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Research Article

# An Authentic Learning Approach to Group Assignments: An Analysis of Student Attitudes

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**Abstract**
Using a difference-in-difference estimator adapted to include student fixed effects, we examine whether exposure to an authentic, business-oriented approach to group assignments improves student attitudes about working in groups. Our results show that, compared with a traditional approach, students exposed to the business-oriented approach had significantly improved attitudes about group assignments in general. Specifically, students indicate that forming groups was more authentic and likable, individual grading processes were fairer, and scheduling group meetings was easier. We also identify the marginal effects for these improved attitudes and show that the relevant factors are, in descending order of importance, improvements to group scheduling, group formation, and individual grading.

## 1 Introduction

The National Association of Colleges and Employers (NACE) reports that, beyond a strong grade point average, the resume attributes that employers desire most are problem-solving skills and an ability to work in teams (NACE 2017). Other highly valued attributes include verbal and written communication skills, leadership skills, analytical skills, and a strong work ethic. To help their students acquire these skills, instructors often require their students to complete group assignments. Existing research shows that these assignments can improve students' abilities to write, speak, solve problems, negotiate, and coordinate plans (Oakley et al. 2004; Hansen 2006; Chapman et al. 2006).

We assess empirically how exposure to the "project manager/private contractor" (PM/PC) approach to group assignments that authentically parallels a common business structure affects student attitudes about working in groups (Brown et al. 2019). Our difference-in-difference (DID) regression results show that students exposed to this business-oriented approach had significantly improved attitudes about group assignments compared with a traditional group assignment approach. Specifically, students report that forming groups was more authentic and likable, individual grading processes were fairer, and scheduling group meetings was easier. Our analysis of the marginal effects indicate that student attitudes improved, in decreasing order of importance, due to difference in group scheduling, group formation, and individual grading.

## 2 The PM/PC Approach

The PM/PC approach to group assignments requires instructors to adopt the role of corporate executive (CEO) and requires students to adopt the role of either a project manager or a private contractor. Under the approach, a student's choices, responsibilities, and incentives in class mirror realities in actual business settings and vary based on the role he or she plays. The instructor facilitates the group formation process by gathering, collating, and redistributing one-page resumes for all students and arranging for all students to give one-minute speeches to their peers about why they want to or should be a manager or contractor. Project managers (PMs) are chosen by a class vote. Students acting as managers recruit their classmates

who act as contractors and support completion of work assignments. Just as managers supervise contractors in business settings, student managers provide oversight of student contractors. Further, student managers become a critical component of the grading mechanism by providing grade recommendations to the instructor in exchange for a lump sum of bonus points that managers may either keep or distribute to their contractors.

This simulated business approach is a specific example of a more general technique called "authentic learning" (Herrington, Reeves, and Oliver 2010). The general technique calls for instructors to create immersive classroom learning environments that go beyond mere reliance on an instructor's personal set of ad hoc stories and examples (Herrington and Oliver 2000). Authentic learning is similar to experiential learning in that both highlight the value of real-world learning environments (e.g., McCarthy and McCarthy 2006). However, authentic learning generally accepts the physical or online classroom as a given, while experiential learning typically envisions students leaving the classroom, for example, to do an internship. While actual encounters afforded by experiential learning are valuable, the quality of such experiences varies in practice. Experiential learning opportunities often lack uniform levels of mentorship across students, particularly guided critical reflection (King and Sweitzer 2014). Likewise, experiential learning does not always target professional development such as real-time management and communication with employees or upward feedback to managers. Simulated encounters, such as the one proposed here, seem to offer structured learning environments that allow for more thoughtfully guided critical reflection and soft-skill development, while still maintaining the appearance and associated benefits of an authentic business environment.

