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Gender Differences in Cooperative Learning with University Students

Differences in achievement were investigated for 80 female and 80 male university students who were randomly assigned to either cooperative or competitive teaching methods. After viewing a videotaped instruction on research design, participants completed a mini-assignment either individually in the competitive condition or with a same-sex partner in the cooperative condition. All participants individually completed a multiple-choice test to assess achievement. Although no differences were found on the multiple-choice test, on the mini-assignment women scored significantly higher in the cooperative than in the competitive condition, whereas men performed about equally in both conditions.

Nous avons étudié les différences de performance chez 80 étudiants et 80 étudiantes universitaires à qui l'on avait assigné, par hasard, un projet conforme, soit à des méthodes de coopération, soit à des méthodes concurrentielles. Après avoir visionné une vidéo de directives portant sur la méthodologie de recherche, les participants ont complété un petit travail seul, dans un contexte concurrentiel, ou bien avec un partenaire de même sexe dans un contexte de coopération. De plus, tous les participants ont complété un examen à choix multiples individuellement, pour mesurer leur performance. Les résultats de cet examen ne révèlent aucune différence. Toutefois, la note e qu'ont obtenue les femmes pour le petit travail était bien plus élevée pour celui accompli dans un contexte de coopération que dans un contexte de concurrence. La performance des hommes était semblable dans les deux contextes.

Over the last 10 years, the research on the use of cooperative learning at the university level has increased dramatically. Many studies have examined the effectiveness of cooperative learning in specific disciplines such as psychology (Baer, 2003), business (Kunkel & Shafer, 1997), education (Rittschof & Griffin, 2001), and science and mathematics (Springer, Stanne, & Donovan, 1999), as well as with specific populations such as university athletes (Dudley, Johnson, & Johnson, 1997) or reentry adults (Brewer, Klein, & Mann, 2003). However,

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few studies have examined gender differences in the effectiveness of cooperative learning. With women now constituting the majority of Canadian undergraduate students, it is important to understand learning approaches that may be particularly well suited to them. To address this gap in the research literature, the current study focused on possible gender differences in university students who were taught in a traditional lecture environment versus an alternative, cooperative learning environment.

Cooperative Learning

Collaborative learning is an umbrella term used to describe a variety of educational approaches involving joint intellectual effort by students or students and teachers. Cooperative learning represents the most carefully structured end of the collaborative learning continuum, where instruction involves small groups of students who work together to maximize their own and each other's learning with the group's learning being structured around precisely defined tasks or problems (Smith & MacGregor, 1992).

Cooperative learning is based on the theory of social interdependence, which focuses on the effect of various types of cooperative, competitive, and individualistic goal structures (Johnson & Johnson, 1999; Johnson, Johnson, & Smith, 1998; Slavin, 1996). The type of social interdependence created by goal specification determines how individuals act and interact in a situation, which in turn affects the outcome of that interaction. Social interdependence can be positive, negative, or neutral. Positive goal interdependence exists where learning is cooperative. Students cooperate and perceive that their own chance of success is increased by the success of other students. In contrast, negative interdependence is created in competitive learning environments where students compete with each other and perceive that their chances of success are diminished by the success of fellow students. Neutral interdependence is when students learn in an individualistic manner such that success in one student is independent of success in other students.

Johnson and Johnson (1999) present five essential features that define cooperative learning as an instructional activity. First, cooperative learning involves face-to-face interaction where students actively participate with one another in contributing to group performance. The second element is individual accountability, which involves participants being responsible for their share of the work and helps to prevent unequal individual contribution. Third, students must possess interpersonal and small-group skills that are necessary for quality cooperative learning and must be motivated to use these skills. Group processing, the fourth key element, requires members to monitor goal achievement and can be fostered by instructors who set specific rather than vague goals, allow sufficient time for group work, and issue clear expectations about group performance. The last and most important feature is positive interdependence, which involves students cooperating, supporting, and helping one another to be successful. This element can be accomplished through the setting of mutual learning goals, with students learning the assigned material and making sure their peers do the same (goal interdependence), having students share resource materials (resource interdependence), establishing group rewards (reward interdependence), or any combination of these.

Cooperative Learning and Achievement

Cooperative learning has generally been shown to result in higher academic achievement in students. From a meta-analysis of 37 studies of undergraduates in science, mathematics, engineering, and technology courses who experienced small-group work inside or outside the classroom, Springer et al. (1999) reported a moderately strong effect size (d=.51) for students with cooperative learning showing higher achievement than students without cooperative learning. Interestingly, effect size was significantly greater when achievement was assessed by instructor-developed evaluations (d=.59) compared with standardized instruments (d=.33).

Other research suggests that homogeneity of cooperative group membership may have a role in achievement, although the results are mixed. In an educational psychology course, Baer (2003) found that homogeneous cooperative groups (determined by early achievement in the course) performed significantly better than heterogeneous cooperative groups on the final examination. More specifically, there was no significant difference for low achievers in either type of group. However, homogeneous grouping was significantly related to achievement for average and high achievers. Similarly, Onwuegbuzie, Collins and Elbedour (2003) found in a graduate research methods course that more homogeneous, high-aptitude cooperative groups produced the best research proposals and article critiques. However, they also found an aptitude (i.e., mean mid-term group performance) by heterogeneity (i.e., variability of individual midterm scores) interaction: the difference in quality of research article critiques between high-aptitude and low-aptitude groups was greater for the more homogeneous groups than for the higher heterogeneous groups. In contrast to Baer, they concluded that instructors should use heterogeneous (in achievement) cooperative-learning groups in their graduate research courses.

