

ED 370 806

SE 054 562

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 TITLE A Student's Perspective on the Intrinsic Characteristics of the Single-Sex Physics Class.
 PUB DATE Apr 94
 NOTE 23p.; Paper presented at the Annual Meeting of the American Educational Research Association (New Orleans, LA, April 1994).
 PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
 DESCRIPTORS Classroom Environment; Classroom Research; *Females; High Schools; *Males; *Physics; *Science Instruction; *Secondary School Science; *Sex Differences; Student Attitudes
 IDENTIFIERS *Single Sex Classes

ABSTRACT

Little is known about the intrinsic characteristics that distinguish single- and mixed-sex classrooms at the secondary level. To address this gap in knowledge, 19 Grade 11 students who were in a mixed-sex Physics 10 (during Grade 10) and a single-sex Physics 20 (during Grade 11) class were asked to compare the two environments. Twenty-four Grade 11 students who were in a mixed sex class also participated. All students had the same teacher and attended the same school during Physics 10 and 20. Students across the three classes did not differ in ability, in overall family income, or in perceptions of workload and content difficulty. In physics achievement, the females in the single-sex class performed equally well in Physics 10 and 20 whereas the males in the single-sex class performed better in Physics 10. The females in the single-sex class reported that Physics 20 was more involving, affiliative, orderly, and organized than Physics 10. They also reported that the teacher exerted less control in the single-sex context. Not surprisingly, the females in the single-sex class had a stronger preference for the gender-specific context of Physics 20 compared to the males in the single-sex class and students in the mixed-sex class. (Author)

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A Student's Perspective on the Intrinsic Characteristics
of the Single-Sex Physics Class

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We are grateful to Sandee Stupan for helping collect the data and for scoring the ability measures; to Pat Krukewich for retrieving the census data; to Connie Varnhagen and Todd Rogers for critiquing an earlier draft of the manuscript; and to the students and staff at Austin O'Brien School for their cooperation.

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RUNNING HEAD: Intrinsic Characteristics

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Abstract

Little is known about the intrinsic characteristics that distinguish single- and mixed-sex classrooms at the secondary level. To address this gap in knowledge, 19 Grade 11 students who were in a mixed-sex Physics 10 (during Grade 10) and a single-sex Physics 20 (during Grade 11) class were asked to compare the two environments. Twenty-four Grade 11 students who were in a mixed-sex class also participated. All students had the same teacher and attended the same school during Physics 10 and 20. Students across the three classes did not differ in ability, in overall family income, or in perceptions of workload and content difficulty. In physics achievement, the females in the single-sex class performed equally well in Physics 10 and 20 whereas the males in the single-sex class performed better in Physics 10. The females in the single-sex class reported that Physics 20 was more involving, affiliative, orderly, and organized than Physics 10. They also reported that the teacher exerted less control in the single-sex context. Not surprisingly, the females in the single-sex class had a stronger preference for the gender-specific context of Physics 20 compared to the males in the single-sex class and students in the mixed-sex class.

A Student's Perspective on the Intrinsic Characteristics of the Single-Sex Physics Class

Researchers are beginning to consistently document the positive effects of single-sex schooling. In two recent studies containing a large randomly-selected sample of high school students, females and minorities in single-sex schools outperformed their mixed-sex counterparts on academic achievement and affective measures after initial ability and home background were statistically controlled (Lee & Bryk, 1986; Riordan, 1990; also see Marsh, 1989 for a counter-example). Despite these initial findings that demonstrate the potential benefits of single-sex schooling, returning to this form of education would have enormous implications. Students, parents, educators, administrators, and government officials would likely have questions and concerns about the impact of such a decision that could not be properly addressed with the empirical studies available to-date. For example, researchers do not know **why** students in single-sex schools outperform students in mixed-sex schools and a question such as--what are the critical attributes of the single-sex environment that contribute to the positive achievement and attitude outcomes?--has yet to be investigated. The purpose of the present study is to begin to investigate some of the intrinsic characteristics of the single-sex classroom that may contribute to positive academic outcomes.

Background

Research comparing the effects of single- and mixed-sex schooling at the secondary level began to emerge in the late 1960s (see Lee & Bryk, 1986, for a thorough review). The early studies **were designed** to identify social and psychological variables that distinguished single- and mixed-sex schools. Researchers found that mixed-sex (also called coeducational) schools tended to have friendlier and more relaxed social climates (Dale, 1969, 1971; Feather, 1974; Jones, Shallcross, & Dennis, 1972) and were described by some as affiliative and pleasure-oriented (Schneider & Coutts, 1982). Conversely, single-sex schools, particularly those for

females, were considered to emphasize control and discipline (Jones et al., 1972, Trickett Castro, Trickett, & Schaffner, 1982). The research was equivocal as to whether single-sex schools were more academically-oriented than coeducational schools (Dale & Miller, 1972; Feather, 1974; Jones et al., 1972; Trickett et al., 1982).

