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## “We’ve Got to Keep Meeting Like This”: A Pilot Study Comparing Academic Performance in Shifting-Membership Cooperative Groups Versus Stable-Membership Cooperative Groups in an Introductory-Level Lab

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### ABSTRACT

This study examined possible ways to increase student engagement in small sections of a large, introductory-level, required university course. Research shows that cooperative group learning boosts achievement through fostering better interpersonal relationships between students. Cooperative group learning is an evidence-based instructional practice engaging students in active learning. The present study investigated whether cooperative groups with sustained-membership functioned more effectively for boosting performance than shifting-membership cooperative groups. Findings indicated that the amount of class time spent in groups influenced the impact of shifting or sustained-membership. A significant difference in performance was found for sustained-group students when group activities were used the majority of the time during recitation.

### KEYWORDS

Cooperative groups; teaching methods; college instruction; group learning; cooperative learning; introductory courses; student performance; academic performance; collaborative groups; pedagogy

Both universities and instructors struggle to find ways to motivate, connect with, and anchor students to the university community at large. Introductory courses at large universities commonly consist of large lecture halls packed with students. Courses serving hundreds of students at once frequently use a lecture-based format, leaving little room for student engagement. Given that these courses often function as required components of general education or liberal arts programs, non-majors comprise much of the enrollment in these classes. In this setting, instructors face the ongoing challenge of engaging students, connecting with them, and helping them achieve. In many universities, attempts to create opportunities for relationship-building between instructors and students include adding a lab meeting to the course. Typically taught by graduate students, universities refer to this extra weekly meeting as a “recitation section.” Designed to act as a buffer for the anonymity present in the large lecture setting, recitation sections consist of weekly meetings of smaller groups of students. In this smaller setting where personal relationships can develop, students work with graduate teaching assistants to arrive at a more complete understanding of the theories, ideas, and concepts covered previously in class meetings devoted to lecture.

Despite these efforts, many programs find the common problem of student apathy unresolved. Students still

frequently arrive into recitation sections without having completed the assigned readings and often exhibit total disinterest and/or unwillingness to participate in the planned class activities and discussions. Given the fact that these meetings occur only once weekly during the semester, the graduate teaching assistants leading the smaller recitation sections often struggle to make those connections with students. The fact that graduate teaching assistants remain responsible for instructing several sections of recitations compounds the problem.

To address these concerns, many university instructors use cooperative learning groups, a common strategy to improve learning outcomes. This learning structure differs from individualistic learning in that students work in small groups to “maximize their own and each others’ learning” (Johnson, Johnson, and Smith 2014, p. 87). In this approach, instructors take care to ensure that students work together to accomplish something rather than work independently on different pieces of a project. Instructors design small cooperative groups with either heterogeneous or homogenous membership (Baer 2003). The issue of which group construction is more effective, however, remains unresolved. Although some recent scholarship suggests heterogeneous groups may benefit student performance (Kagan 1992; Woodfolk 200; Zamani 2016), other research found homogenous groups superior (Davidson 1990; Santrock 2004). Previous

research found that students prefer to work in homogeneous groups (Mathews 1992). During class meetings the groups take on structured tasks to complete. The tasks require interdependence from group members, who must work together to complete them, but grading also includes a facet of individual accountability. Instructors carefully and actively monitor group interactions to ensure all members contribute, rather than just giving a blanket group score (Millis 2014). This active learning approach transfers the responsibility for learning onto the students themselves.

Students' relationships with both instructors and other students can greatly influence their quality of university life (Astin 1993; Pascarella 2001; Tinto 1994), and these positive relationships can increase a student's commitment to their studies while boosting social adjustment and integration to university life, which improves the odds that the student will stay at the university (Tinto 1994). Programs add a weekly small discussion section to a large introductory course in part to reduce the anonymity and isolation of the larger class setting. But using small group activities within those discussion settings can further increase the effect of camaraderie and accountability. Studies repeatedly demonstrate that when instructors use small cooperative groups, students perceive more social support, trust, and social cohesion in their classes than when instructors design assignments where students work individualistically or competitively (Johnson et al. 2014). Thus, many instructors turn to cooperative groups in college courses to try to build rapport and trust among students and with instructors (Springer, Stanne, and Donovan 1999; Tseng and Yeh 2013).