The authors of the PM/PC approach speculate that the model might improve student attitudes about group assignments. Students often, but not always, oppose group assignments (Felder and Brent 2001; Phipps et al. 2001). For example, Gottschall and Garcia-Bayonas (2008) find that over half of business students have negative attitudes toward group work. Buckenmyer (2000) and others identify many reasons why students have negative attitudes about group assignments: unclear instructor expectations, mismatched grade expectations among group members, free riders, and students' lack of knowledge about how to form teams, choose team leaders, and divide work effectively (Caspersz, Wu, and Skene 2003). Pfaff and Huddleston (2003) generalize student objections and identify three basic problems. Students do not like (i) how instructors form teams, (ii) how instructors assign individual grades, and (iii) how challenging it is to schedule group meetings. Building on the descriptive foundation laid by the authors of the PM/PC approach, we evaluate empirically how exposure to that approach affects student attitudes about group projects. Evidence suggests that when students have positive attitudes about the method of their instruction, they are more receptive to course content and are more successful students (Caspersz, Wu, and Skene 2003).

## 3 Treatment and Comparison Courses

We use a DID approach adapted to include student fixed effects to assess how exposure to the PM/PC model affects student attitudes about group assignments. The DID approach is an example of a quasi-experimental research design in which there is a treatment group and a nonrandomly assigned comparison group with the latter serving as a natural, though imperfect control. For our quasi-experimental research design, we identified two similar undergraduate courses at different universities, implemented the PM/PC approach in one (the treatment course), and used traditional group assignment approaches in the other (the comparison group). We taught the treatment course in the Fall 2017 term and the comparison course in the Spring 2018 term.

The treatment and comparison courses were similar, but not identical. Both courses were advanced undergraduate agricultural finance courses offered at large, public, research-oriented, land-grant

universities. The two courses shared the same four learning outcomes, including the same wording.[1] Both instructors pursued these four learning outcomes in similar ways using lectures on financial principles, Microsoft Excel applications, and group work solving business problems.

The treatment course included three group projects. Each project emphasized financial management decision making by agricultural producers. The target number of students per group was four. To form groups, the instructor solicited resumes from and then created resume packets for each student. Students each made one-minute speeches in class about their qualifications. Students then ranked which students they thought should be PMs. The instructor compiled the rankings and announced who the PMs were, and each PM recruited three private contractors (PCs) from among the remaining students. To grade individual students, the instructor assigned a grade to each project that, by default, was also the PM's grade and awarded to each PM additional bonus points equal to 10 percent of the maximum points possible for the assignment. If they desired, the PMs distributed any portion of their bonus points to their PCs. The PMs also recommended grades for each of their PCs with the constraint that the average PC grade in their group must equal the project grade assigned by the instructor. The three group projects varied in points possible, but together the projects counted for 95 percent of students' final course grades. To facilitate scheduling of meetings, the instructor allocated two 75-minute class periods for each of the three group projects (7.5 hours total) for groups to work together in the computer lab with Microsoft Excel applications. To accommodate this additional in-class meeting time, the instructor distributed lecture content (PowerPoint sides) via the learning management system equal to three hours of in-class lecture time. The instructor implemented exactly the "basic" PM/PC approach described by Brown et al. 2019. As these authors encourage, the instructor frequently reminded students to think of their group assignments as actual business activities, to remember their roles and responsibilities, and to behave accordingly.

In the comparison course, the instructor formed groups, graded individuals, and scheduled meetings using traditional processes. The instructor assigned students to groups randomly with a target number of four students per group. The instructor assigned seven group projects worth 50 percent of students' final grades, including six Harvard Business School cases and one comprehensive project on company financial analysis.[2] Student groups completed Microsoft Excel application exercises and prepared discussion briefs for each case. The instructor in the comparison course graded each group project and adjusted individual grades based on two peer evaluation surveys administrated in the middle and at the end of the term. These peer evaluation scores measured students' citizenship contributions such as responsiveness to group communications, willingness to contribute, attitude, timeliness, and each member's relative percent contribution to the overall group effort (Kaufman and Felder 2000). To facilitate group meetings, the instructor in the comparison course allowed six 50-minute class periods (5 hours total) for in-class group interactions. Groups completed the semester-long company financial analysis projects completely outside the class meeting time with a 70-minute class period for final project presentations.

