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Students' Perceptions of Their Classroom Participation and Instructor as a Function of Gender and Context

The purpose of the present study was to explore the influence of individual and contextual factors on students' assessments of their own participation in the university classroom and of their professor's classroom behaviors. Classroom participation is considered by both female and male students to be one of the factors related to effective learning and to result in more positive views of the learning experience (Sadker & Sadker, 1994). Perceptions of the overall amount, the form of student participation, and students' general activity level were examined in the present study. Differences in the form of student participation are important, because certain types of participation are expected to be more responsible for students' impressions of the university classroom (e.g., more intrusive styles such as interrupting), to contribute more to effective learning and positive experiences (e.g., length of exchange), and to be more likely to demonstrate gender differences. Cornelius, Gray, and Constantinople (1990) and others (e.g., Fassinger, 1995a, 1995b) have emphasized that student participation is determined

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by multiple factors and, unless multiple factors are examined, the nature of student-faculty interaction in the college classroom will most likely be misrepresented. The contextual factors considered in the present study were class size, class composition in terms of gender balance, discipline, gender of the instructor, and specific instructor behaviors that encourage participation. In addition, the individual factors of student gender, age, and students' perceived level of general activity in the university classroom were examined, as well as students' perceptions of a number of specific student behaviors.

This research is informed by a series of studies dealing with the "chilly climate" construct (Hall & Sandler, 1982, 1984; Sandler & Hall, 1986). The term applies to the aggregated impact of a host of micro inequities and forms of systemic discrimination that disadvantage women in academic environments. Examples include: the sexist use of language; presentation of stereotypic, disparaging views of women; differential interaction patterns of professors as a function of student gender; paucity of women faculty as role models and mentors; and gender-based differential attributions. Although some investigators have failed to find evidence of the operation of the construct (Crawford & MacLeod, 1990; Heller, Puff, & Mills, 1985; Howard & Henney, 1998; Howard, Short, & Clark, 1996; Strenta, Elliott, Adair, Matier, & Scott, 1994), documentation supporting the existence of a chilly climate has been reported by a number of other researchers (Canada & Pringle, 1995; Janz & Pyke, 2000; Pyke, 1997; Sands, 1998; Seagram, Gould, & Pyke, 1998; Stalker & Prentice, 1998; The Chilly Collective, 1995; Williams, 1990). Pascarella et al. (1997), for example, found modest support "for the hypothesis that a perceived chilly campus climate can, in fact, have negative implications for women's cognitive growth" (p. 123). In an extension of this work, Whitt, Edison, Pascarella, Nora and Terenzini (1999) obtained corroborating results.

Yet another consequence of the effect of a chilly climate may be a reduced propensity on the part of women students to participate in the university classroom. Several investigators have specifically explored the relevance of the chilly climate construct as an explanation for gender differences in classroom participation. Fassinger (1995a, 1995b), based on a questionnaire survey administered to students and professors in 51 classes, concludes that male students are more likely to participate in classes than females and that the participation of female students is affected by the emotional climate of the classroom and their level of confidence. These results are not inconsistent with the chilly climate interpretation of women's academic experiences. Contrary to expectation, however, was the finding that faculty traits, including gender, had no

significant effect on class participation. Other investigators, however, report markedly different results with respect to faculty influence on participation (Nunn, 1996; Statham, Richardson, & Cook, 1991). Canada and Pringle (1995) for example, in an observational study of classroom interactions of students and faculty, conclude that gender matters: "The behaviors of female students and of both male and female professors were strongly related to whether or not male students were present in the classroom, and the behaviors of both female and male students in mixed-gender classes were related to the proportion of male students" (p.179).

In addition to factors subsumed under the chilly climate rubric, there are other contextual factors that may also potentially influence student participation. One such variable is class size. It has been assumed that many students are reluctant to participate in large classes, and hence many universities have structured smaller group meetings for discussion (e.g., tutorials) as adjuncts to large group lectures. In fact, Constantino, Cornelius, and Gray (1988), in an observational study of over 40 classes, consistently found negative correlations between number of students present and total student response. These researchers had trained 58 undergraduate students to serve as observers in classes in which they were regularly enrolled. When class size was entered as a covariate, student gender effects, favoring more participation from males, moved from marginal to full significance, whereas instructor gender effects were no longer significant, suggesting that instructor gender effects had been carried by differences in class size. In a subsequent study by the same group of researchers (Cornelius et al., 1990), class size was found to be one of the three significant variables affecting the type and amount of student-faculty classroom interactions. Furthermore, Crawford and MacLeod (1990) reported that class size affected all dimensions of the classroom climate examined in their study, with greater rates of participation reported in smaller classes. Nunn (1996) notes that although her data failed to reveal a strong relationship between participation and class size, the trend is for fewer students to speak and to spend less time participating in larger (35 or more students) classes. Thus, variations in class size may account for at least some of the phenomena interpreted as reflections of chilly climate effects.

Class composition in terms of gender balance is an additional contextual factor examined in the present study. To date, few studies have investigated this factor. Are women or men more likely to participate in a class in which students of their gender are in the majority? In a study by Krupnick (1985), in which classes were videotaped, males were found to dominate classroom discussions, particularly in classes with male in-

structors and a majority of male students. Cornelius et al. (1990) have also reported that there is some preliminary support for the suggestion that female students may be more affected by characteristics of the university classroom, such as class composition and size, than are male students. They found that, when there were more males present in a class, there were proportionately fewer interactions directed to female students by both male and female instructors, and the interactions directed by female instructors to their female students were shorter in length. More recently, Janz and Pyke (2000) have suggested that there is variability in students' sensitivity to the characteristics of the university environment.

