment at the last minute (based on the scale above)?



What was your high school grade point average (GPA)?

Did you take the SAT and/or ACT?

Yes, I took SAT.

Yes, I took ACT.

Yes, I took both SAT and ACT.

No, I didn't take SAT or ACT.

What is your current status at school?

Freshman

Sophomore

Junior

Senior

Other

What is your current grade point average (GPA)?

To the best of your knowledge, what was your SAT score?  
If you took SAT more than once, please enter your highest scores.

SAT Reading Score	<input type="text"/>
SAT Math Score	<input type="text"/>

To the best of your knowledge, what was your ACT score?  
If you took ACT more than once, please enter your highest scores.

ACT Composite Score	<input type="text"/>
ACT English Score	<input type="text"/>
ACT Math Score	<input type="text"/>

What is your gender?

female

male

non-binary

What is your age?

What is your ethnicity?

African-American

Asian

Caucasian

Hispanic

Other

What is the highest level of education your father completed?

- No Education
- Primary Education
- High School Drop Out
- High School Degree
- College Drop Out
- College Degree
- Master's Degree or PhD
- Do not know

What is the highest level of education your mother completed?

- No Education
- Primary Education
- High School Drop Out
- High School Degree
- College Drop Out
- College Degree
- Master's Degree or PhD
- Do not know

How much do you spend on food, clothing, leisure each month, on average?

- \$0 - \$49
- \$50 - \$99
- \$100 - \$149
- \$150 - \$199
- \$200 - \$299
- \$300 - \$399
- \$400 - \$499
- \$500 - \$749
- \$750 - \$999
- \$1000 - \$1499
- \$1500 - \$1999
- \$2000 - \$2499
- \$2500 - \$3000
- more than \$3000

What is your family's approximate annual income?

- \$0 - \$9,999
- \$10,000 - \$24,999
- \$25,000 - \$49,999
- \$50,000 - \$74,999
- \$75,000 - \$99,999
- \$100,000 - \$149,999
- \$150,000 - \$199,999
- \$200,000 - \$299,999
- \$300,000 - \$499,999
- \$500,000 - \$1,000,000
- more than \$1,000,000
- Do not know

### 1.3.2 Endline Survey Questions

#### *SAGA instrument*

#### What do you think about group assignments in general?

Please choose the answer that best describes your feelings.

	Strongly Disagree	Disagree	Agree	Strongly Agree
Doing assignments as a group is less time consuming than doing them by myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group assignments give me a chance to learn from my peers' knowledge.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group assignments provide me with the opportunity to get feedback on my understanding.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am unhappy when assignments need to be completed in a group situation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Finding a time to meet for group assignments is difficult	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Strongly Disagree	Disagree	Agree	Strongly Agree
It is highly motivating for me to work on assignments with a group of peers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am happy to work on assignments with a group of peers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Finding an effective way to communicate with peers while working on group assignments is challenging	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My motivation for the group assignments generally decrease because of the peers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group assignments give me a valuable opportunity to rethink my own ideas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



*SAGA instrument (Specific)*

*This question is only asked to the students in the treatment group.*

**What do you think about group quizzes in this class?**

Please choose the answer that best describes your feelings.

	Strongly Disagree	Disagree	Agree	Strongly Agree
It was highly motivating for me to work on quizzes with a group of peers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group quizzes gave me a valuable opportunity to rethink my own ideas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I was happy to work on quizzes with a group of peers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group quizzes provided me with the opportunity to get feedback on my understanding.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I was unhappy since quizzes needed to be completed in a group situation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Strongly Disagree	Disagree	Agree	Strongly Agree
My motivation for the quizzes generally decreased because of the peers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group quizzes gave me a chance to learn from my peers' knowledge.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Finding an effective way to communicate with peers while working on quizzes was challenging	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Doing quizzes as a group was less time consuming than doing them by myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## *Growth Mindset Survey*

First, you will answer an opinion survey about **beliefs and goals regarding ability and performance.**

It is very important that you give your honest opinion, not what you believe someone else would think best.