In another vein, several studies disconfirm a significant relationship between achievement and cooperative learning. Two studies (Klein & Schnackenberg, 1999; Kunkel & Shafer, 1997) compared cooperative groups with individual learning and found that the individual learning students scored significantly better on an exam than the cooperative groups. In comparing randomly assigned in-class and out-of-class reciprocal peer tutoring groups with an individual learning control group in a graduate educational research course, Rittschof and Griffin (2001) found no differences in achievement on an exam of course material. Finally, a study (Crooks, Klein, Savenye, & Leader, 1998) comparing cooperative and individual learning in undergraduates using computer-based instruction reported no statistically significant differences in achievement.

From these representative studies it is not clear whether homogeneous or heterogeneous (in ability level) cooperative learning groups are more likely to facilitate achievement. However, it may be that other grouping variables such as gender are as important as or more important than ability.

Cooperative Learning and Gender

Writings from the Stone Center (Jordan, Walker, & Hartling, 2004) conceptualize women's sense of self as being rooted in connections and relatedness, whereas men's self-concepts are based more on separation and autonomy.

Some research supporting this view has shown women to be higher in affiliation, cooperative attitude, and interdependence (Fultz & Herzog, 1991; Markus & Kitayama, 1991). It is possible to perceive learning as a social activity that can be moderated by social interdependence and independence. If women have more positive attitudes than men toward cooperation and social interdependence, then it follows that learning methods that allow for the development of trusting and interdependent relationships among students and between students and teachers should be more effective for women than for men. Thus where interdependence, cooperative attitudes, and desire for affiliation exist, competitive teaching methods may not create the most effective learning environments for women.

Research by Inglehart, Brown, and Vida (1994) has supported this belief. They found that the more competitive women perceived the environment to be, the less well they achieved, probably because they tended to focus more on interpersonal aspects of competition. Inversely, the more competitive men perceived the environment to be, the better they performed, probably because they tended to focus on achievement-related aspects of competition. Similarly, Ellison and Boykin (1994) reported that their sample of university women achieved better following cooperative learning than individualistic learning, and the cooperative learning was significantly related to more time on task, more positive attitudes toward the learning experience, and more perceived ability.

One construct that has been found to be related to cooperative learning for women is affiliation (being oriented toward connection with others and nurturance). Fultz and Herzog (1991) reported a gender-by-construct interaction whereby women were higher than men in affiliation, whereas men were higher than women in instrumentality (independence and goal achievement). More recent studies on affiliation and cooperative learning in postsecondary education (Brewer et al., 2003; Klein & Schnackenberg, 1999), however, did not examine gender differences on affiliation. In contrast, Springer et al. (1999), in their meta-analysis of science and math students, found no significant differences in the effects of small-group learning, where they include "cooperative and collaborative forms of small-group learning" (p. 25), on student achievement between predominantly female groups and heterogeneous or mixed-gender groups. Finally, Golbeck and Sinagra (2000) randomly assigned male and female students to same-sex and mixed-sex collaborative groups and in an individual learning control condition and found no differences among the three groups in learning a Piagetian spatial task.

Because of these mixed results, more research is needed to clarify the interaction among gender, affiliation, and cooperative learning. Klein and Pridemore (1993) did such an aptitude-treatment-interaction (ATI) study investigating affiliation in relation to cooperative versus competitive teaching effects on academic achievement, time on task, and satisfaction in a university sample that was 85% women. Results showed that participants who worked cooperatively spent more time on the practice exercises than people who worked individually, and the high-affiliation group who learned cooperatively experienced superior achievement in the application section of the test, whereas high-affiliation students who worked alone showed the lowest level

of achievement. Because the mean affiliation score for this predominantly female sample was higher than the norm, these results suggest that a gender-related ATI may have been present.

An aptitude-treatment interaction provides another basis for predicting gender differences in cooperative versus competitive learning. Gender differences in affiliation, interdependence, and instrumentality could potentially interact with effectiveness of teaching method, but this remains to be demonstrated. In addition, all the cited research was performed in the United States, and there is a need to verify these relationships in a Canadian context. Accordingly, it was hypothesized in the present study that cooperative teaching methods would result in better achievement than competitive teaching methods for female students, whereas cooperative teaching methods would result in equal or lower achievement than competitive teaching methods for male students. It was also expected that women would score higher than men on a measure of affiliation. Finally, multiple regression analyses are used to determine the best predictors of achievement for men and women.

Method

Participants and Design

One hundred, sixty students (80 male and 80 female), drawn from the introductory psychology subject pool at the University of Western Ontario, participated in this experiment. All participants received course credit. The age of participants ranged from 17-50 years (M=20.6 years). Half the participants in each gender group were randomly assigned to the cooperative (pairs) method of learning and half were assigned to the competitive (individual) method.

Materials

The instructional device was a 26-minute professional videotape from a series *Inside Statistics* that covered the topic of experimental design. It consisted of three sections: observations versus experiments; confounding; and randomized comparative experiments. Important concepts were presented in each section, followed by detailed descriptions of real experiments that illustrated those concepts.