Cooperative group learning groups can be conceived in a multitude of ways in terms of strategies to build groups. In the shifting-membership approach, instructors form groups for the purpose of the single task during a single class period. For future tasks, the instructor forms new groups that students again abandon at the class meeting's end. In the stable-membership group, alternatively, instructors form groups that will be maintained over the course of a longer period, such as a semester, unit, or grading period. Educators can make an argument for either approach. Forming a new group for each task enables students to meet and become acquainted with more classmates. Students have the opportunity to plant the seeds of relationship-building with more classroom peers, which could result in more of a sense of class community, belonging, and cohesion. Given that any randomly formed group could easily turn out to be dysfunctional, using a shifting-membership approach gives students a new opportunity each class meeting to be part of a functional group. Conversely, the

stable-membership groups approach provides the potential to contribute to deeper relationship-building. Repeated exposure over time to the same students could breed familiarity and a stronger sense of belonging to the student's assigned group, if not to the entire class. This research examines the use of both of these types of small groups. Given that existing research establishes the advantage of using small cooperative groups in higher education courses, this study seeks to investigate different outcomes comparing the shifting-membership group approach and the stable-membership group approach.

## Background

Research shows that compared to traditional learning environments (individualistic, competitive), cooperative group learning boosts student achievement, improves interpersonal relationships among students themselves, and fosters more positive attitudes toward the course (Hwang, Lui, and Tong 2005; Kopenhaver and Shrader 2003; Norman, Rose, and Lehmann 2004). Cooperative group learning helps boost performance through relationship building (Johnson and Johnson 1999; Johnson, et al. 2014; Mitchell, Reilly, Bramwell, Solnosky, Lilly 2000; Springer et al. 1999). As Johnson and Johnson (1999) pointed out, "long-term caring peer relationships [are] necessary to influence members consistently to work hard in school" (p. 69). This is especially important at the collegiate level, where "researchers and practitioners have shown that positive peer relationships are essential to success in college" (Smith 1996, p.72). Further, when college students do not develop a social circle of classmates, the risk of dropping out increases (Tinto 1994). Small group approaches in the classroom allows college students to get to know both classmates and their professor better (Huggins and Stamatel 2015).

While increasing learning and investment requires relationships between teachers and students, even the best teachers are often unable to form close connections with every single student (Giani and O'Guinn 2010). However, peer relationships can help bridge that gap. Even in the absence of strong student-teacher connections, peer-to-peer relationships provide support, increase engagement, and encourage achievement (Timar and Maxwell-Jolly 2012). Student investment in working together tends to increase affection for one another, which can increase how hard students work toward academic achievement (Johnson et al. 2014).

The benefits of cooperative group learning can be connected to constructivist educational theory, which relies on the idea that learners construct knowledge through social interaction. According to Vygotsky (1978), student learning does not occur through passive

listening but through communication and interaction with other people. In this view of learning, we do not acquire knowledge. Rather, students *make* knowledge while socially constructing personal interpretations, which are steeped in students' own experiences.

Accordingly, cooperative group learning serves as the central pedagogical approach used in constructivist educational learning, rather than the passive acquisition of knowledge that lectures require of students. Because students take the role of active thinkers who experience class materials directly in tandem with classmates (Jones and Becker 2002), the stage is set for the construction of knowledge (Elliot, Kratochwill, and Littlefield Cook 2000; Jones and Becker 2002). Cooperative group learning also fosters a sense of community within the classroom, which can have important positive effects on the ability of students to construct knowledge (Rodriguez and Berryman 2002).