The discipline of the course has been found to be another contextual factor that influences students' perceptions and participation. Constantinople et al. (1988) reported higher student participation in arts and social science courses than in natural science courses. True to the stereotype, the natural science classes tended more toward the lecture format, whereas humanities classes tended more toward a discussion format, and the social science disciplines had a more or less balanced distribution of the two formats. In their subsequent study (Cornelius et al., 1990), discipline was one of the three significant factors affecting student-instructor interactions.

Instructor gender has been examined in previous studies as a contextual factor that is expected to influence students' participation rates. Consistent with the claims of Hall and Sandler (1982), it could be argued that women students with female instructors, supervisors, or mentors would experience the university environment as a more benign, less alienating setting (Pyke, 1997) and hence feel more comfortable about participating in class. Certainly the reports of a number of authors (Bruce, 1995; Field & Caldwell, 1979; Tidball, 1973, 1976; Worthington & Stern, 1985) suggest that same-gender professor-student dyads may be more beneficial or productive than cross-gender pairings. With respect to specific classroom interactions, there are some conflicting results on the effects of instructor gender. Karp and Yoels (1976) and Sternglanz and Lyberger-Ficek (1977) both found in their observational studies that female students participated more in classes taught by female than male instructors. There is evidence from survey research (Crawford & MacLeod, 1990) that female instructors are perceived in general as being more effective in creating a participatory climate for all students, both female and male. In three studies, males have been reported as being more active participants than females, but only with male instructors (Karp & Yoels, 1976; Pearson & West, 1991; Sternglanz & Lyberger-Ficek, 1977). Karp and Yoels (1976), for example, reported that male students were twice as likely as female students to respond to

a comment made by a male instructor, and male instructors were more likely to call on male than female students, whereas no such differences occurred with female instructors. However, incommensurate results have been reported in other research (Boersma, Gay, Jones, & Morrison, 1982; Brooks, 1982; Constantinople et al., 1988). For example, Constantinople et al. (1988) found that the highest participation rates in their study were consistently those of male students in female-instructed arts and social science courses. Similarly, Brooks (1982) reported more male participation (i.e., interrupting, higher frequency and longer duration of interactions) among first year social work students, but only in classes taught by female instructors. In the Boersma et al. (1982) study, in female-taught classes, male interactions were characterized by more student-teacher exchanges than were female interactions. Resolution of these contradictory results with respect to the relation between instructor gender and student participation requires further research that will take into consideration a number of additional contextual factors, for example, class size (Constantinople et al., 1988; Cornelius et al., 1990).

There is also the contextual issue of instructor behaviors. Do specific instructor behaviors encourage or conversely curtail student participation and are such behavior patterns related to instructor gender and/or student gender? In the few empirical studies conducted to date, there is no clear evidence for a pervasive bias either by male or female instructors in the behaviors measured. The few differences that have been reported, however, have favored males. Karp and Yoels (1976) reported that male instructors were more likely to call directly on male than on female students. Constantinople and colleagues (1988) observed that males received more acknowledgment of their contributions to class discussion and more elaboration of their remarks than did females. This effect was independent of instructor gender, discipline of course, and class size.

In addition to reported gender differences in language style and communication patterns (see Wood, 1994), a few research investigations have also found differential participation effects in the university classroom as a function of student gender. In general, men have been shown to talk more (e.g., Hall, 1984) and to interrupt more frequently than women (McMullen, 1992). When the more specific environment of the university classroom has been examined empirically, support for gender differences favoring males has been inconsistent. However, when differences have been reported, typically males have been found to participate more frequently and more assertively than do females (Brooks, 1982; Constantinople et al., 1988; Crawford & MacLeod, 1990; Karp & Yoels, 1976; Sternglanz & Lyberger-Ficek, 1977).

Most investigations of gender differences in participation rates have failed to take sufficient contextual factors into account, have generally included at most two factors, and some have employed global measures of students' participation rates. In the current study, we examined different forms of class participation, such as raising one's hand versus the more aggressive style of interrupting, as well as students' perceptions of the length of their interactions. The present study was designed to determine the effects of a number of contextual factors, as well as student gender, on these different forms of participation and also on students' impressions of their instructor's behaviors.

In addition to overall participation rates and differences in various forms of participation, the present study incorporated the additional individual factor of students' general activity level in the classroom. The university classroom has been described as having the organizational feature of "consolidation of responsibility"—students know that a small percentage of the class can be relied upon to carry most of the discussion/participation responsibility (Karp & Yoels, 1976). Karp and Yoels (1976) and Nunn (1996) have reported that on average a very small number of students are responsible for the bulk of university classroom participation. In the former study, 4 to 5 students accounted for 75% of the total interactions in classes with less than 40 students, and 2 to 3 students accounted for 51% of the total interactions in classes of more than 40 students. Similarly, Smith (1992) has found that a few students, usually the highest participators, begin early and participate continually throughout the semester. Furthermore, the overall participation rate seems to increase in the early stages of the semester as students assess the system, then plateaus, then tails off toward the end of the semester, when only a small core of high participators are still active. In the present study, students' perceptions of their own activity level in a specific university course were assessed.