The treatment and comparison courses were similar but not identical with respect to student backgrounds. Figure 1 shows frequency distribution comparisons for these variables. The medians of all such measures are the same in the two classes. A typical student from our sample has senior class standing with a cumulative GPA between 2.6 to 3.0 and an age less than 20 years old. With respect to the group project experience, a typical student in the sample reports having more than 12 months of paid work experience and reports learning to work in groups about as much from their past college classes as from

[1] "Upon the completion of this course, students will be able to (1) explain financial concepts used in the financial management, (2) apply financial concepts and analytic tools to real world problems, (3) use Microsoft Excel to solve financial problems, and (4) have enhanced written and oral communication skills for solving problems that require leadership and/or teamwork" (quote taken verbatim from the treatment course syllabus and the comparison course syllabus).

[2] While the number of group assignments in the comparison course ($n$ = 7) was more than the number of group assignments in the treatment course ($n$ = 3), neither course instructor received any direct or perceived any indirect signals indicating student fatigue with the number of group assignments. If unobserved fatigue was higher in the comparison course, we may overestimate the treatment effect.

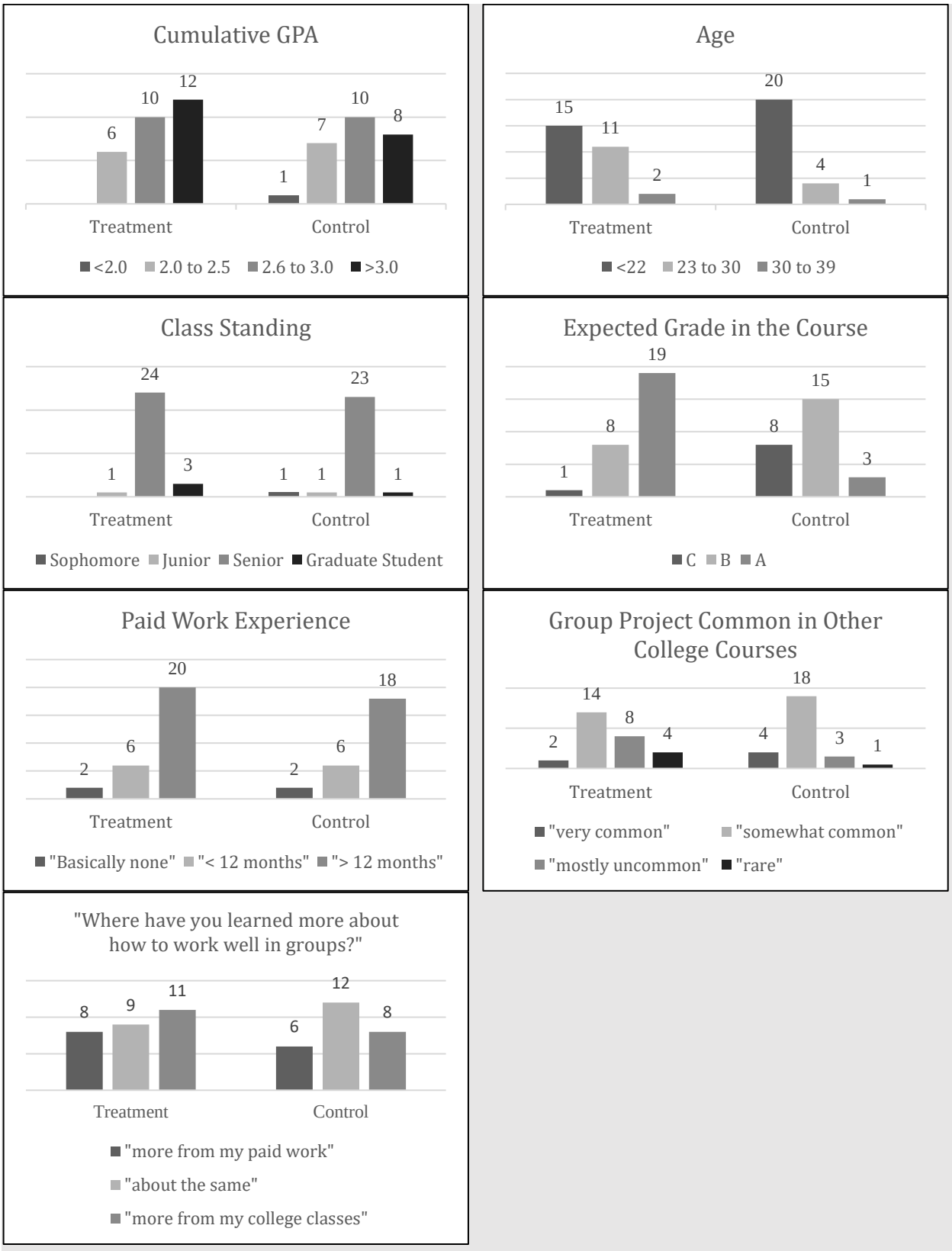


**Figure 1. Student Background Comparisons Between Treatment and Control Groups**

their paid work experiences. We apply the Mann-Whitney test further to determine whether our two independent samples of students were from populations having the same distribution. Three variables

show significant differences between treatment and comparison courses at the 90 percent confidence level based on the tests. Students in the treatment course were older, expected higher grades in the course, and had less experience with group projects in their past college courses (Figure 1). Taking advantage of the panel structure of the data, which provides two survey observations per student, we modify the simple DID estimator with the inclusion of student fixed effects. This modified DID approach controls for all student-specific characteristics that do not vary between each student's "before" and "after" responses.[3]

## 4 Discussion of Research Design

One concern with any quasi-experimental design is that assignment to the treatment group is not random, raising concerns about selection bias. In our situation, students registered for their course generally without knowledge of the course's planned approach to group assignments and without other meaningful options such as enrolling in the same course at a different institution. These factors diminish selection bias that might occur if study participants, for example, selected into the treatment course based on the expected benefits of that particular approach. The above factors diminish similar concerns that nonrandom assignment to the treatment course will result in baseline differences between the treatment and comparison groups, potentially confounding outcome effects. The advantage of using the DID approach with student fixed effects is that the student fixed effects help control for any unobserved time-invariant student-specific characteristics.