Practice exercises or mini-assignments were prepared for participants to complete for each of the three sections of the instructional videotape. For the first exercise, the individuals or pairs were instructed to think of an observation they had made outside the experimental situation, ask a legitimate question based on it, form a hypothesis, and come up with a brief description of an experiment to test that hypothesis. The second exercise directed students to read summaries of two experiments and critique experimental design and conclusions. The third exercise provided students with a research question and required them to design an experiment to answer the question. These assignments were scored by awarding one mark for each valid point recorded by participants with respect to the assigned task. Participants' scores ranged from 8 to 27. A 24-item, multiple-choice achievement test was given to all participants to test their knowledge of the information from the video presentation and practice exercise segments. Test items were constructed to reflect the six categories of Bloom's Taxonomy (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956): knowledge, comprehension, application, analysis, synthesis and evalua-

tion. The maximum possible score on this test was 24, and participants' scores ranged from 9-23.

Procedure

Participants were tested in groups of three to 10 and told that they were taking part in a study designed to determine the best way to teach research design to university undergraduates, but were not informed of the details of the teaching methods. Each experimental session was designated by random assignment as either cooperative or competitive. Depending on the treatment condition, participants were informed that they would work either individually (in the competitive condition) or in same-sex pairs (in the cooperative condition). In the cooperative learning condition, individuals were randomly assigned a same-sex partner and were seated next to that partner facing a video monitor. In the competitive condition, students were asked to seat themselves individually facing the video monitor.

Individuals in the competitive condition were told that the person who received the highest score based on a combination of his or her test score and the results of his or her practice exercise work would win a lottery ticket; and that individual scores would be rank-ordered from highest to lowest and posted on the chalk board at the front of the room. Individuals in the cooperative condition were told that the two individuals in the group with the highest combined score, derived in the same manner as in the competitive condition, would each win a lottery ticket; and that team scores would be rank-ordered from highest to lowest and posted.

The instructional sequence was the same in both the cooperative and competitive conditions. The video was switched on and then stopped after the first 10-minute segment, and the first set of mini-assignments was distributed, completed, and collected. Participants then completed the multiple-choice achievement test items keyed to that instructional segment. The next video segment was then shown, followed by the second set of practice exercises and test items, and so on for the final video segment. In the competitive condition, each student was given a copy of each practice exercise to complete and hand in. In the cooperative condition, each group received one copy only of the practice exercise, with instructions that both parties must contribute to and agree on the content before it was handed to the experimenter. In both the competitive and cooperative conditions, there was a 15-minute time limit to complete and return each practice exercise. Any groups or individuals who were not finished in the allotted time were asked to turn in their materials unfinished. Following the submission of practice materials, a 10-minute time limit was provided for completion of the appropriate multiple-choice test items.

Following the three-stage instructional sequence, all participants completed both the Affiliation Scale and the CLI Cooperative and Competitive scales individually to provide manipulation checks. While the participants were engaged in these tasks, the experimenter scored the mini-assignments, summed the results for each participant or pair of participants, posted the results, and distributed the prize(s).

Manipulation Checks

The Affiliation Scale of the Personality Research Form (PRF; Jackson, 1984). This was given to participants to check for male versus female differences in need for affiliation. This 16-item, true-false scale measures the degree to which an individual is motivated to affiliate with others and is normed for college populations. A high score on this scale suggests that the individual enjoys maintaining associations with others, accepts others readily, and is more cooperative. Jackson reports an internal consistency reliability of .86 with college samples.

Classroom Life Instrument (CLI; Johnson, Johnson, & Anderson, 1983). This instrument contains two scales: Competitive and Cooperative, with internal consistency reliabilities of .89 and .83 respectively. Both scales use a 5-point Likert scale to identify the degree to which students agree with descriptions about their learning environment. It was expected that a high score on the Competitive Scale would be associated with a low score on the Cooperative Scale and that the mean scores on the two scales would match the actual assigned experimental condition (cooperative or competitive) to which the participant was assigned. Kline (1995), who administered the Cooperative and Competitive scales of the CLI to a sample of university undergraduate students that was over 80% female, found a small negative, nonsignificant relationship between the two scales and interpreted this result as evidence that the two scales are orthogonal. Also, Kline found no significant gender-related mean differences on these scales, but did report that extreme scorers (scoring high cooperative/low competitive) were usually women.

Results

Manipulation Check for Teaching Method

A manipulation check was done to establish whether cooperative versus competitive teaching methods were successfully implemented as indicated by mean scores on the Cooperative and Competitive scales of the Classroom Life Instrument. Factorial 2 x 2 analyses of variance were conducted to determine if the perception of cooperativeness and competitiveness differed as a function of teaching method and gender. As there were eight items on the Competitive scale and only seven items on the Cooperative scale, means and standard deviations in Table 1 are expressed as percentages of the maximum possible scale score.