This study explores student perceptions of their own participation and of certain professor behaviors and does not measure actual participation rates or provide observations of professorial classroom performance. Certainly perceptions and objective indices of "reality" may vary (Karp & Yoels, 1976), although Statham et al. (1991) report a high level of consistency across three sources of information—professor interviews, observations of professor behaviors, and student ratings of professors. Similarly, Nunn (1996) found a strong relationship between student and teacher perceptions of selected teaching techniques designed to facilitate communication and actual observational data. In any event, it is important to investigate student perceptions, because these perceptions (even if not congruent with reality) have been shown to influence stu-

dents' judgments, decisions, and development in a variety of contexts. Consider for example, the imposter phenomenon (King & Cooley, 1995) or the denial of personal disadvantage (Crosby, Pufall, Snyder, O'Connell, & Whalen, 1989) or the work of Pascarella and his colleagues with respect to cognitive development (Pascarella et al., 1997; Whitt et al., 1999).

In summary, the goal of the present study was to determine the impact of a number of contextual features of the university classroom on the perceived participation of students and on students' perceptions of their instructor. More specifically, student gender, the form of their interactions, and their general level of activity in the classroom were all examined in light of these contextual factors. Based on the findings in the literature and the chilly climate construct, it was predicted that female students as compared with male students would perceive themselves as participating less overall, using less assertive modes of participation, participating more in classes taught by female faculty, and having more positive perceptions of female professors. Furthermore, we hypothesized that active students would hold more positive perceptions of their classroom experience than would less active students, as would students in smaller classes and students in arts/social science classes as compared to natural science classes. Finally, because some recent research has indicated that older students participate in class more than younger students (Howard & Henney, 1998; Howard et al., 1996), additional analyses were conducted to explore the effects of student age on self perceptions of participation.

Method

Participants

The participants were 541 students from a university with an undergraduate population of approximately 13,000, located in a mid-sized Canadian city. The students were solicited from 18 classes (see Table 1): 11 classes in arts/social sciences (5 female and 6 male instructors) and 7 classes in the natural sciences (4 female and 3 male instructors). All students who were in attendance agreed to participate.

Twenty-two students were excluded, 10 because of incomplete information and an additional 12 as a result of indicating that they "never" or "rarely" attended class. Subsequently, 9 students (6 female, 3 male) were identified as multivariate outliers (based on Mahalanobis' distance) and were excluded from the analyses. In the resulting sample of 270 females and 240 males, 20% of the females and 17% of the males were 25 years of age or older.

TABLE 1
Class Size and Proportion of Female Students by Instructor Gender and Discipline of Course

Course	Female Instructors				Male Instructors			
	Arts/Social Science		Science		Arts/Social Science		Science	
	S ^a	%F ^b	S	%F	Course	S	%F	Course
Psy-2	36	83	31	9	Engl-2	28	59	Eng-2
Engl-2	36	86	43	51	His-2	24	58	Bio-4
His-2	22	57	47	47	PolSc-3	32	55	CompSc-4
PolSc-3	24	46	18	28	Psy-3	36	78	
Engl-3	18	67			Engl-3	19	75	
Mean	27.2	67.8	34.8	33.8	Rec-4	16	81	
						25.8	67.7	

NOTE: Courses are abbreviated as follows: Bio=Biology; CompSc=Computer Science; Eng=Engineering; Engl=English; His=History; PolSc=Political science; Psy=Psychology; Rec=Recreology. The number following the course abbreviation indicates the year of the course (e.g., 2 represents second year). N = 519; includes the 9 students who were identified as multivariate outliers.

^aS=Size of class.

^b%F=Percentage of female students in the class.

Although the sample of students participating in this study is reasonably large ($N = 510$), students were drawn from a limited number of classes ($N = 18$) and from a single institution. These restrictions may raise questions about the generalizability of the results. The 18 classes were randomly selected to include second-, third-, and fourth-year level courses and to cover a cross-section of disciplines within the humanities/social sciences and the natural sciences. In most cases, a course with a male instructor was matched with that of a female instructor. Classes were considered for selection if they had a minimum of 20 students (based on registration information). The sample, with a mean age of 23.2 and 53% females, is quite reflective of the undergraduate student population at this university (mean age: 25.2; 59% females). In keeping with the vast majority of Canadian universities, this institution is government supported and quite characteristic of the large group of medium to small-sized universities in the country, offering both undergraduate and graduate programs across a wide array of disciplines. Thus, there is some reason to believe that our findings will be comparable to those that would be found in other institutions and in other classes.

Measures

The 24-item Classroom Experience Questionnaire was designed to measure students' perceptions of their own behavior, of other students' behavior, and of their instructor's behavior. Items pertaining to student behaviors were derived from Hall and Sandler's (1982) report on the college classroom climate. Items pertaining to instructor behaviors were adapted from the work of Heller, Puff, and Mills (1985). The items assess students' perceptions of their own or their instructor's behavior in a particular university class. The items have a 5-point Likert response format. A higher score indicates that students perceived a greater frequency or a more positive behavior occurring. In addition, items concerning students' age, gender, and course code were included at the end of the questionnaire.

Activity level. Two items in the questionnaire measured students' perceptions of their general activity level in a particular class. The two items were "In this course, how often do you ask questions, make comments, and/or answer questions?" and "In this course, when the professor directs a question to the class, how often do you answer?" The responses for both items were: (1) Never, (2) Rarely, (3) Occasionally, (4) Often, (5) Very Often. The two items were summed to give a total activity level score. The distributions of the activity level scores are presented separately by gender in Table 2. Students were categorized as Less Active if they had a score of 2, 3, or 4 (64% of the students) and Active if

they had a score of 5 or higher (36% of the students). This categorization resulted in 327 Less Active students (56.3% females, 43.7% males) and 183 Active students (47.0% females, 53.0% males).