Read each statement, decide how much you agree or disagree with the statement.

	Disagree a Lot	Disagree	Disagree a Little	Agree a Little	Agree	Agree a Lot
I like my work best when I can do it really well without too much trouble.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To tell the truth, when I work hard, it makes me feel as though I'm not very smart.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
No matter how much intelligence you have, you can always change it a good deal.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When something is hard, it just makes me want to work more on it, not less.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Disagree a Lot	Disagree	Disagree a Little	Agree a Little	Agree	Agree a Lot
You can learn new things, but you cannot really change your basic level of intelligence.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like my work best when I can do it perfectly without any mistakes.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like work that I'll learn from even if I make a lot of mistakes.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like my work best when it makes me think hard.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## *Grit Survey*

Here are a number of statements that may or may not apply to you. When responding, please think about how you compare to everyone not just the people you know. There are no right or wrong answers, so just answer honestly!

	Very much like me	Mostly like me	Somewhat like me	Not much like me	Not like me at all
I have been obsessed with a certain idea or project for a short time but later lost interest.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often set a goal but later choose to pursue a different one.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am a hard worker.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Setbacks don't discourage me. I don't give up easily.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Very much like me	Mostly like me	Somewhat like me	Not much like me	Not like me at all
I have difficulty maintaining my focus on projects that take more than a few months to complete.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am diligent. I never give up.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I finish whatever I begin.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
New ideas and projects sometimes distract me from previous ones.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**How many hours per week, on average, did you spend on studying for all your classes outside of the time you spent in the classroom this semester?**

[Just type the number of hours you spent. For example, if you spent 20 hours on average, type 20. If you spent 15 hours and 30 minutes, type 15,5. Do not enter any blanks.]

**How many hours per week, on average, did you spend for studying for ECON 3100 outside of the time you spent in the classroom this semester ?**

[Just type the number of hours you spent. For example, if you spent 20 hours on average, type 20. If you spent 15 hours and 30 minutes, type 15,5. Do not enter any blanks.]

100% Alone 100% With Others  
0 10 20 30 40 50 60 70 80 90 100

Considering all your classes during this semester, what percentage of your overall studying time (outside of class) did you spend with others (based on the scale above)?



100% Alone 100% With Others  
0 10 20 30 40 50 60 70 80 90 100

Considering ECON 3100, what percentage of your overall studying time (outside of class) did you spend with others (based on the scale above)?



Never Always  
0 10 20 30 40 50 60 70 80 90 100

Considering all your classes during this semester, how much did you cram for exams or do an assignment at the last minute (based on the scale above)?



*These questions are only asked to the students in the treatment group.*

Outside of any in-class activities, did you study with your peers for problem sets, quizzes, or exams for ECON 3100?

[Check that all apply]

Yes, for problem sets

Yes, for quizzes

Yes, for exams

No

For each randomly assigned partner, please answer the following questions.

**PARTNER 1:**

Did you know your partner when you were first assigned?

Did you work together with your partner for a class other than ECON 3100?

Do you think you are similar with your partner in terms of personality?

Do you think you are similar with your partner in terms of academic level?

**PARTNER 2:**

Did you know your partner when you were first assigned?

Did you work together with your partner for a class other than ECON 3100?

Do you think you are similar with your partner in terms of personality?

Do you think you are similar with your partner in terms of academic level?

**PARTNER 3:**

Did you know your partner when you were first assigned?

Did you work together with your partner for a class other than ECON 3100?

Do you think you are similar with your partner in terms of personality?

Do you think you are similar with your partner in terms of academic level?