Psychological variables were also reported to be different in single- and mixed-sex schools. For example, Trickett et al. (1982) found that girls in single-sex high schools showed a significantly higher level of interest in the feminist movement than girls in coeducational schools. Lockheed (1976) reported that adolescent females participated in more activities when in a single-sex context.

In the late 1980s, a second wave of research comparing single- and mixed-sex schools at the secondary level emerged. Researchers were sensitive to the limitations of the early studies in this area and adopted a more rigorous approach in two respects. First, confounding variables, such as initial ability and home background, were statistically controlled using techniques such as covariance adjustment (Anderson, Auquier, Hauch, Oakes, Vandaele, & Weisberg, 1980). Second, researchers began to focus on how achievement and attitudinal variables were related to academic performance. By focusing on a broader range of outcome measures, researchers were able to investigate a variety of variables believed to differ across the two environments.

Two studies that exemplify this more rigorous contemporary approach were conducted by Lee and Bryk (1986) and Riordan (1990). Both studies are based on a sample of students obtained from High School and Beyond (HSB), a national survey of American high school students. According to Riordan (1990), the HSB dataset contains the highest quality survey data available because respondents were randomly-selected from a representative sample of single- and mixed-sex American high schools. Students were tested in Grade 10 and again in

Grade 12 on a variety of measures, some of which could be used to statistically control for the effects of confounding variables.

Lee and Bryk (1986) compared students in single- and mixed-sex schools using student background, curriculum track, and school social composition as the adjustment variables. Compared with females in mixed-sex schools, females in single-sex schools were more interested in math and english, associated with more academically-oriented friends, spent more time on homework, and enrolled in more mathematics classes. On gain scores comparing test results from Grades 10 to 12, females in single-sex classes had higher scores on reading and science tests, higher educational aspirations, and lower sex-role stereotyping than their same sex coeducational peers. Gain scores for all achievement measures favored the single-sex context indicating a trend in the data existed, although not comparisons were statistically significant.

For the males, students in the single-sex schools had a more positive attitude toward socially active peers and student athletes, did more homework, and enrolled in more mathematics and physical sciences classes than mixed-sex males. On gain score measures comparing test results from Grades 10 to 12, males in the single- and mixed-sex classes did not perform significantly different on the achievement or attitude measures. Gain scores for one achievement test (writing) favored the mixed-sex content, although it was not statistically significant. Lee and Bryk (1986) concluded: "In our view, the observational evidence that we assembled provides strong support for concluding that there are positive effects associated with attendance at girls' schools. The picture is more ambiguous with regard to the effects of the boys' school" (p. 392).

Riordan (1990), also using a randomly-selected sample from the HSB data base, compared white and minority (i.e., Black and Hispanic) students in single- and mixed-sex schools. After adjusting for initial ability and home background, Riordan found that white females in single-sex

schools outperformed white females in mixed-sex schools on science and civics tests. All of the gain scores favored the single-sex context, although only two were statistically significant. There were no significant differences on the achievement outcomes for white males in single- and mixed-sex schools. Adjusting for initial attitude, initial ability, and home background, white females in single-sex schools had more positive attitudes toward working women compared to white females in mixed-sex schools. There was no significant difference on the attitude measures between white students in single- and mixed-sex schools.

Minority students in single-sex schools had higher science and civics scores than their mixed-sex counterparts when scores were adjusted for initial ability, race, and home background. Minority males in single-sex schools outperformed minority males in mixed-sex schools on a test of advanced mathematics. Gain scores on the achievement tests for both females and males favored the single-sex context except in advanced math as the females in the mixed-sex schools outperformed the females in single-sex schools, but the difference was not statistically significant. On the attitude measures, minority females in single-sex schools had a more positive attitude toward working women and minority males in single-sex schools had a stronger internal locus of control than their respective mixed-sex peers. Across both the achievement and attitude measures, minority students in mixed-sex schools did not perform significantly better than minority students in single-sex schools.

The findings reported by Lee and Bryk (1986) and Riordan (1990) indicate that single-sex schooling tends to benefit students, especially females and minorities. To-date however, little is known about what critical attributes of the single-sex context contribute to the positive achievement and attitude outcomes consistently observed. To address this issue, we adapted the Classroom Environment Scale-Revised (CES-R) and asked students to compare the organization and social climate of the single- and mixed-sex physics class.