Students' perceptions of their own behavior. Students' perceptions of their own particular classroom behavior were measured for two forms of participation: the more frequently used and less intrusive method of raising one's hand (one item) and the more intrusive method of interrupting (two items; $\alpha = 0.64$). The three items were as follows: "When you participate in this course, how often do you get the professor's attention by raising your hand and waiting for the professor to choose you?"; "When you participate in this course, how often do you get the professor's attention, not by raising your hand, but rather by talking out when there is a pause in the conversation or lecture?"; "When you participate in this course, how often do you get the professor's attention by breaking into the ongoing conversation or lecture in order to ask a question or to make a comment?" In addition, students' perceptions of the length of their exchanges (two items; $\alpha = 0.64$) were assessed. The items were "In this course, how many back and forth exchanges do you have on the average in an interaction with the professor?" and "In this course, what is the typical length of your questions, comments, and/or answers to the professor?" For these two items and for subsequent items that do not refer to the perceived frequency of a behavior, the response choices reflect the question asked (e.g., 1 = An average of one "back and forth" exchange in an interaction; 5 = An average of five or more "back and forth" exchanges in an interaction). As a means of examining the aggregate effect of these three particular student behaviors, a student response

TABLE 2
Distribution of Activity Level Scores by Gender

Activity level score	Females		Males		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
2	87	32.2	65	27.1	152	29.8
3	36	13.3	30	12.5	66	12.9
4	61	22.6	48	20.0	109	21.4
5	31	11.5	24	10.0	55	10.8
6	28	10.4	37	15.4	65	12.8
7	11	4.1	15	6.3	26	5.1
8	8	2.9	13	5.4	21	4.1
9	7	2.6	6	2.5	13	2.5
10	1	0.4	2	0.8	3	0.6
Total	270		240		510	

score (Total Student Response) was obtained by summing across these three behaviors.

It should be noted that the independent variable of perceived activity level, which may appear to overlap with the dependent variables exploring perceptions of more specific student participatory behaviors such as hand raising or interrupting, is actually quite distinct both conceptually and methodologically. With respect to the former, it is possible, for example, for a student to perceive her- or himself as very active in the classroom but not as frequently interrupting or speaking out. Thus, the independent activity variable explores a student's sense of her/his overall participation level, whereas the dependent variables assess the form in which the participation is perceived to be expressed. Methodologically the independent activity variable is treated as a dichotomous variable (Active, Less Active), whereas the dependent measures are continuous.

Students' perceptions of their instructor's behavior. Students' perceptions of their instructor's behavior were assessed for three particular behaviors: instructor's positiveness (two items; $\alpha = 0.78$), personalizing (two items; $\alpha = 0.50$), and probing for elaboration (one item). The five items were as follows: "In this course, how does the professor react to the questions or comments you make in class?" (Very Negative to Very Positive); "In this course, how does the professor react to your questions, comments, and/or answers?" (Strongly Discourages to Strongly Encourages); "In this course, does the professor smile, nod, and generally communicate interest and approval in what you have to say?"; "In this course, how often does the professor call you by name?"; "In this course, does the professor probe for elaboration or further extension when you answer a question or make a comment?" In addition, as for the student behaviors, an aggregate instructor score was calculated (Total Instructor Score). Finally, one item assessed students' overall impression of their instructor. The item was "Please give us your overall impression of the professor in this course as pertains to yourself by responding to the following description. In this course, the professor encourages and facilitates my participation. The professor, in an overt and/or subtle manner, shows his/her confidence in and/or value of me as a student" (Very Untrue to Very True).

Covariates. The covariates of Class Size and Proportion of Females were based on the total number of students and proportion of females for each of the 18 classes (see Table 1).

Procedure

The questionnaire was group administered to each classroom of students by a female research assistant and required approximately 15 min-

utes to complete. Questionnaires were administered in the 10th or 11th week of a 13-week semester. Students were informed that the purpose of the study was to investigate the classroom experience of university students, that their participation was voluntary, and that their responses would remain confidential. Respondents were instructed to complete the questionnaire according to their own perceptions of the university class in which the questionnaire was administered. The treatment of participants was in accordance with the ethical standards of both the Canadian and American Psychological Associations.

Data Analyses

The data were analyzed in two series of 2 x 2 x 2 x 2 ANCOVAs: one on students' perceptions of their own behaviors and a second on their perceptions of their instructor's behaviors. The four independent variables were students' Activity Level (Less Active, Active), Student Gender, Instructor Gender, and Discipline (Arts/Social Science versus Natural Science); the two covariates were Class Size and Proportion of Females. In the first series of analyses, students' perceptions of their own behaviors were analyzed for three particular student behaviors and for a Total Score (to examine the aggregate effect of the particular behaviors). In the second series of analyses, students' perceptions of their instructor were analyzed for three particular instructor behaviors and for a total aggregate instructor score. To decrease the possibility of reporting spurious results, the Bonferroni correction of alpha for multiple tests was implemented. Only results achieving a probability value of 0.0125 are reported as statistically significant (0.05/4, corrected for one aggregate measure and three particular behaviors in each series of analyses). Finally, students' Overall Impression of their instructor was analyzed separately.

The four-way ANCOVA analyses were performed using the SPSS (Version 6; SPSS, Inc., 1993) MANCOVA program which provides adjusted means (i.e., adjusted for the two covariates) and eta squared values (η^2), an estimation of effect size. When comparing results of different studies, the order of entry of covariates will affect their relative importance. If the traditional experimental method, which previously was the default in the SPSS ANCOVA program (Version 4, 1990), is employed, a hierarchical structure for the partitioning of variance is used. In this method, a covariate's importance is a function of both its unique variance and any variance that it shares with variables that are entered subsequently. However if the unique method is employed, which is the current default in the SPSS ANCOVA program (Version 5, 1992 and

Version 6, 1993), then only the unique variance of a variable is used to determine its contribution. Some of the differing results in the extant literature may be due to the fact that samples have not only differed on relevant factors (e.g., class size) but also on the statistical procedures (e.g., unique versus experimental) employed to analyze the results. In the present study, the unique method, in which only the unique variance of each variable (i.e., covariates, independent variables) is used to measure its effect on the dependent variable, was employed.