An umbrella term for numerous approaches, cooperative group learning can be implemented in a number of ways. Groups can range from pairs to larger collections of students. Either group membership can be predetermined by the instructor, or students can self-select group members (Davidson and Major 2014). Instructors can choose group membership by purposeful selection or random assignment (e.g. drawing numbers). Membership can be stable through the semester, or it can shift throughout at regular intervals. Instructors have the choice to form cooperative groups solely for a specific task or goal that lasts no longer than a class period (Johnson et al. 2014), or instructors may decide to maintain group memberships for activities stretched over several weeks (Michaelson, Davidson, and Major 2014). Much of this depends upon personal preference. In fact, instructors often rotate between the approaches depending upon the task.

## Methods

### *Setting and sample*

The researchers conducted this study at a large, four-year public university. Two semesters (15-weeks each) of a large introductory sociology course with enrollments of 152 and 176 students comprise the data used in this study. In this course, instructors evaluated students in a variety of ways, including individual test scores, quiz grades, in-class activities, and individual papers. Similar methodologies have been employed in other studies examining teaching methodologies and pedagogies (Echeto 2015; Huggins and Stamatel 2015; Jarjoura, Tayeh, and Zgheib 2015; Lew and Schmidt 2011). Class meetings included two 50-minute sessions per week

where the entire class met for lecture, and one additional 50-minute recitation section where a smaller subset of approximately 30 students met with a graduate teaching assistant. At the university where the study occurred, the program designed recitations as a space where students could expand on the concepts presented during lecture, clarify material from the course, receive additional instruction, and gain increased understanding.

Three graduate teaching assistants split the recitation sections for one large lecture introductory course. Only two of those assistants participated in this research and participated across both semesters. Both graduate teaching instructors instructed three recitation sections both semesters. The recitation meetings occurred throughout the week. This scheduling permits students to be able to work the recitation into their schedule and the department to be able to adequately staff the sections. Both recitation instructors previously served in the same capacity for the specific course examined in this study.

Following the general curriculum mandated by the supervising professor, every recitation section meeting began with a quiz over the unit in the course textbook for a given week. During seven recitation meetings over the course of the semester, film clips were shown. During the remaining time each week, the graduate teaching assistants elected to split students into groups in an effort to improve learning outcomes. In all of the recitation classes, student groups worked on critical thinking activities requiring discussion, problem-solving, and consensus-building. Often students were given complex scenarios to consider using a sociological lens and instructed to form an action plan. Each group approached the problems presented in in-class assignments, applied sociological concepts, debated solutions, and reached consensus. Students routinely disagreed and had spirited conversations regarding their selected solutions to these issues. The graduate teaching assistants chose different approaches to group construction, which forms the basis of the study at hand.

The university where the study took place serves a population fairly that is evenly split among gender lines (nearly 52% female), is primarily White (75%), and is made up primarily of students native to the state (greater than 75%). The students in the recitations closely mirrored the campus population during the first semester. The second semester featured a more skewed sample: more female and White.

### *Shifting-membership groups versus stable-membership groups*

The two graduate teaching assistants took different approaches to group formation. The first graduate

teaching assistant had students take quizzes independently and then move into groupings of three to five students formed on-the-spot to complete the in-class activities that followed. Each week, this graduate teaching assistant used a different randomized method for forming groups, (e.g. asking students to count off, having the students draw numbers upon entry to the classroom, etc.). This produced a unique and random grouping with a different configuration of group members for each and every class meeting. The first graduate teaching assistant made this decision based on prior experience using groups, as well as her pedagogical view of group formation (e.g. giving students equal opportunity to be members of a functional group, giving students the opportunity to form connections with more classmates, etc.).

The second graduate teaching assistant used five-to-seven-member groups during the first class meeting, which led to stable and static membership over the course of the semester. To construct the groups initially, the graduate teaching assistant used a random selection method (drawing playing cards). The two instructors' competing philosophies regarding group formation methodology accounted for the difference in the size of groups. Instructor one constructed smaller groups coming from the philosophy that smaller group membership puts more onus on each member to contribute and creates a less hospitable environment for "free loaders." Instructor two came from the rational that slightly larger group size ensures groups will not be "resource deficient" when faced with the various tasks presented throughout the semester (Michaelson, Knight, and Fink 2014, p. 60). Both graduate teaching assistants maintained the same group formation approach over both semesters.