The CES-R contains eight categories that may differ in the single- and mixed-sex classroom and may be related to academic performance. The eight categories are: (a) involvement; (b) affiliation; (c) task orientation; (d) competition; (e) order and organization; (f) rule clarity; (g) teacher control; and (h) innovation.

Method

Subjects

The sample consisted of 43 Grade 11 students in a Catholic school system. Through an administrative initiative to pilot a single-sex classroom at the secondary level, the smaller of two mixed-sex Physics 20 classes was divided into a single-sex class for males and females. A total of 19 students (9 males; 10 females) from two single-sex Physics 20 classes and 24 students (14 males; 10 females) from one mixed-sex Physics 20 class participated. All students in the study had the same teacher for Physics 10 and 20 and attended the same school in both grades 10 and 11. All students were in a mixed-sex class for Physics 10.

Materials

Classroom Environment Scale-Revised (CES-R). The Classroom Environment Scale-Revised (CES-R) was used to assess changes between the Physics 10 and 20 class, as perceived by students. Based on the research findings of Moos and Trickett (1974), eight classroom environment variables that may differ in the single- and mixed-sex class were assessed with the CES-R. Students were instructed to respond to 64 statements comparing the Physics 10 and 20 classes using a 5-point scale ranging from "Strongly Disagree" to "Strongly Agree". One category (teacher support) and several items from the original instrument were omitted from the CES-R because we felt these questions were inappropriate for the high school students in this study¹.

The first classroom environment variable was involvement. This category was designed to measure students' interest toward class activities and discussions. The second category,

affiliation, was designed to assess friendship and rapport in the classroom. Task orientation, the third category, assessed the emphasis placed by the teacher for staying on-task and completing class activities and assignments. The fourth category, competition, was designed to measure the amount of competition that occurred for marks and recognition in class. Order and organization, the fifth category, assessed student behavior in class as well as the overall organization of assignments and activities. Rule clarity was the sixth category and measured the emphasis placed on establishing and following teacher-made rules in class. The seventh category, teacher control, measured the severity and consistency of the consequences that followed when teacher-made rules were broken. The final category, innovation, was designed to assess the degree to which the teacher attempted new and creative assignments and activities as well as different instructional techniques.

General Questions. Students were asked to compare the workload and content difficulty of Physics 10 and 20. They were also asked whether they preferred (or thought they would prefer, in the case of the mixed-sex class) gender-specific to coeducational schooling.

Henmon-Nelson Ability Test, Canadian Edition. The Henmon-Nelson Ability Test, Canadian Edition was used as a measure of general cognitive ability to ensure that the students in the single- and mixed-sex classes were comparable to one another. In a test critique by Clark and Gardner (1988), the Henmon-Nelson Test of Mental Ability, which was the predecessor to the Henmon-Nelson Ability Test, Canadian Edition, was described as: "a good test of mental ability, especially in the Grade 3 to 12 range. It compares favorably to its many competitors and has a long and venerable history. The authors have invested much time and effort in test development, and it shows." (p. 232) We considered the Henmon-Nelson Ability Test to be a reliable and valid measure of a student's current level of developed ability (see technical information in examiner's manual, Henmon-Nelson Ability test, Canadian Edition, 1990).

School Test Scores and Attendance. Final teacher-awarded marks in Physics 10 and 20 were collected along with attendance data for Physics 20. Attendance data for Physics 10 was not available for all students.

Procedure

The Henmon-Nelson Ability test, the CES-R, and the general questions were administered to all three Physics 20 classes. Students were tested during their regular physics class time slot in the physics classroom. The females in the single-sex class and the students in the mixed-sex class were tested one day and the males in the single-sex class on the following day. Practice items were completed on both the Henmon-Nelson Ability test and the CES-R prior to beginning each assessment.

Results

Comparability of the Three Classes

The first set of analyses was conducted to ensure that students in the single- and mixed-sex classes were comparable in ability and socio-economic status (SES), and that students perceived the workload and content difficulty in Physics 10 and 20 to be similar (see Table 1 for means and standard deviations). Using a 4(Group: Single-Sex Males vs. Single-Sex Females vs. Mixed-Sex Males vs. Mixed-Sex Females) analysis of variance, mean scores on the Henmon-Nelson Ability test did not differ significantly among the four groups, $F(3, 39) = .99$, $p = .41$, indicating that students had a similar ability level and therefore were comparable on this measure.