Results

Sample Characteristics

Chi square analyses were used to examine the characteristics of our sample. These analyses indicated that there were no significant differences by Instructor Gender (male, female instructors) in the distribution of Active and Less Active students (see Table 3). There were, however, significant differences in the distribution of Active and Less Active students by Student Gender (male, female), $\chi^2(1, N= 510) = 4.05, p < 0.05$, with more male Active students than expected. There were differences by Discipline (arts/social science, natural science), $\chi^2(1, N= 510) = 4.20, p < 0.05$, with more Active students in arts/social science courses than expected.

Students' Perceptions of Their Own Behavior

Four-way ANCOVAs were conducted on Total Student Response and the three particular student behaviors contributing to this aggregate score. The two covariates of Class Size and Proportion of Females were

TABLE 3
Percentage of Students in Less Active and Active Participation Groups as a Function of Student Gender, Instructor Gender, and Discipline

	Less Active	Active
Student gender ^a		
Females	68	32
Males	60	40
Instructor gender		
Females	63	37
Males	65	35
Discipline ^a		
Arts/social science	60	40
Science	69	31

^aChi-square distributions differ significantly at $p < 0.05$.

not significant and thus did not account for a significant amount of unique variance given the independent variables included in our analyses. There were significant main effects of Activity Level, Student Gender, and Discipline, as well as four significant two-way interactions involving Activity Level and one significant interaction of Discipline and Instructor Gender. For the significant effects, F ratios are presented in Table 4 and eta squared values are included in parentheses in the text. Adjusted means are provided in Table 5.

The main effect of Activity Level was significant for Total Student Response ($\eta^2 = 0.27$) and for each of the three particular student behaviors, with the extent of the effect varying by behavior: Hands-up ($\eta^2 = 0.18$), Interrupting ($\eta^2 = 0.10$), and Length of interaction ($\eta^2 = 0.16$), with Active students having higher scores than Less Active students. The main effect of Student Gender was significant for Total Student Response ($\eta^2 = 0.03$) and for two of the three particular student behaviors: Interrupting ($\eta^2 = 0.02$), and Length of interaction ($\eta^2 = 0.02$), with males having higher scores than females. The main effect of Discipline was significant for Total Student Response ($\eta^2 = 0.01$) and for Length of

TABLE 4
Summary of Significant Effects of the Analyses of Covariance (η^2 values)

Source	df	Perceptions of Own Student Behavior ^a			
		Aggregate Score	Hands-up	Interrupting	Length
Activity level (A)	1	179.06**	107.08**	53.72**	96.66**
Student gender (S)	1	16.28**	3.86	9.94**	9.46**
Discipline (D)	1	6.51*	1.78	0.08	21.44**
A x S	1	6.43*	0.66	8.52*	1.55
A x D	1	6.83**	2.82	0.18	12.46**
Instructor gender x D	1	4.69	8.67*	0.2	1.22
S within-group error	492	-0.29	-1.73	-0.54	-0.36
		Perceptions of Instructor's Behavior ^a			
		Aggregate Score	Positiveness	Personalizing	Probing
Activity level	1	123.52**	72.73**	91.19**	48.30**
Discipline	1	0.02	6.42*	0.14	16.87**
S within-group error	492	-0.49	-0.51	-0.94	-1.35
		Overall Impression of Instructor			
Activity level	1	17.48**			
S x Instructor gender	1	4.34*			
S within-group error	492	-1.01			

NOTE: Values in parentheses represent mean square errors. S = subjects.

^aSignificance values corrected for four student and for four instructor dependent variables.

* $p < 0.05$. ** $p < 0.01$.

TABLE 5
Adjusted Means for Analyses of Covariance with Factors Activity Level by Student Gender by Instructor Gender by Discipline.

Variable	Less active (n = 327)												Active (n = 183)											
	Females						Males						Females						Males					
	FI	Sc	A/S	MI	Sc	FI	FI	Sc	A/S	MI	Sc	FI	FI	Sc	A/S	MI	Sc	FI	FI	Sc	A/S	MI		
n	57	40	70	17	17	19	55	27	42	36	12	33	5	21	32	24	20							
Aggregate score	1.55	1.29	1.43	1.45	1.45	1.62	1.37	1.48	1.64	2.29	1.81	2.46	1.75	2.64	2.17	2.50	2.60							
Hands-up	2.22	1.66	1.96	1.99	1.99	2.36	1.88	1.76	2.53	3.65	2.64	3.66	3.39	4.04	3.19	3.90	3.85							
Interrupting	1.39	1.24	1.27	1.43	1.43	1.33	1.35	1.26	1.51	1.73	1.77	1.93	1.33	2.11	2.19	1.99	2.47							
Length	1.39	1.17	1.32	1.19	1.19	1.54	1.15	1.57	1.32	2.17	1.42	2.39	1.35	2.48	1.63	2.30	2.10							
Perceptions of Own Student Behavior																								
Perceptions of Instructor's Behavior and Overall Impression																								
Aggregate score	2.79	2.52	2.48	2.57	2.57	2.50	2.76	2.57	2.95	3.37	3.46	3.49	3.19	3.94	3.51	3.46	3.52							
Positiveness	3.41	3.46	3.17	3.44	3.44	3.28	3.57	3.32	3.92	3.85	4.24	3.85	4.21	4.18	4.18	3.93	4.45							
Personalizing	2.14	2.09	1.94	2.12	2.12	1.80	2.30	2.06	2.54	2.96	3.11	3.01	2.83	3.91	3.36	3.00	2.95							
Probing	2.86	1.49	2.22	1.70	1.70	2.32	2.04	2.08	1.84	3.21	2.63	3.71	1.88	3.52	2.48	3.46	2.77							
Overall impression	3.99	3.90	3.27	3.55	3.55	3.60	3.81	3.32	4.20	3.92	4.42	3.85	3.84	4.13	4.50	4.27	4.38							