### ***Delivery and time spent in groups***

The researchers conducted this inquiry over two semesters. An important shift took place between semester one and semester two. Specifically, during the first semester the supervising professor required the graduate teaching instructors to show films lasting 15 to 20 minutes during seven of the 15 recitation section meetings. Given that an opening quiz over the week's reading already cut into the recitation meeting timing, the films cut the available class time dramatically. This resulted in only around 10 to 15 minutes available for group work in nearly half of the recitation section meetings. Meanwhile, in the other half of recitation meetings, after the opening quiz, the graduate teaching assistants devoted the entire remaining class period (30 to 35 minutes) to group work. However, during the second semester, the graduate teaching assistants received permission from the supervising professor to reduce the number of films shown during recitation. As

a result, in the second semester of this inquiry, the graduate teaching assistants showed film clips in only 5 of the 15 weeks. Further, the supervising professor granted permission for the graduate teaching assistants to cut the running time of these clips down to approximately 7 minutes apiece. Therefore, during the second semester, the graduate teaching assistants devoted 30 to 35 minutes to group work in 10 of the 15 recitation section classes. In the remaining five classes, the graduate teaching assistants dedicated 23 to 28 minutes to group work.

## ***Measures***

### ***Dependent variable***

The researchers used final exam scores to assess overall academic performance in the courses. This exam consisted of a variety of multiple choice and true/false questions. Students could earn scores ranging from 0–100.

### ***Independent variables***

A dummy variable measuring whether students participated in a recitation section using shifting-membership groups or stable-membership groups served as the primary variable of interest. The value of "0" represented those students who participated in a recitation section using shifting-membership groups, while the value of "1" signified those students participating in a stable-membership recitation section.

### ***Control variables***

The researchers designed the variable for gender as a binary measure, where the value of "0" corresponded to male students, and the value of "1" represents female students. The researchers categorized students into racial categories according to self-identified race and ethnicity categories, including White, African American, Asian American, Hispanic/Latino, and Middle Eastern. Due to the small number of non-White students, the researchers constructed a binary variable, where the value of "0" signified White students, and the value of "1" corresponded to non-White students. Researchers created a categorical variable measuring grade-level standing with the following categories: 1st-year (which was the reference category), 2nd-year, 3rd-year, and fourth-year. Finally, the researchers included in the models the first quiz grade earned by the students. Since the first quiz of the semester took place prior to students spending time in groups of any kind, this measure served as a proxy for the students' abilities and performance before the effects being considered in this inquiry. Table 1 displays the descriptive statistics for the aforementioned variables separated by cohort and semester.

**Table 1.** Descriptive statistics.

Variables	Semester One					Semester Two				
	Cooperative		Team-Based		Sig	Cooperative		Team-Based		Sig
	Mean	(SD)	Mean	(SD)		Mean	(SD)	Mean	(SD)	
Female	50%		56%			66%		67%		
White	75%		82%			83%		87%		
Grade Level										
First Year	71%		50%		**	54%		37%		*
Second Year	6%		27%		**	33%		44%		
Third Year	15%		10%			9%		6%		
Fourth Year	9%		13%			4%		14%		*
First Quiz	—		—			6.7	(1.56)	7.15	(1.61)	*
N	68		84			82		87		

\* $p < .05$ \*\* $p < .01$ \*\*\* $p < .001$ . (two-tailed test)

## Analyses

The researchers used STATA to conduct separate T-tests for each semester to examine whether significant differences in the mean scores for the final exam for the stable-membership cohort and shifting group membership cohort existed. Building on these bivariate tests, to test for differences while including controls and controlling for clustering by section for each semester, the researchers used STATA to run multilevel linear regressions.

## Results

At the bivariate level, the T-tests demonstrated no significant difference in the final exam scores of the stable-membership cohort compared to the shifting-membership cohort during the first semester of this study ( $t = -1.40$ ,  $p = 0.16$ ). Therefore, during the first semester, the difference in group construction failed to result in significant improvements in student final test scores.