Using Cooperative scale scores as the dependent variable, the ANOVAs were significant for gender, $F(1,159)=8.56$, $p<.01$, and teaching method, and $F(1, 159)=615.94$, $p<.01$. A significant interaction was also present, $F(1, 159)=5.27$, $p<.05$ (see Figure 1). Results of post-hoc tests (Tukey's HSD) indicated that consistent with the prediction, a significant difference between men and women in ratings of cooperativeness was found in the cooperative condition, but contrary to expectation, this effect was not found in the competitive condition, $q$crit $(4,>120)=2.06$, $q(3, 156)=5.20$ and $q(3, 156)=.63$ respectively. Using the Competitive scale scores as the dependent variable, a second 2 x 2 ANOVA was performed. However, contrary to expectation, no significant difference was found for either gender, $F(1, 159)=.48$, $p>.05$, or teaching method, $F(1,159)=.93$, $p>.05$.

Table 1
Means and Standard Deviations of Cooperative and Competitive Scale Scores as a Function of Gender and Teaching Method

Cooperative Scale

Gender	Teaching Method					
	Competitive		Cooperative		Total	
	M	*SD*	*M*	*SD*	*M*	*SD*
Male	.27	(.10)	.70	(.16)	.48	(.26)
Female	.28	(.11)	.80	(.11)	.54	(.29)
Total	.27	(.10)	.75	(.15)	.51	(.27)

Competitive Scale

Gender	Teaching Method					
	Competitive		Cooperative		Total	
	M	*SD*	*M*	*SD*	*M*	*SD*
Male	.58	(.23)	.61	(.22)	.59	(.23)
Female	.58	(.22)	.54	(.23)	.56	(.23)
Total	.58	(.23)	.57	(.23)	.58	(.23)

The results of this manipulation check show that although more cooperation was perceived in the cooperative teaching condition than in the competitive teaching condition, perceived competitiveness did not differ between cooperative and competitive conditions. Also, although females perceived significantly more cooperation than did males in the cooperative condition, there was no overall gender difference in perceptions of competitiveness.

Manipulation Check for Affliliation

Contrary to expectation, the ANOVA for gender and affiliation was not significant, $F(1, 159)=2.73$, $p>.05$. The mean scores for men ($M=9.2$, $SD=3.4$) and women ($M=10.1$, $SD=3.6$) did not differ significantly. An ANOVA of affiliation scores by gender and teaching method revealed no significant difference due to method, indicating that, as expected through random assignment, participants did not differ in level of affiliation across treatment groups, $F(1,156)=2.62$, $p>.05$. The results of this manipulation check indicate that random assignment was successful in equating cooperative and competitive conditions. Interestingly, both men and women had higher mean scores than the college norms reported by Jackson (1984), $M=8.3$ and $M=8.9$ respectively.

Analysis of Variance of Affiliation Levels

Preliminary ANOVAs, which evaluated level of affiliation in relation to the two outcome measures, were included to provide information about the role of affiliation in the academic achievement of undergraduates. Based on a median score of 10 on the PRF Affiliation scale, two groups were formed through use of a median split: a high-affiliation group ($n=89$) with 38 men and 51 women, and a low-affiliation group ($n=71$) with 42 men and 29 women. One-way

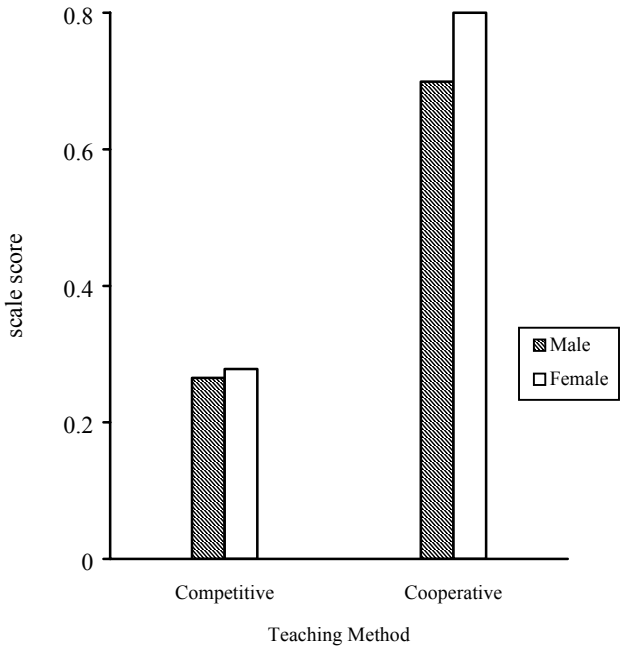

Figure 1. Cooperative scale score as a function of gender and teaching method.

ANOVAs were not significant for affiliation group with multiple-choice test scores, $F(1, 159)=2.73$, $p> .05$, nor with mini-assignment scores, $F(1, 159)=.29$, $p> .05$.

A set of one-way ANOVA's examined the effect of affiliation on achievement for the high-affiliation group as compared with the low-affiliation group for each of the criterion measures, first in the cooperative condition, then in the competitive condition. With the multiple-choice test as the criterion measure, there was no significant difference for the high-affiliation group compared with the low-affiliation group in the competitive, $F(1, 79)=1.56$, $p>.05$, or cooperative teaching condition, $F(1, 79)=.73$, $p>.05$. Similarly, the ANOVAs with mini-assignments as the criterion measure were not significant, indicating that there was no effect due to affiliation level for either of the two outcome measures.