NOTE: Total N=510 students. Covariates are class size and proportion of females in each class. FI = female instructor classes; MI = male instructor classes. A/S = Arts/Social Science classes; Sc = Natural Science classes.

interaction ($\eta^2 = 0.04$), with students in arts/social science courses having higher scores than students in science courses.

There were, however, four two-way interactions involving the Activity Level variable. For Student Gender, the Activity Level by Student Gender interaction was significant for Total Student Response ($\eta^2 = 0.01$) and for the particular behavior of Interrupting ($\eta^2 = 0.02$): Active male students rated their participation and interrupting higher than did their Active female peers, whereas among Less Active students males and females did not differ, thus indicating that the gender difference occurred predominantly among Active students.

For Discipline, the Activity Level by Discipline interaction was significant for Total Student Response ($\eta^2 = 0.01$) and for Length of interaction ($\eta^2 = 0.03$): Active students in arts/social science classes rated their participation higher and perceived their interactions to be longer than did their Active peers in science classes, whereas Less Active students in arts/social science and science classes did not differ. This is further evidence that, for students who perceive themselves as being Less Active, contextual or situational factors do not appear to affect their university classroom behaviors. The Less Active students' responses were, in general, quite similar across all cells in the analyses (see Table 5). For Discipline, there was also a significant Discipline by Instructor Gender interaction effect for the non-intrusive style of participating by Hands-up ($\eta^2 = 0.02$): Among students with female instructors, students in arts/social science classes rated their participation by Hands-up higher than did their peers in science classes, whereas students with male instructors did not differ by Discipline.

Students' Perceptions of Their Instructor's Behavior

Four-way ANCOVAs were conducted on Total Instructor Score and the three particular instructor behaviors contributing to this aggregate score. In contrast to the student behaviors, the two covariates of Class Size and Proportion of Females were significant. For Total Instructor Score, the covariate of Class Size was inversely related and accounted for a significant amount of unique variance ($\eta^2 = 0.06$). For the three particular instructor behaviors, both covariates were significant for each behavior, however the direction of effect varied by covariate and by independent variable. The covariate of Class Size was significant and inversely related to the instructor behaviors of Positiveness, Personalizing, and Probing for Elaboration (η^2 s = 0.03, 0.06, 0.03). The covariate of Proportion of Females was significant and positively related to Positiveness and Personalizing (η^2 s = 0.02, 0.02) and inversely related to Probing for Elaboration ($\eta^2 = 0.03$).

For instructor behaviors, there were only significant main effects of Activity Level and Discipline (see Tables 3 and 4). There was a significant and substantial main effect of Activity Level for Total Instructor Score ($\eta^2 = 0.20$) and for each of the three particular instructor behaviors: Positiveness ($\eta^2 = 0.13$), Personalizing ($\eta^2 = 0.16$), and Probing for Elaboration ($\eta^2 = 0.09$), with Active students reporting higher scores for their instructor than did Less Active students. There was a significant main effect of Discipline on the instructor behaviors of Probing for Elaboration ($\eta^2 = 0.03$) and Positiveness ($\eta^2 = 0.01$), with the two effects being in opposite directions. Instructors of arts/social science courses were perceived by their students to probe more for elaboration, but to be somewhat less positive in their responding than instructors in science courses who were perceived to probe less, but to be more positive.

Students' Overall Impression of Their Instructor

For the four-way ANCOVA on Overall Impression, the covariates of Class Size (inversely related) and Proportion of Females were significant (η^2 s = 0.03, 0.01). There was a main effect of Activity Level ($\eta^2 = 0.03$), with Active students having a more positive overall view of their instructor than did Less Active students. There was a significant Student Gender by Instructor Gender interaction effect ($\eta^2 = 0.01$), with female students with male instructors reporting a lower Overall Impression of their instructor than did female students with female instructors or male students with either male or female instructors.

Additional Analyses: Age Effects

To examine for possible effects of student age, chi square analyses and ANCOVAs were conducted. Following the procedures employed in previous research (Howard & Henney, 1998; Howard et al., 1996), students were categorized as either younger than 25 years of age (81%) or 25 and older (19%). The 2 x 2 chi square analysis for Activity Level by Age was significant, with more older students in the Active group than would be expected by chance and more younger students in the Less Active group. This effect was found at the overall sample level (Active: 56%, 32%; Less Active: 44%, 68%), $p < 0.001$, and separately for females (Active: 54%, 27%; Less Active: 46%, 73%), $p < 0.001$, and males (Active: 60%, 37%; Less Active: 40%, 63%), $p < 0.01$. The Student Gender by Age chi square analysis, however, revealed no statistically significant difference in the distribution of student gender in these two age groups.