Insert Table 1 about here

To ensure that students in the three classes were comparable on SES (which serves as a measure of home background), family income was estimated for each student using the most

recent Statistics Canada census track data. Each student's home address was used to locate the census track. On the basis of a 4(Group) analysis of variance, mean scores on family income did not differ across the four groups using a .05 alpha level as the criteria, $F(3, 39) = 2.44$, $p = .08$, indicating that students came from similar SES backgrounds and were comparable on this measure.

Finally, to ensure that students in the three classes perceived the workload and content difficulty of Physics 10 and 20 to be similar, students responded to three questions. All responses were analyzed with a 4(Group) analysis of variance. For the first item--Compared to Physics 10, on average, how much time do you spend doing homework in Physics 20?--students responded on a five-point scale ranging from "Much less time" to "Much more time". Mean responses ranged from 2.8 to 3.5, where a 3 corresponds to "About the same", and did not differ across the four groups, $F(3, 39) = .89$, $p = .45$. For the second item--Compared to Physics 10, how difficult do you find the topics covered in Physics 20?--students responded on a five-point scale ranging from "Much less difficult" to "Much more difficult". Mean responses ranged from 2.9 to 4.0, where a 3 corresponds to "About the same", and did not differ across the four groups, $F(3, 39) = 2.50$, $p = .07$. For the third item--Compared to Physics 10, how much work do you have to do in order to "keep up" with the work covered in Physics 20?--students responded on a five-point scale ranging from "Much less work" to "Much more work". Mean responses ranged from 3.1 to 3.5, where a 3 corresponds to "About the same", and again did not differ across the four groups, $F(3, 39) = .37$, $p = .77$. Lastly, the rate of absenteeism for Physics 20 did not differ across the four groups, $F(3, 39) = 2.72$, $p = .06$, although the effect did approach significance at the .05 alpha level.

Taken together, these results strongly suggest that students in the single- and mixed-sex classes were comparable on the key variables that could serve to confound the performance and survey results. There were no statistically significant differences at the .05 alpha level on

measures of ability, SES, and perceptions of workload and content difficulty across the three classroom groups did not differ significantly on the number of days absent from Physics 20 class.

Physics Performance

The second set of analyses was performed to compare students' final marks in Physics 10 and 20 across the four groups to determine whether the classroom context influences academic performance. Using a 4(Group) x 2(Course: Physics 10 vs. Physics 20) analysis of variance with repeated measures on the last variables², mean scores differed for group, $F(3, 39) = 3.37$, $p < .05$, but not for course, $F(1, 38) = 2.91$, $p = .09$. The group effect was qualified by group x course interaction, $F(3, 38) = 3.32$, $p < .05$. (see Table 2 for means and standard deviations).

Insert Table 2 about here

The group x course interaction was examined by calculating simple main effects (Kirk, 1982). Males in the single-sex class received a lower mark in Physics 20 compared to Physics 10, $F(1, 38) = 4.50$, $p < .01$, whereas the performance of the females in the single-sex class did not differ between Physics 10 and 20, $F(1, 38) = .43$, $p = .52$. Differences in Physics 10 and 20 performance for the students in the mixed-sex class were also negligible (p 's $> .13$).

Intrinsic Characteristics

The third set of analyses was conducted to compare the intrinsic characteristics of the single- and mixed-sex classrooms. To investigate the distinction between the eight CES-R categories across the groups, ratings were analyzed with a 4(Group: Single-Sex Males vs. Single-Sex Females vs. Mixed-Sex Males vs. Mixed-Sex Females) multivariate analysis of variance followed by a series of univariate tests. Mean ratings are presented in Table 3. Applying the Pillai-Bartlett Trace (V) as the criterion for the multivariate test, CES-R ratings

differed across the four groups, $V = 1.16$, $F(24, 87) = 2.28$, $p < .01$. Of the eight univariate tests, the groups differed in their perceptions of involvement, $F(3, 34) = 5.43$, $p < .01$, affiliation, $F(3, 34) = 7.87$, $p < .01$, order and organization, $F(3, 34) = 3.16$, $p < .05$, and teacher control, $F(3, 34) = 4.83$, $p < .01$. The four groups did not differ in their perceptions of task orientation, competition, rule clarity, and innovation.