Analyses of Variance of Gender x Teaching Method

The problem of nonindependent data was encountered in the analyses of variance of gender and teaching method due to participants in the cooperative condition working in pairs, resulting in data that were not independent for members of the same pair. To address this problem, all analyses were repeated using the individual, or nonindependent, data in one analysis and the combined, or independent, data for pairs of cooperative participants in a follow-up analysis. Because all results using paired data were identical in terms of statistical significance and magnitude and direction of relationships between variables to ANOVA results using individual data, only the results for individual data are reported here.

Factorial 2 x 2 analyses of variance were conducted to test the main hypothesis that gender would interact with teaching method to determine student achievement. Using multiple-choice test score as the dependent variable, no significant differences were found for either gender, $F(1, 159)=.37$, $p>.05$, or teaching method, $F(1,159)=2.43$, $p>.05$. The interaction of gender and teaching method was similarly nonsignificant, $F(1,159)=.08$, $p>.05$. Examining the data separately for both men and women across teaching methods, no significant differences in multiple-choice test scores were found, $F(1, 79)=.99$, $p>.05$ and $F(1,79)=1.47$, $p>.05$ respectively. Both men and women had means that ranged from 17.5 to 18.3 out of 24 in both conditions or 73-76%.

The same 2 x 2 analysis was next carried out using the mini-assignment scores as the dependent variable. Examining the data for all participants in all conditions, significant main effects were found for teaching method, $F(1, 159)=7.73$, $p<.01$, with higher scores in the cooperative than the competitive condition; and for gender, $F(1, 159)=14.22$, $p<.01$, with higher scores for female participants. A significant interaction was also found, $F(3, 156)=23.51$, $p<.01$. As may be seen in Figure 2, women performed better in the cooperative condition than in the competitive condition, whereas men performed about equally in both conditions. Table 2 shows that the range in means was larger for this measure than on the multiple-choice test.

The cell means of interest were then tested using the Tukey HSD to determine which groups differed significantly in the interaction. The results indicated that for women there was a significant difference due to teaching method, $q(1, 79=8.62$, $q$crit $(4, >120)=2.06$, whereas for men there was no significant difference due to teaching method, $q(1, 79)=1.086$. Results of tests for gender holding teaching method constant were also statistically significant. Specifically, there was a significant difference in the mini-assignment scores of men as compared with women in both competitive and cooperative conditions, with men receiving higher scores than women in the competitive condition, $q(1, 79)=2.07$; and women receiving higher scores than men in the cooperative condition, $q(1, 79)=7.64$. These results indicate that although the hypothesized interaction between gender and teaching method was not found for multiple-choice test scores, the mini-assignment scores did differ significantly in the predicted direction, with women performing better than men in the cooperative condition and men performing better than women in the competitive condition.

Table 2
Means and Standard Deviations of Mini-Assignment Scores by Gender and Teaching Method

Gender	*Teaching Method*					
	Competitive		*Cooperative*		*Total*	
	M	*SD*	*M*	*SD*	*M*	*SD*
Male	16.4	4.0	15.7	3.0	16.0	3.5
Female	15.2	3.5	20.2	4.1	17.7	4.6
	15.8	3.8	17.9	4.2	16.8	4.1

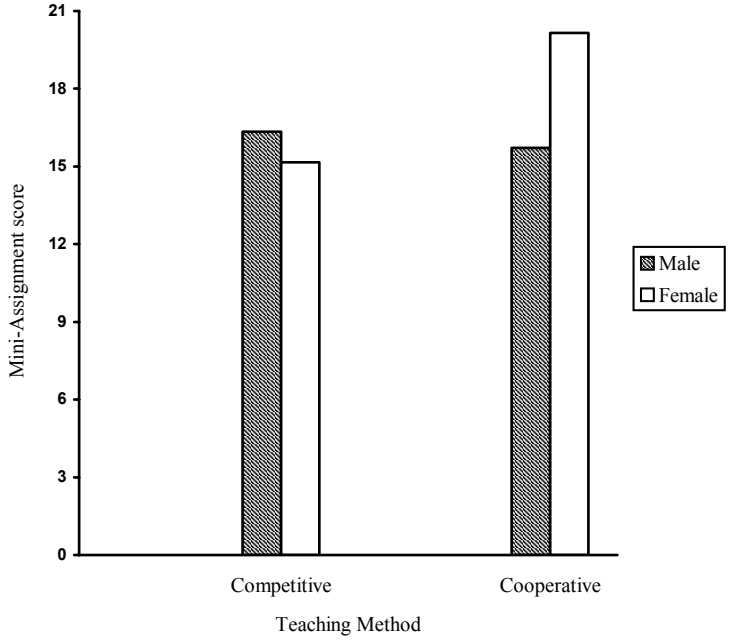

Figure 2. Mean scores on mini-assignments as a function of gender and teaching method.

Predicting Performance

A series of direct-entry multiple regression analyses were carried out to determine the best predictors of performance on both the mini-assignment and multiple-choice test for women, men, and the total sample. The six independent variables (age, gender, Cooperative scale, Competitive scale, Affiliation, and teaching method) were regressed on each performance measure separately. Using multiple-choice test score as the dependent variable, the direct entry regressions were not significant for all participants (F=1.19, p>.05), for women (F=.820, p>.05), or for men (F=.500, p>.05).