Two-way ANCOVAs for Age and Student Gender were conducted on

the student and instructor variables, with Class Size and Proportion of Females as covariates. The results indicated a general pattern of younger female students reporting lower scores than the other three groups of students and older students reporting higher scores than younger students on a number of student and instructor variables. Significant interaction effects were found for the student behavior of Length of Interaction, $F(1, 505) = 6.65, p < 0.01, \eta^2 = 0.01$, and for the instructor behavior of Personalizing, $F(1, 505) = 5.54, p = 0.02, \eta^2 = 0.01$, with younger female students having lower scores ($M_s = 1.42, 2.37$) than the other three groups (M_s range from: 1.70 to 1.82, 2.63 to 2.82). Significant main effects were obtained for Total Student Response, $F(1, 505) = 6.80, p < 0.01, \eta^2 = 0.01$, Interrupting, $F(1, 505) = 8.49, p < 0.005, \eta^2 = 0.02$, and for the instructor behavior of Probing for Elaboration, $F(1, 505) = 6.14, p = 0.01, \eta^2 = 0.01$, with older students reporting higher scores than younger students.

Discussion

This study explored student perceptions of certain features of the academic environment. In particular, the influence of various contextual aspects of the university classroom (i.e., class size and gender balance, discipline, instructor gender) on student perceptions of their own participation and of their instructor were examined, as well as the influence of three individual factors: student gender, student self-perceived general activity level, and student age.

The most consistent findings in this study relate to the activity variable: students' ratings of their general level of classroom activity in a particular university course. In the ANCOVA analyses conducted on the nine dependent measures, activity was a statistically significant effect in every instance. Students categorized as active class participants perceived themselves to raise their hands more frequently, interrupt more frequently, and intervene for longer periods of time as compared to those categorized as less active. These findings provide some evidence of concurrent validity with respect to the activity measure. The significant interaction results reveal a differential relationship between the perceived activity measure and the other variables. To illustrate, students who perceived themselves to be less active did not differ in their specific behavior patterns as a function of gender or discipline, whereas the male active students interrupted more, and those categorized as active who were in Arts/Social Science disciplines reported long and/or more frequent interactions with instructors.

The more intriguing finding is that active students also perceived their

instructors differently from their less active counterparts. Active participants regarded their professors as more positive, as more personalizing, as stimulating more discussion, and they had a more positive impression of their professors overall than did students who perceived themselves as less active. There was some variability in the magnitude of effect, with a smaller effect for students' overall impression (0.03) and larger effects for specific professor behaviors (0.20 to 0.09). Smith (1992) at the university level and Sadker and Sadker (1994) at the elementary and high-school level have also found that participating students hold a more favorable view of their classroom experience. Whether this positive orientation derives from or is in some sense created by active participation or whether both the favorable views of professors and the frequency of participation stem from a third variable, such as energy level, age, or degree of motivation, requires further investigation. However, the implication is clear that creating a classroom environment that generates higher levels of student participation is likely to be associated with more positive perceptions of the professor's behavior. The implications of these findings for student teaching evaluations are obvious. Interestingly enough, the variable of student levels of classroom participation has not been investigated in this context (see reviews by d'Appollonia & Abrami, 1997; Greenwald, 1997; Marsh & Roche, 1997), although Marsh and Roche specifically note the need to relate student teaching evaluations to actual classroom processes, including presumably students' activity level. Future research might profitably explore this relationship.

There is evidence from our sample of over 500 students from 18 university classes that the university classroom has the organizational feature of consolidation of responsibility for classroom activity among only a portion of the students. Sixty-four percent of the students (327/510) reported that they never, rarely, or only occasionally asked or responded to a question in class. These students, who were categorized as less active, perceived their own and their instructor's behavior as remarkably similar across an array of contextual and individual factors—discipline, instructor gender, and student gender. Although 36% of the students (183/510) had a score of 5 or higher and were classified as active, only 6% of the females and 9% of the males had a score of 8 or higher, which suggests that fewer than 10% of students consider themselves to be very active. These findings are consistent with the proportion of "talkers" reported by other researchers (Howard & Henney, 1998; Howard et al., 1996; Karp & Yoels, 1976). Furthermore, among the active students there was a significantly greater percentage of males than females. This result is consistent with the frequently reported finding of greater male participa-

tion and is also congruent with expectations derived from the chilly climate construct.

In terms of student gender effects, the adjusted means reveal that male students rated their own participation as significantly higher than did female students from the same classes. Males reported significantly higher levels of participation overall, significantly higher levels of interrupting, and significantly more and longer interactions with their instructor than did females. It must be remembered, however, that we assessed self-perceptions rather than the actual incidence of these behaviors. Nevertheless, the fact that these effects are consistent with some prior studies that have reported that males talk more and interrupt more than do females (e.g., Haas, 1979; Stewart, Cooper, & Friedley, 1986) suggests that these perceptions may be veridical. Further, the failure to find student gender differences in perceptions of instructors' behaviors supports a conclusion that these significant results are not simply a function of gender differences in questionnaire responding.

Two of these student gender effects (overall participation and frequency of interrupting) were involved in a significant interaction with activity level. The interaction reveals that the gender differential is restricted to the students who self-identified as active. No gender differences were observed among students categorized as less active. A further complexity is introduced with examination of the age variable. Consistent with the findings reported by Howard et al. (1996) and Howard and Henney (1998), older students reported significantly higher levels of perceived participation than younger students on these same two measures, and there are significantly more older students in the group defined as active. Thus, the students who perceive themselves to be most interactive are older males. To further our understanding of the university experience, females and males should not be considered as two separate homogeneous groups: Within-gender factors that would be expected to affect students' experience of the university classroom need to be examined.