A second concern for the DID estimator is the assumption of parallel trends. This assumption allows analysts to attribute a divergent evolution of the treatment group over time, if observed, to the impact of the treatment. Ideally, we would have multiple pre-period observations of all participants to assess whether the outcome variables and/or covariates exhibited parallel evolutions over time in the historic pre-period. Unfortunately, we only have two periods of data and so cannot directly test for empirical evidence of parallel trends using historic data. However, we see no meaningful argument to suggest that the parallel trend assumption should not hold. Students at both institutions share many similarities. We draw all study participants from two advanced undergraduate agricultural finance courses offered at large, public, research-oriented, land-grant universities. Although we do not know the residency mix of students in each course, the Education Commission of the States (Macdonald, Zinth, and Pompelia 2019) reports that secondary school graduation requirements are similar for each institution's in-state students who compose the majority of undergraduate students at each institution.[4] In general, we feel comfortable maintaining the parallel trends assumption to permit a causal interpretation of our estimated impacts.

The third concern of the DID approach is the Stable Unit Treatment Value Assumption (SUTVA). This assumption requires no interference between treatment and comparison groups and no different versions of treatment. Since we taught the treatment and comparison courses at different institutions, we expect minimal interference or spillover effects between the two groups of students. Also, we implement the basic version of the PM/PC approach fully without variable levels of treatment. Thus, the SUTVA holds.

A final concern of the DID approach is that interactions with all study participants during the study period should be the same with the only difference being that the treatment group receives the treatment. A limitation of our study is that we have different instructors for the treatment and comparison courses, creating the possibility that we cofound the effects of exposure to the PM/PC approach with the effect of exposure to instructor-specific qualities. However, both instructors in our study were early career full-time assistant professors with similar levels of teaching experience. They both adopted active learning practices and cultivated collaborative and active learning environments for their students.

[3] The final data set used for the fixed effects regression models has 108 observations from 54 students; the ratio of the number of parameters to be estimated to the number of observations is 0.55.

[4] During the period of study (2017/2018), the resident population at the comparison course institution was 57 percent, and at the treatment course institution, it was 69 percent. Both states required secondary school graduates to complete 22 Carnegie units total, including four units of English, three units of social studies, three units of science, and either three or four units of math.