With the mini-assignment score as the dependent variable, the direct entry regression for all participants yielded a significant regression equation, F=4.22, p<.01, with a multiple R of .38, accounting for 14% of the variance in the mini-assignment score. Of the six predictors, two were found to be significant: Competitive scale, t=2.35, p<.05, and gender, t=2.56, p<.05 (see Table 3). The regression for women was significant, F=8.22, p<.001, with a significant multiple R of .60, accounting for almost 36% of the variance in mini-assignment scores. Only one of the predictors was found to be significant: teaching method, t=2.53, p<.05. The regression equation for men was not significant, F=1.18, p>.05, although the score on the Competitive scale was significant, t=2.08, p<.05.

Taken together, these findings mirror the ANOVA results. With the multiple-choice test score as the criterion, none of the variables included in the analyses predicted achievement. However, with mini-assignments as the criterion, criterion variance in achievement was predicted in part by gender and Competitive scale score. For women, more than one third of the variance was accounted for by teaching method alone. When paired with the ANOVA

Table 3
Multiple Regression Analysis of Mini-Assignment Scores for Entire Sample and for Males and Females Separately

Variable	*All Participants (N = 160)*	*Beta Weights Males Only (N = 80)*	*Females Only (N = 80)*
Age	.0150	.0759	.1135
Gender	.1994*	N/A	N/A
Cooperative scale	.0811	.1542	.0373
Competitive scale	.1769*	.2344*	.1852
Affiliation scale	.0053	.0630	.0224
Teaching Method	.1961	.0460	.6343*

*$p<.05$.

result that women scored higher on mini-assignments when taught by cooperative as compared with competitive methods, the result suggests that women have the best opportunity for higher achievement on assignments when taught using cooperative methods. For men, teaching condition did not seem to make a difference in scores on either the multiple-choice test or the mini-assignment. Interestingly, the correlation between the scores on the multiple-choice test and the mini-assignment was not significant, $r=.08$, $p>.05$, indicating that these two outcomes were measuring different items.

Discussion

The purpose of this research was to examine gender differences in achievement in cooperative versus competitive teaching conditions, as well as to determine the best predictors of achievement from the study variables for both male and female students. Each finding from the study is discussed briefly before implications of the results for educators are addressed.

Students' Perceptions of Teaching Conditions

Earlier research comparing cooperative and competitive teaching has not included the type of manipulation check for teaching fidelity that was included in this study. Results for this manipulation check suggest that in general, participants perceived the two teaching conditions to be as intended. Using the Classroom Life Instrument (Johnson et al., 1983), analyses revealed that the amount of cooperation perceived in the cooperative condition was significantly higher than that perceived in the competitive condition. There was also a significant gender difference, with women perceiving more cooperation than men in both conditions. This gender difference was also manifested in complaints from some participants in the cooperative condition such as, "What? Can't I work alone?" and "Oh great. I hate group stuff!" All these negative reactions came from male students. In contrast, no complaints were heard from female participants. Although no positive comments were received from the men in the cooperative condition, women's comments reflected their positive approval: "Oh good, do you want to be partners?" and "I like this!" These findings are consistent with research by Beer and Darkenwald (1989), who

found that women perceived more positive interaction with other students in the classroom and believed that they participated more actively and attentively in classroom activities, although it must be noted that the absence of any audible complaints does not itself provide conclusive evidence of the absence of such feelings.

In the case of perceived competitiveness, the results indicated that contrary to expectation, there was no significant difference in the amount of competitiveness perceived in the cooperative as compared with the competitive condition. There was also no significant gender difference on the Competitive scale. With the wisdom of hindsight, the finding of no significant difference in perceived competitiveness in the two teaching conditions may have been due to the presence of *intergroup* competition in the cooperative condition, as compared with *interpersonal* competition in the competitive condition. Indeed, finding that perceived competition was roughly equal in cooperative and competitive conditions supports the belief of earlier researchers (Jagers, 1992; Johnson, Maruyama, Johnson, Nelson, & Skon, 1981; Widaman & Kagan, 1987) that intergroup competition is an essential part of the cooperative teaching environment and was achieved in the present study.

Achievement and Teaching Conditions

In general, the results of this study provided partial support to the hypothesis that cooperative teaching methods would be more effective than competitive methods for women, whereas no difference was expected for men in the two conditions. Although scores on the multiple-choice test failed to show the predicted interaction effect, women scored significantly higher on the mini-assignments when they were taught using cooperative methods as compared with competitive methods, whereas men scored equally high on the same assignment when they were taught with either method.

Finding no significant interaction effect for multiple-choice test scores was congruent with earlier research (Crooks et al., 1998; Klein & Schnackenberg, 1999; Kunkel & Shafer, 1997; Rittschof & Griffin, 2001), which also used exams as the measure of achievement. In considering why in contrast women scored higher on the mini-assignments in the cooperative condition, it may be that that cooperative learning facilitates transfer or application of knowledge to novel situations (e.g., mini-assignments), but cooperative learning has less effect on simple memorization of facts or concepts (e.g., multiple-choice test). Multiple-choice tests have been criticized as being decontextualized, artificial, and of little value for indicating which concepts students understand. Thus even though the test was carefully constructed to reflect each of the six categories of Bloom's Taxonomy, it may not have been sufficiently sensitive to the manipulations in the present study.