During the second semester, however, the researchers found a significant difference in the final exam scores ( $t = -2.73$ ,  $p < 0.01$ ). In semester two, the bivariate analysis demonstrated that the students in the stable-membership cohort had test scores over 4 points higher on average compared to their counterparts assigned to shifting-membership groups.

The researchers recognize the possibility that the differences found in the second semester could be attributable to other factors. First, as shown in Table 1, during the second semester, class enrollment resulted in significant differences in the percentages of 1st-year students versus 4th-year students in the sections employing shifting-membership groups versus the stable-membership groups. In the stable-membership groups sections, the class enrollment featured 34% fewer 1st-year students, and nearly three times as many fourth-year students. Second, we also recognize the possibility that unmeasured differences between the sections themselves could play a role as well, including differences in student

**Table 2.** Multilevel models of team-based learning clustered by section.

Variables	Semester One				Semester Two				
	Model 1		Model 2		Model 3				
	<i>b</i>	(SE)	<i>b</i>	(SE)	<i>b</i>	(SE)		(SE)	
Stable Membership	1.98	(2.18)	2.72	*	(1.39)	2.34	*	(1.43)	
Female	-1.24	(2.07)	-1.4		(1.44)	-1.74		(1.42)	
White	0.19	(2.56)	1.63		(1.90)	0.98		(1.89)	
Grade Level									
Second Year	6.05	*	(2.91)	1.07	(1.49)	0.87		(1.47)	
Third Year	3.9		-(3.30)	-0.55	(2.72)	0.61		(2.72)	
Fourth Year	-0.51		(3.39)	5.26	*	(2.53)	4.71	*	(2.50)
First Quiz Grade						1.08	**	(0.44)	
Constant	74.97	***	(2.80)	79.93	***	(2.13)	73.43	***	(3.37)
Number of Grps	6			6			6		
Avg Obs	25.3			28.2			28.2		
Rho	0			0			0		
N	152			169			169		

\* $p < .05$ \*\* $p < .01$ \*\*\* $p < .001$ . (one-tailed test)

**Table 3.** Means tests of cooperative versus team-based Learning.

	Cooperative		Team-Based		<i>t</i>	<i>Sig</i>
	Mean	(SD)	Mean	(SD)		
Semester One	75.38	13.44	78.38	12.65	-1.41	
Semester Two	80.86	9.86	84.30	8.00	-2.5	*

\* $p < .05$ \*\* $p < .01$ \*\*\* $p < .001$ . (two-tailed test)

backgrounds and abilities, the abilities of the graduate teaching assistants, and the graduate teaching assistants' teaching style, to name a few.

To address these concerns, we employed multilevel analyses employing random effects at the section level examining the students' final exam scores, the stable-membership measure, and demographic controls. As shown in Table 3, consistent with the bivariate findings, the students in the stable-membership cohort did not perform differently on the course final exam compared to the shifting-membership cohort. Alternatively, as shown in Model 2, in the second semester the results indicate that students in the stable-membership sections scored 2.72 points higher on the final exam on average compared to the students in the shifting-membership cohort. The models also demonstrate that there is more than a six-point difference between the final exam scores of the first-year and fourth-year students in this inquiry. Taken together, this result was consistent with the bivariate findings presented in Table 2, and indicates that, while differences in section composition can contribute to higher test scores (e.g., the distribution of grade-level), there is also a significant effect attributable to the use of the stable-membership approach.

To test this finding more rigorously, Model 3 includes the grades earned by students on the first quizzes, which were given at the beginning of the second recitation section class meeting before the students had ever participated in group work. This measure, therefore, can serve as a proxy for a student's baseline ability and performance before the effects of the type of group work conducted in class could take place. Importantly, even with this control added to the model, the significant effect for the stable-membership cohort remains. Even when controlling for at least some aspect of students' natural abilities, drive, and performance, there is significant evidence that the stable-membership approach still resulted in higher achievement. It should also be noted that there was no significant effect attributable to unmeasured difference between the discussion sections in any of the models. In fact, the rho coefficient for each of the analyses was essentially 0, which indicates that nearly all of the variance in the final test scores is attributable to the individual differences in the students.