# 5 Survey Design and Administration

To measure student attitudes about group work in the treatment and comparison courses, we elected to use a retrospective pretest survey. Retrospective pretest surveys, as described by Hill and Betz (2005), require respondents to think about a prior time (e.g., experiences in courses prior to this one) and complete a retrospective rating and then immediately afterward complete a rating of the current practice (e.g., experiences in this course). Investigators often prefer such surveys to traditional pretest/post-test surveys when they think respondents are unlikely to maintain constant standards for judging their attitudes or self-assessments from pre- to post-test (Skeff, Stratos, and Bergen 1992). Respondents are more likely to change their rating standards as the length of time from pre- to post-test increases and the more that the treatment stimulates respondents to think about the dimensions being rated. We chose to use a retrospective pretest survey rather than a traditional pre- to post-test intervention survey for this reason. We wanted student ratings to reflect only the effects of the intervention and not changes in the standards students used for their self-ratings. In our case, a four-month academic term seems a relatively long time, and our experience implementing the PC/PM approach previously suggests to us that the approach increases students' understanding of how groups can form, how individuals can be graded, and how meetings can be scheduled (i.e., the very dimensions we seek to measure).

In our retrospective pretest survey, we asked students six different five-point Likert-style questions to measure their attitudes about the three areas of concern previously discussed, namely how groups are formed, how individuals are graded, and how meetings are scheduled (Table 1). We use the student responses to these six questions as dependent variables in six different DID models. For each, we asked students to indicate their level of agreement with each statement both retrospectively ("before") and currently ("after") using a five-point Likert scale. The Likert scale options were "Strongly Disagree," "Disagree," "Neither Agree nor Disagree," "Agree," and "Strongly Agree." Our survey also included questions about students' general background, including their current cumulative GPA, age, year in school, expected final grade in the course, and group project experience in other college courses, as well as their paid work experience (Figure 1). We administered our retrospective survey in our treatment and comparison courses near the end of their respective semester terms, December 2017 and April 2018, respectively. We received 54 total responses, 28 from the treatment course and 26 from the comparison course.

**Table 1. Likert-Scale Measures of Six Student Attitudes from Survey (Dependent Variables)**

| Type of Student Concern | Survey Prompt |
|---|---|
| Forming Groups | (1) "Forming groups reflected the real world." |
| | (2) "I liked the group forming process." |
| Grading Individuals | (3) "The grading process was fair." |
| | (4) "I liked the grading process." |
| Scheduling Meetings | (5) "It was easy to find times to work together." |
| Overall | (6) "I like class group projects." |

# 6 Empirical Specification

The discrete choices from our survey are logically ordered, where one refers to "strongly disagree" and five refers to "strongly agree." Thus, we adopt an ordered logit model to estimate changes in our dependent variables (Greene 2012, p. 760). Assume that one latent preference, $Y^*$, varies continuously in the space of individual utility and underlies students' discrete responses, $Y$, in the survey, as shown in equation (1). Then:

$$Y_{it}^* = \beta_1(Treat_i \times After_t) + \beta_2 After_t + c_i + \varepsilon_{it}, \quad (1)$$
$$Y_{it} = j \; if \; \gamma_{j-1} < Y_{it}^* < \gamma_j, j = 1,2,3,4,5$$

We can interpret $Y^*$ as the continuous student attitude about a given group process. The parameter $\gamma_j$ is the unobserved cut points to convert the continuous latent preference into discrete responses. The dummy variable *Treat* equals one if the observation is from the treatment group and zero if from the comparison group. The dummy variable *After* equals one if the observation occurs post-treatment and zero if the observation occurs pretreatment. The parameter $c_i$ represents a fixed effect for student *i* that controls for all time-invariant, student-specific characteristics (e.g., historic GPA, race-ethnicity, gender, secondary school education, etc.), including whether the student is in the treatment group or not. Under the identification assumptions, the sign of $\beta_1$ indicates the sign of the treatment effect, and the magnitude of the effect can be obtained using post-estimation predictions. An ordered logit model (Equation 2) can be used to estimate the nonlinear DID specification (Athey and Imbens 2006; Karaca-Mandic, Norton, and Dowd 2012; Puhani 2012). The probability of having $Y_i = j$ conditional on the vector *x* corresponds to a standard logistic distribution function, $L\ (\omega)$:

$$P(Y_{it} = j|x) = F(\beta_1(Treat_i \times After_t) + \beta_2 After_t + c_i) \quad (2)$$

where $F(\cdot) = L\ (\omega) \equiv \frac{e^{\omega}}{1-e^{\omega}}$ and $j = 1,2,3,4,5$.