Another central finding in this study has to do with class size. Contrary to results in other studies (e.g., Crawford & MacLeod, 1990), we did not find that student perceptions of their own participation were influenced by class size. Class size had significant but low correlations with three of the four student measures, however as a covariate, class size did not predict a significant amount of unique variance. Although actual participatory behavior may be affected by class size (Canada & Pringle, 1995), clearly perceptions of participation are not, at least under the range of class sizes (16 to 50) studied here. In contrast, students in smaller classes perceived their professors more favorably, on all five measures examined, than did students in larger classes. This association

of perceptions of professors with class size has some relevance to the interpretation of student evaluations of courses. We would expect students to evaluate smaller classes more positively, and this is indeed the finding reported in the literature (Marsh & Roche, 1997).

Somewhat comparable results were observed with the other covariate, gender balance. Here again, although Canada and Pringle (1995) report a negative effect on women's participation of increasing the number of males in the class, this variable had no impact on student perceptions of their own behavior, but was a significant covariate for student perceptions of instructor behaviors. In general, the higher the proportion of women in the class, the more positively the instructor was viewed, except for probing, on which the instructor was perceived to engage in less probing of students' responses. This perceived paucity of instructor probes is consistent with the chilly climate claim that instructors are less likely to seek explanations from female students, however, the positive relation with instructor Positiveness and Personalizing is contrary to expectations based on the chilly climate hypothesis.

Discipline, as a contextual factor, did not yield a large number of significant effects. There were, however, a number of significant main effects when the covariates were not entered in the analyses, indicating that there was variance explained in the measures, and this variance was shared between the covariates of class size and gender balance and the discipline variable. These differing results emphasize the importance of assessing a number of contextual factors (Cornelius et al., 1990). The significant discipline effects that were observed in general favored the arts/social science courses. For example in the case of active students, their total participation scores were significantly higher and the length of their interactions longer in arts/social science classes than in science classes. Professors in arts/social science courses were perceived to probe for or seek elaboration more frequently than were science professors. These findings suggest that science classes may be more didactic in structure than classes in other discipline areas, or students in these classes may be more reluctant to participate for other reasons.

Although we found no main effect of instructor gender on student perceptions of their own or their instructor's behavior, instructor gender did appear in two significant interactions: one with student gender and one with discipline. Consistent with the chilly climate model, female students with male instructors reported a significantly less favorable overall impression of their instructors than did females with female professors or males with either male or female professors. These latter three groups of students had on average very similar impressions of their instructor (range 3.9 to 4.1). These effects occurred even though in our sample it

was these female students with male instructors who were in smaller classes on average than were the other three groups of students. These results suggest that it is predominantly female students in classes with male professors who may be finding the classroom environment less positive as opposed to female students in general. However, at the level of particular instructor behaviors, the interaction effect was not significant, indicating that it is at the overall impression level that female students with male instructors are perceiving less support and encouragement from their male instructors. These results indicate that it is important not only to examine various specific professor behaviors, but also to examine students' overall impression of their professor in investigations of classroom climate.

Commensurate findings have been reported by a number of other researchers. Field and Caldwell (1979), for example, found that females with male supervisors reported less satisfaction with their supervision than did female students with female supervisors. Worthington and Stern (1985) demonstrated that both women and men with same-gender supervisors perceived their relationship with their supervisors to be closer and attributed greater influence to their supervisors than did women and men with supervisors of the opposite gender. Generalizing from this earlier work, we might expect that women students would perceive their male professors less positively than their female professors. Seagram, Gould, and Pyke (1998) found that male doctoral students were more satisfied with the quality of supervision they received than were female doctoral students. Because most of the individuals in their sample were supervised by male professors, this finding is in accord with the result in the present study.

The fact that student perceptions of their own participation were not influenced by the gender of professors is contrary to what would be predicted from the chilly climate model. However, as Janz and Pyke (2000) have argued, there is variability in students' sensitivity to the micro-inequities and systemic discrimination characteristic of a chilly climate. Women, graduate students, feminists, minority students, and students who have taken courses in women's studies appear to be more aware of these factors than other students. The sample in the present study, although including women, was composed entirely of graduates and the other categories of 'sensitized' students may have been relatively under-represented. Hence in the aggregate, the students may have been quite unaware of the impact of instructor gender on their perceptions of their own classroom participation.

In sum, the results of this study provide only partial support for the chilly climate model. The three gender effects obtained favored males;

furthermore, among the active students, the active male students perceived themselves as participating more and interrupting more than did the active female students, whereas among the 64% of the students who were less active, males and females did not differ. Older students perceived themselves as participating more and were disproportionately represented in the active group. At the level of students' overall impression of their instructor, female students with male instructors reported less favorable impressions of their instructor than did other students. This finding partially parallels the student gender/teacher gender interaction found by Feldman (1993). Feldman notes that "students tend to rate same-gendered teachers a little higher than opposite-gendered teachers" (p. 151), and indeed this result was replicated in our study. The results also underscore the relevance of contextual factors, particularly with respect to perceptions of instructors. Class size, the proportion of women in the class, and to a lesser extent the discipline area all contribute to perceptions about specific professor behaviors. The other major finding is the importance of students' self-perceptions of their general level of activity in the university classroom, in particular, the positive relation between students' perceived activity level and their ratings of professor behaviors. Students who regarded themselves as active in class also had more positive overall impressions of their professors. These findings have implications in terms of students' evaluation of instructors. In conclusion, the importance of examining multiple contextual factors in our attempt to understand more accurately the university classroom experience is stressed. Given the robustness of our results for the individual factor of activity level, we suggest that in future research females and males should not be considered as two separate homogeneous groups, but rather that important within-gender differences be examined.

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