## Discussion

This study examined whether using stable-membership group work compared to shifting-membership group work led to gains in student achievement during recitation/lab section meetings for a large-enrollment introductory sociology course. Using two semesters of data, the analyses demonstrated that the stable-membership approach did result in higher test scores compared to the use of more traditional ad hoc student groups. This finding came with an important caveat: the stable-membership approach only resulted in higher test scores in one of the two semesters.

These seemingly inconsistent findings lead to an additional question: why was there a difference between the two semesters in the data? Across both semesters, team construction protocol, the group assignments, and the graduate teaching assistants remained stable. The single important difference between the two semesters was the amount of time students spent in groups. As outlined earlier, during the first semester of the study, the supervising professor required the graduate teaching assistants to devote a significant amount of recitation class time to a quiz and the presentation of relatively lengthy film clips. During the second semester, while the quizzes remained, the supervising professor permitted the graduate teaching assistants to significantly reduce the number and duration of the film clips. This suggests that while the group composition used in the stable-membership sections is important, it is likely conditioned upon the amount of time students actually spent interacting and working with team members.

This study has a number of implications. First, this study indicated that the stable-membership approach in large introductory courses during recitation meetings can have an improved impact over the shifting-membership approach. The difference reported above—around 2.4 points on the final exam—is worth nearly half a letter grade. The structural limitations presented by classes of this type as outlined above make this result especially significant. The fact that the models found such significant differences in student performances despite the fact that the students only worked in groups for one of three class meetings per week indicates the potential of the stable-membership approach in this setting as a means for improving student performance.

Next, this study suggests the importance of the manner in which groups are constructed and administered during recitation meetings. The findings for the second semester of data demonstrated that, on its own, an increased amount of time spent in groups was not sufficient to raise test scores. Rather, time spent doing group work increased its effectiveness when group memberships

do not change from class to class. Even though the students in the shifting-membership groups met and worked with different peers all semester long, the results suggest a greater impact on relationship-building when students consistently work with the same peers each week, so long as sufficient time is given to small group work each class meeting. This supports the existing literature regarding the value of peer-to-peer relationships in building engagement and increasing learning.

### Limitations

One limitation of these data is that it is not an experiment. The data presented represent a post-hoc analysis of two different recitation sections. The results represent preliminary data that could be used to construct a more rigorous study about the differences between stable-membership groups and shifting-membership groups in a cooperative learning environment. Further study on this topic is warranted.

The fact that teaching assistants served as the instructors in this inquiry represents another limitation of this study. Teaching assistants are often inexperienced teachers still juggling their own student responsibilities. A program's graduate teaching assistants also vary from semester to semester. While two seasoned professors attempting static-membership groups over shifting-membership groups may experience the same outcomes, further study is necessary to determine that fact. Given that many universities use the recitation/lab model presented here, these results remain relevant to those settings. In other pedagogical environments, this inquiry serves as a starting point of investigation.

Both graduate teaching assistants used different group sizes in their classes. While this difference could play a role in the disparity in achievement between the groups, in the first semester of data collection, group size differences existed, and the data demonstrated no difference between the student groups. The only difference in achievement between the shifting-membership groups and the static-membership groups occurred in the second semester of data collection, during which the difference in group size remained constant.

### Conclusion

This study sought to answer the question: Compared to a shifting-membership group approach, does a stable-membership approach lead to improved educational outcomes? Using data from two semesters of instruction for an introductory sociology class, the models indicated that this question can be answered in the affirmative. The analyses used in this study demonstrated that a

stable-membership approach correlates with improved educational outcomes compared to group work performed in shifting-membership groups, with one important caveat: The positive outcomes associated with the stable-membership approach were conditioned on the amount of time students spent working in groups. Thus, this research shows that a stable-membership approach used during recitation/lab section meetings for large introductory classes can improve student success, so long as students spend adequate class times in those groups, giving them time to form relationships with one another.

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