As shown by Karaca-Mandic, Norton, and Dowd (2011) and Puhani (2012), the sign of the treatment effect in a logit DID model is equal to the sign of the coefficient of the interaction term, $\beta_1$. We estimate all models with student fixed effects. We obtain marginal effects with post-estimation predictions, which we interpret as average treatment effects, following Norton, Wang, and Ai (2004) and Karaca-Mandic, Norton, and Dowd (2012).

# 7 Results

We first present basic DID comparisons (Table 2) without including any control variables and without relying on our fixed effects assumption. These basic comparisons show that students exposed to the traditional group assignment processes generally exhibit no statistically significant change in attitudes "after" such exposure. Students in the PM/PC course, however, liked the group forming process more ($p < 0.01$) and found it to be a better reflection of real business settings ($p < 0.01$). These students also agreed more strongly that the group grading process was fair ($p < 0.10$) and that scheduling group meetings was easier ($p < 0.01$). They also agreed more strongly that they liked class group projects overall ($p < 0.01$).

The lone exception to the statistically significant differences noted above is that students exposed to the PM/PC approach did not like the individual grading process any more or less than students exposed to the traditional approach. Students thought grading under the PM/PC approach was fairer ($p < 0.10$), but they did not like the grading process any more or less ($p \geq 0.10$). It appears that the authenticity of the group assignment approach does not affect how much students like grading in a course. In our experience implementing the PM/PC approach, we note that PMs regularly assign the same grade to all contractors without adjusting according to effort. If PMs do not regularly adjust PC grades based on differentiated effort, we might appropriately expect that students' attitudes about grading methods are statistically no different than traditional approaches.

To identify differences in student attitudes resulting from the PM/PC treatment in more detail, we estimate six ordered logit regression models with individual fixed effects. These independent models explain students' reported levels of agreement with each of the six statement prompts (dependent variables). Results are shown in Table 3. These six regression models reinforce our initial findings from our basic DID comparisons that the PM/PC approach positively affects student attitudes about group assignments. The signs and levels of statistical significance from Table 2 and Table 3 reflect the same findings for all six of our regression models. These basic results suggest that the instructor effect is minimal and that the observed difference in students' attitudes about group work is actually the consequence of the PM/PC group assignment approach.

**Table 2. Basic Difference-in-Differences Calculations**

| Survey Prompt | | Before | After | Difference |
|---|---|---|---|---|
| *Real Forming* "Forming groups reflected the real world." | Treatment | 2.46 | 4.43 | 1.96*** |
| | Comparison | 3.31 | 3.88 | 0.58** |
| | **Difference** | -0.84*** | 0.54** | 1.39*** |
| *Like Forming* "I liked the group forming process." | Treatment | 2.89 | 4.14 | 1.25*** |
| | Comparison | 3.38 | 3.23 | -0.15* |
| | **Difference** | -0.49** | 0.91*** | 1.40*** |
| *Fair Grading* "The grading process was fair." | Treatment | 3.71 | 4.32 | 0.61*** |
| | Comparison | 3.85 | 3.92 | 0.08 |
| | **Difference** | -0.132 | 0.40* | 0.53* |
| *Like Grading* "I liked the grading process." | Treatment | 3.37 | 4.19 | 0.81*** |
| | Comparison | 3.27 | 3.65 | 0.38 |
| | **Difference** | 0.09 | 0.53* | 0.43 |
| *Easy Meeting* "It was easy to find times to work together." | Treatment | 2.50 | 4.46 | 1.96*** |
| | Comparison | 3.04 | 2.96 | -0.08 |
| | **Difference** | -0.54* | 1.50*** | 2.04*** |
| *Like Groups* "I like class group projects." | Treatment | 2.39 | 4.11 | 1.71*** |
| | Comparison | 2.96 | 3.31 | 0.35 |
| | **Difference** | -0.57* | 0.80** | 1.37*** |

Note: ***, $p < 0.01$; **, $p < 0.05$; *, $p < 0.10$. Higher values indicate greater levels of agreement with survey prompt. Survey prompts (dependent variables) are five-point Likert-style measures (1 = "strongly disagree" and 5 = "strongly agree") of student attitudes about various aspects of group assignments that concern students. "*Real Forming*" and "*Like Forming*" relate to student concerns about how instructors form groups. "*Fair Grading*" and "*Like Grading*" relate to student concerns about how instructors grade individual students. "*Easy Meeting*" relates to student concerns about scheduling meetings with their other group members. "Like Groups" measures students' attitudes about group assignments overall.