The mini-assignments, in contrast to the multiple-choice test, could be described as meaningful, context-rich, and relevant, all elements of a valuable assessment tool (Bateson, 1994). This type of measure, an example of *authentic assessment*, has been promoted as a tool that evaluates competence in the areas of contextual insight, good judgment, and the skills and dispositions essential to further learning (Wiggins, 1993). Using this line of reasoning would suggest that mini-assignment scores represent a more valid type of dependent measure

to assess the differential effectiveness of cooperative and competitive teaching methods.

Role of Affiliation

A secondary intention of this study was to ascertain whether the dimension of affiliation had any relationship to the success a student experienced in either of the two teaching methods. As expected given the random assignment of students to teaching methods, there was no significant difference in affiliation scores for cooperative versus competitive teaching conditions. However, contrary to expectation, there was also no significant difference in affiliation scores between men and women. The median affiliation scores found in this study were similar to those reported by Klein and Pridemore (1993), and in both cases were above the norms established by Jackson (1984), indicating that university men may be reporting more affiliation characteristics than 20 years ago, making this variable less important for distinguishing between genders. The present study also found no relationship between level of affiliation and performance on the multiple-choice test, which is similar to Klein and Pridemore's results for their posttest.

Aptitude-Treatment Interactions

The major hypothesis of this study predicted an aptitude-treatment interaction, with men performing best when taught using competitive methods, whereas women would perform best in the cooperative condition. This relationship was present for mini-assignment scores, except that there was no significant difference for men between competitive and cooperative conditions. Finding that mini-assignment scores were higher for cooperative than for competitive teaching for all participants combined is consistent with reports of earlier researchers that students in general experience higher academic achievement with cooperative learning (Springer et al., 1999). Extending this further, the finding that women experienced the best achievement with cooperative learning mirrors similar results found by earlier researchers with female university students (Ellison & Boykin, 1994).

The evidence provided by this study, especially when taken into consideration with supporting results from earlier research, indicates that there may indeed be an aptitude-treatment interaction at work involving gender differences in cooperative versus competitive learning. The presence of such an ATI could explain some of the inconsistent findings of the past and help explain what about cooperative teaching works so well for female students. Also, we can conclude from these data that there is evidence for benefits in differentially allocating students to cooperative and competitive teaching methods in order to provide learning environments that give both female and male students the greatest potential for success.

As in earlier research (Golbeck & Sinagra, 2000), no gender differences were found in the competitive learning condition. It may be that university students are a sample with a restricted range of above-average grades, and thus are individuals who generally perform well in competitive situations.

Implications

Before any implications of the results can be discussed, the limitations of the study need to be addressed. The biggest limitation of the study was its

analogue nature. The advantage of a laboratory study is the ability to control carefully the two teaching conditions. The disadvantage is that the artificial learning environment with its low-stakes test and small reward (lottery ticket) may not elicit the same types of responses from participants as occurs in university classrooms. Another limitation may have been the multiple-choice test. Although the test was carefully constructed to include comprehensive coverage of information in the video and had questions at all levels of Bloom's Taxonomy, it may not have been sufficiently sensitive to the manipulations used in the study. It may be that another type of test (e.g., short-answer, essay) would have resulted in findings that were congruent with the mini-assignments.

Although the current study has a number of limitations, it is still possible to draw some implications from these results for educators of university students. First, most of the earlier research on cooperative teaching methods has occurred at the elementary and secondary school levels. The few studies on cooperative learning with university students included in this article used samples from the US. This work needs to be validated with Canadian university students, and laboratory studies that carefully control many aspects of the teaching-learning experience are an appropriate way to begin this validation process.

Considering that men in this study achieved roughly equal levels of success when taught using cooperative and competitive methods, whereas women experienced significantly better performance when taught using cooperative methods, it seems reasonable to consider using this technique in today's university classroom. Inglehart et al. (1994) address this concern by offering recommendations for educators including providing female students with more social support in their academic pursuits through cooperative teaching methods and the use of mentors.

However, major obstacles to using cooperative teaching methods in university classroom can originate from both students and instructors. For students, group work can be perceived as undesirable because they do not wish to be dependent on the performance of peers for their own grades. These objections may be overcome in a cooperative learning environment by having students work in groups and share resources when learning new material, but requiring each student to produce his or her own work for a grade.

Teachers' objections to cooperative techniques may come from the perceived increase in time and effort required, the loss of feeling in control in the traditional lecture-style classroom, or the fear that all the required material will not be covered. These objections may be overcome by designing lessons around learning objectives, not around the mastery of chunks of material. For example, if an instructional objective is to teach to maximize transfer of knowledge to novel situations, cooperative techniques will achieve that objective. Also, a cooperative learning environment does not require a great deal of expertise on the part of the instructor or much time to prepare and implement.

In conclusion, cooperative teaching methods can make a significant difference in achievement for female students without negatively affecting the performance of male students. Given this finding, the provision of cooperative

learning opportunities to all students may be reasonable for students, educators, and administrators.

References

Baer, J. (2003). Grouping and achievement in cooperative learning. *College Teaching, 51*, 169-174.

Bateson, D. (1994). Psychometric and philosophic problems in "authentic assessment": Performance tasks and portfolios. *Alberta Journal of Educational Research, 40*, 233-245.