## *Trust Game*

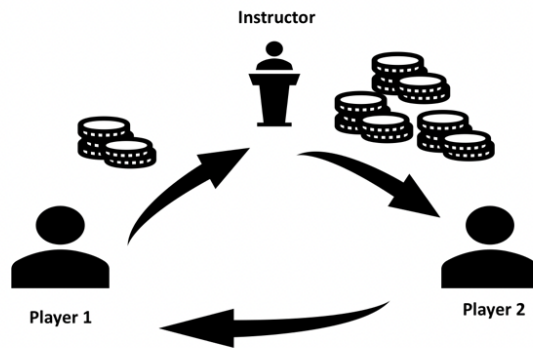
### **Game Instructions**

Now, you will play a game in which you will be randomly paired with another person (henceforth your partner).

Both you and your partner will receive \$2 to start with.

### **Here is the sequencing of the game:**

- Player 1 will decide how much of the \$2 to send to Player 2.
- The amount Player 1 decides to send to Player 2 will be tripled by us.
- Player 2 will decide how much of his/her total money to send back to Player 1.



You will now answer four questions regarding this game.

Depending on the question, you will either be Player 1 or Player 2. Furthermore, depending on the question you will either be matched with a partner in your section of ECON 3100 or in another section of ECON 3100.

At the end of the survey, one of these questions will be randomly selected. You will be paid with an Amazon e-gift card based on your answer in that question only. You can earn up to \$8.

Suppose you are randomly assigned to play the role of **Player 1**.  
Suppose Player 2 is someone in **this** section of ECON 3100. How much of your \$2 are you willing to send to Player 2?  
(Remember: The amount you choose to send will be tripled and then passed to Player 2. Player 2 will then decide how much of his/her total money to send back to you! Your payment will be the amount you choose not to send plus the amount player 2 will send to you.)

\$0

\$0.5

\$1

\$1.5

\$2

Suppose you are randomly assigned to play the role of **Player 1**.  
Suppose Player 2 is someone in **another** section of ECON 3100. How much of your \$2 are you willing to send to Player 2?  
(Remember: The amount you choose to send will be tripled and then passed to Player 2. Player 2 will then decide how much of his/her total money to send back to you! Your payment will be the amount you choose not to send plus the amount player 2 will send to you.)

\$0

\$0.5

\$1

\$1.5

\$2



Suppose you are randomly assigned to play the role of **Player 2**.  
Suppose Player 1 is someone in **this** section of ECON 3100. How much  
will you send back in each of the following situations?

(Remember: Your payment will be your \$2 plus the tripled amount  
Player 1 sends you minus the amount you send back to Player 1.)

Please enter the numerical amount (no blanks, no dollar signs, no  
words).

The amount you will send back to Player 1 (\$)

If player 1 sends \$0  
(you have \$2 in  
total):

If player 1 sends  
\$0.5 (you receive  
\$1.5 so you have  
\$3.5 in total)

If player 1 sends \$1  
(you receive \$3 so  
you have \$5 in total)

If player 1 sends  
\$1.5 (you receive  
\$4.5 so you have \$6  
in total)

If player 1 sends \$2  
(you receive \$6 so  
you have \$8 in total)

Suppose you are randomly assigned to play the role of **Player 2**.  
Suppose Player 1 is someone in **another** section of ECON 3100. How  
much will you send back in each of the following situations?  
(Remember: Your payment will be your \$2 plus the tripled amount  
Player 1 sends you minus the amount you send back to Player 1.)

Please enter the numerical amount (no blanks, no dollar signs, no  
words).

The amount you will send back to Player 1 (\$)

If player 1 sends \$0  
(you have \$2 in  
total):

If player 1 sends  
\$0.5 (you receive  
\$1.5 so you have  
\$3.5 in total)

If player 1 sends \$1  
(you receive \$3 so  
you have \$5 in total)

If player 1 sends  
\$1.5 (you receive  
\$4.5 so you have \$6  
in total)

If player 1 sends \$2  
(you receive \$6 so  
you have \$8 in total)