Other than signs and significance levels, coefficient estimates from ordered logit models like ours can be hard to interpret. Post-estimation predictions and marginal effects can make results more understandable. Table 4 shows these post-estimation results. The values in Table 4 indicate the change in likelihood as a percentage that a student will have a particular response to a particular survey prompt due to exposure to the PM/PC approach, holding all else constant. For example, after exposure to the PM/PC approach, students are 20.4 percent more likely ($p < 0.01$) to "strongly agree" and 12.4 percent less likely ($p < 0.10$) to "strongly disagree" that they "like class group projects," holding all else constant.

Similarly and, again, holding all else constant, students exposed to the PM/PC methods are 38.8 percent more likely to "strongly agree" that scheduling meetings is easy compared with the comparison group ($p < 0.01$). The same students under the same conditions are 31.2 percent more likely ($p < 0.01$) and 17.2 percent more likely ($p < 0.10$) to respond this way about the likability of the group forming process and the fairness of the grading process, respectively. When students in the treatment course are relatively more likely to strongly agree that a particular positive statement is true (e.g., +38.8 percent for easy scheduling versus +17.2 percent for fair grading), we interpret that difference as a measure of students' relative enthusiasm for one component of the PM/PC model versus others. By this logic, the marginal effects indicate that the factors most contributing to students' improved attitudes are, in descending order of importance, improvements in group scheduling, group formation, and group grading processes effectuated by the use of the PM/PC approach.

**Table 3. Ordered Logit Model Results of the Treatment Effect**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | "Forming groups reflected the real world." | "I liked the group forming process." | "The grading process was fair." | "I liked the grading process." | "It was easy to find times to work together." | "I like class group projects." |
| **Y =** | *Real Forming* | *Like Forming* | *Fair Grading* | *Like Grading* | *Easy Meeting* | *Like Groups* |
| ***Treat × After*** (DID) | **4.796**$^{***}$ | **4.833**$^{***}$ | **2.539**$^{*}$ | **1.626** | **8.940**$^{***}$ | **4.267**$^{***}$ |
| | (1.427) | (1.583) | (1.424) | (1.242) | (2.351) | (1.419) |
| ***After*** (Current Course) | 2.031$^{**}$ | -0.521 | 0.554 | 1.628$^{*}$ | -0.278 | 1.354 |
| | (0.876) | (0.878) | (1.175) | (0.928) | (0.780) | (0.889) |
| N | 108 | 108 | 108 | 107 | 108 | 108 |
| Pseudo $R^2$ | 0.449 | 0.343 | 0.488 | 0.345 | 0.535 | 0.449 |
| Log-likelihood Value | -86.953 | -93.145 | -64.352 | -88.194 | -73.346 | -86.953 |
| Individual Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |

Note: We estimate ordered logit models with individual fixed effects (number of students = 54). The individual fixed effects control for all time-invariant student characteristics, including assignment to the treatment or comparison course and students' self-reported cumulative GPA, age group, class standing, expected final grade in the course, months of paid work experience, the common level of group projects in other college classes, and most meaningful source of group work experience (college classes or paid employment). Standard errors are clustered by individuals. "Treat" is a dummy variable indicating that a student was exposed (one) or not exposed (zero) to the PM/PC approach. "After" is a dummy variable indicating that a student response includes (one) or does not include (zero) consideration of experiences in the "Current Course" (i.e., the treatment or comparison course). ***, $p < 0.01$; **, $p < 0.05$; *, $p < 0.10$

# 8 Conclusions and Discussion

In this study, we evaluate the effects of the PM/PC approach on students' attitudes about group assignments. Our analysis provides empirical support that the basic PM/PC approach, likely due to its increased authenticity, yields improved student attitudes toward group scheduling, group formation, and group grading processes. We identify limitations of our data and analysis, including reasonable concerns about the parallel trends assumption, the quasi-experimental study design with different instructors, and nonrandom assignments of participants to the treatment and comparison courses. Our study results are limited also by the small sample sizes of about 30 participants in each course. Further investigation using more robust study designs and richer data is needed to increase confidence in our conclusions.