Beer, C.T., & Darkenwald, G.G. (1989). Gender differences in adult student perceptions of college classroom social environments. *Adult Education Quarterly, 40*, 33-42.

Bloom, B.S., Engelhart, M.B., Furst, E.J., Hill, W.H., & Krathwohl, O.R. (1956). *Taxonomy of educational objectives: The classification of educational goals*. New York: Longman.

Brewer, S.A., Klein, J.D., & Mann, K.E. (2003). Using small group learning strategies with adult reentry students. *College Student Journal, 37*, 286-297.

Crooks, S.M., Klein, J.D., Savenye, W., & Leader, L. (1998). Effects of cooperative and individual learning during learner-controlled computer-based instruction. *Journal of Experimental Education, 66*, 223-245.

Dudley, B.S., Johnson, D.W., & Johnson, R.T. (1997). Using cooperative learning to enhance the academic and social experiences of freshman student athletes. *Journal of Social Psychology, 137*, 449-159.

Ellison, C.M., & Boykin, A.W. (1994). Comparing outcomes from differential cooperative and individualistic learning methods. *Social Behavior and Personality, 22*, 91-104.

Fultz, N.H., & Herzog, A.R. (1991). Gender differences in affiliation and instrumentality across adulthood. *Psychology and Aging, 6*, 579-586.

Golbeck, S.L., & Sinagra, K. (2000). Effects of gender and collaboration on college students' performance on a Piagetian spatial task. *Journal of Experimental Education, 69*, 22-35.

Inglehart, M., Brown, D.R., & Vida, M. (1994). Competition, achievement, and gender: A stress theoretical analysis. In P.R. Pintrich, D.R. Brown, & C.E. Weinstein (Eds.), *Student motivation, cognition, and learning: Essays in honor of Wilbert. J. McKeachie* (pp. 311-330). Mahwah, NJ: Erlbaum.

Jackson, D.N. (1984). *Personality research form manual*. Port Huron, MI: Research Psychologists Press.

Jagers, R.G. (1992). Attitudes toward academic interdependence and learning outcomes in two learning contexts. *Journal of Negro Education, 61*(4), 531-538.

Johnson, D.W., & Johnson, R.T. (1999). *Learning together and alone: Cooperation, competition, and individualization* (5th ed.). Boston, MA: Allyn and Bacon.

Johnson, D.W., Johnson, R.T., & Anderson, D. (1983). Social interdependence and the classroom climate. *Journal of Psychology, 114*, 135-142.

Johnson, D.W., Johnson, R.T., & Smith, K.A. (1998). Maximizing instruction through cooperative learning. *ASEE Prism, 7*, 24-29.

Johnson, D.W., Maruyama, G., Johnson, R.T., Nelson, D., & Skon, L. (1981). Effects of cooperative, competitive, and individualistic goal structures on achievement: A meta-analysis. *Psychological Bulletin, 89*(1), 47-62.

Jordan, J.V., Walker, M., & Hartling, L.M. (Eds.). (2004). *The complexity of connection*. New York: Guilford Press.

Klein, J., & Pridemore, D.R. (1993). Effects of cooperative learning and need for affiliation on performance, time on task and satisfaction. *Education Technology Research and Development, 40*, 39-47.

Klein, J.D., & Schnackenberg, H.L. (1999). Effects of informal cooperative learning and the affilication motive on achievement, attitude, and student interactions. *Contemporary Educational Psychology, 25*, 332-341.

Kline, T.B. (1995). Cooperativeness and competitiveness: Dimensionality and gender specificity of the Classroom Life Instrument. *Educational and Psychological Measurement, 55*, 335-339.

Kunkel, J.G., & Shafer, W.E. (1997). Effects of student team learning in undergraduate auditing courses. *Journal of Education in Business, 72*, 197-200.

Markus, H.R., & Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review, 98*, 224-253.

Onwuegbuzie, A.J., Collins, K.M.T., & Elbedour, S. (2003). Aptitude by treatment interactions and Matthew effects in graduate-level cooperative-learning groups. *Journal of Educational Research, 96*, 217-230.

Rittschof, K.A., & Griffin, B.W. (2001). Reciprocal peer tutoring: Reexamining the value of a cooperative learning technique to college students and instructors. *Educational Psychology, 21*, 313-331.

Slavin, R.E. (1996). Research on cooperative learning and achievement: What we know, what we need to know. *Contemporary Educational Psychology, 21*, 43-69.

Smith, B.L., & MacGregor, J.T. (1992). What is collaborative learning? In A. Goodsell, M. Maher, & V. Tinto (Eds.), *Collaborative learning: A sourcebook for higher education* (pp. 9-22). University Park, PA: Center on Postsecondary Teaching.

Springer, L., Stanne, M.E., & Donovan, S.S. (1999). Effects of small-group learning on undergraduates in science, mathematics, engineering, and technology: A meta-analysis. *Review of Educational Research, 69*, 21-51.

Widaman, K.F., & Kagan, S. (1987). Cooperativeness and achievement: Interaction of student cooperativeness versus competitive classroom organization. *Journal of Social Psychology, 25*, 355-365.

Wiggins, G. (1993). Assessment: Authenticity, context, and validity. *Phi Delta Kappan, 75*, 200-214.