Additionally, further examination about how student attitudes change in response to alternate versions of the PM/PC approach is required. For our study, we implement and examine only the "basic" version of the approach as described by [citation omitted for blind review]. These authors mention several ways to modify their basic approach, for example, by using alternate rules for grading or by offering guided reflections about leadership attributes as part of the group formation process. Regarding the latter, existing scholarship indicates that choosing leaders is a complex social process involving gender, ethnic, and other biases that should not be approached naively (Carnes, Houghton, and Ellison 2015; Brescoll 2015; Beckwith, Carter, and Peters 2016). The specific adaptations of the PM/PC approach that are needed to deal with these biases most appropriately have not been studied.

Further study could also examine impacts beyond improving student attitudes, for instance, how the PM/PC and other simulated business approaches affect student academic performance. Weldy and Turnipseed (2010) assess how working in groups on actual—not simulated—business management

**Table 4. Summary of Marginal Effects**

| | Strongly Disagree | Disagree | Neither Agree nor Disagree | Agree | Strongly Agree |
|---|---|---|---|---|---|
| *Real Forming* | | | | | |
| "Forming groups reflected the real world." | -0.127* | -0.256*** | -0.036 | 0.061 | 0.359*** |
| | (0.068) | (0.07) | (0.023) | (0.038) | (0.091) |
| *Like Forming* | | | | | |
| "I liked the group forming process." | --- | -0.542*** | -0.069 | 0.300*** | 0.312*** |
| | | (0.151) | (0.042) | (0.071) | (0.100) |
| *Fair Grading* | | | | | |
| "The grading process was fair." | --- | -0.081 | -0.142* | 0.051 | 0.172* |
| | | (0.053) | (0.084) | (0.035) | (0.093) |
| *Like Grading* | | | | | |
| "I liked the grading process." | -0.018 | -0.07 | -0.12 | 0.086 | 0.121 |
| | (0.022) | (0.052) | (0.087) | (0.067) | (0.086) |
| *Easy Meeting* | | | | | |
| "It was easy to find times to work together." | -0.153 | -0.697*** | 0.18* | 0.282*** | 0.388*** |
| | (0.106) | (0.147) | (0.109) | (0.097) | (0.065) |
| *Like Groups* | | | | | |
| "I like class group projects." | -0.124* | -0.217*** | -0.046* | 0.184*** | 0.204*** |
| | (0.072) | (0.045) | (0.027) | (0.064) | (0.071) |

Note: We estimate ordered logit models with individual fixed effects. The individual fixed effects control for all time-invariant student characteristics, including assignment to the treatment or comparison course and students' self-reported cumulative GPA, age group, class standing, expected final grade in the course, months of paid work experience, the common level of group projects in other college classes, and most meaningful source of group work experience (college classes or paid employment). Standard errors are clustered by individuals. ***, $p < 0.01$; **, $p < 0.05$; *, $p < 0.10$

projects affects students' learning. They find that both student perceptions of learning and actual learning are high as a result of such group projects with actual business ties. The impact of the PM/PC approach on student learning outcomes calls for future research.

Finally, further consideration and study is needed to assess how well the PM/PC approach works for different disciplines and different course types. For our study, we implemented the approach in an undergraduate agricultural finance course. Students may demonstrate better attitudes and more learning if the approach is used in courses with students who, as a group, have more diverse knowledge, skills, and experiences (Fleischmann and Daniel 2010). In such cases, students would need to wrestle more with the advantages and disadvantages of their choices of managers and contractors. Given a group project assignment of sufficient complexity, forming teams would likely be more challenging, the consequences of choosing well or poorly would likely be more impactful, and the student experience overall would therefore likely be more enriching. Further study is needed to confirm these hypotheses.

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