Insert Table 3 about here

Keeping in mind that the principal difference between Physics 10 and 20 was the classroom context (given that students reported Physics 10 and 20 were comparable in workload and content difficulty, that students had the same teacher for both courses, and that students attended the same school for Grades 10 and 11), females in the single-sex class reported that Physics 20 was more involving than Physics 10 when compared to the males in single-sex class, $F(1, 34) = 3.00$, $p < .05$, and the males in the mixed-sex class, $F(1, 34) = 3.71$, $p < .05$. Females in the single-sex class also perceived the Physics 20 class to be more affiliative than Physics 10 when compared to the males in the single-sex class, $F(1, 34) = 3.38$, $p < .05$, and the males in the mixed-sex class, $F(1, 34) = 4.67$, $p < .05$. Females in the single-sex class reported that Physics 20 was more orderly and organized than Physics 10 whereas the males in the single-sex class believed the opposite was true, $F(1, 34) = 2.93$, $p < .05$. Lastly, females in the single-sex class reported that the teacher exerted more control during Physics 10 and differed from the males in the mixed-sex class who perceived the teacher to exert more control during Physics 20, $F(1, 34) = 3.42$, $p < .05$. Females in the single-sex class scored higher on involvement, affiliation, order and organization, and lower on teacher control than females in the mixed-sex class suggesting a trend exists in the data although the effects were not statistically significant.

Students across the three groups did not differ on their ratings of task orientation, rule clarity, and innovation. This finding should not come as a surprise given that students had the same teacher for Physics 10 and 20 and reported that the workload and content difficulty were comparable across the two courses. The teacher appears to be consistent from Physics 10 to 20 in how he emphasizes the need to complete class activities and assignments, in how he establishes and applies rules, and in how he teaches. Students across the four groups also reported that the level of competition was similar in Physics 10 and 20. Thus, the single-sex context does not appear to influence the amount of competition that occurs in the classroom.

Given that the single-sex class for females seems to be a more desirable environment when compared to the mixed-sex class (more involving, affiliative, orderly and organized, less teacher control), one would expect the females in the single-sex class to prefer this context. To evaluate this hypothesis, students were asked to respond, using a 5-point scale ranging from "Strongly disagree" to "Strongly agree", to the statement: I prefer gender-specific to coeducational Physics classes (the mixed-class was asked, I think I would prefer gender-specific to coeducational Physics classes). Responses were analyzed with a 4(Group) analysis of variance. Mean ratings differed across the groups, $F(3, 39) = 9.25, p < .01$, with a mean and standard deviation of 3.0 and 0.9 (where 3 = Not sure) for the females in the single-sex class, 1.2 and 0.7 for the males in the single-sex class, 1.9 and 0.2 for the females in the mixed-sex class, and 1.5 and 0.2 for the males in the mixed-sex class. The response of females in the single-sex class differed from the males in the single-sex class, $F(1, 39) = 4.81, p < .05$, the males in the mixed-sex class, $F(1, 39) = 4.41, p < .05$, and the females in the mixed-sex class, $F(1, 39) = 3.06, p < .05$. Differences between the males in the single-sex class and the students in the mixed-sex class were not statistically significant. This finding demonstrates that while the females in the single-sex class were ambivalent about the Physics 20 context, they

clearly distinguished themselves from the other three groups who reported to strongly prefer coeducational classes.

In summary, female students who had been in a mixed-sex class for Physics 10 and a single-sex class for Physics 20 reported that the single-sex classroom was more involving and affiliative when compared to the males in the single- and mixed-sex classes. The females in the single-sex class found the Physics 20 class to be more orderly and organized and differed from the males in the single-sex class who reported the opposite effect. The females in the single-sex class perceived the teacher exerts less control in Physics 20 and differed from the males in the mixed-sex class who believed that the teacher exerts more control in Physics 20. Females in the single-sex class felt ambivalent about the Physics 20 context but were clearly distinguished from the other three groups who preferred coeducational classes. It is important to note that a trend in favor of the single-sex context for the females exists as this group had higher mean ratings on involvement, affiliation, order and organization, and lower mean ratings on teacher control than the females in the mixed-sex class. The non-significant effects may be attributed to the small sample size.

Discussion

The purpose of this pilot study was to investigate the attributes of the single-sex classroom that may contribute to the positive achievement outcomes documented in the literature. The conditions in this study were unique. The students who participated had the same physics teacher and attended the same school in grades 10 and 11. Nineteen of the students, however, were in a mixed-sex physics class in grade 10 and a single-sex physics class in grade 11, and therefore the main difference between Physics 10 and 20 was the classroom context. This situation enabled us to have students compare the single- and mixed-sex environment on variables that may differ in the two contexts while using the mixed-sex class as a control group.

The single- and mixed-sex classes were characterized by different intrinsic variables that may help account for the performance differences. Females in the single-sex class reported that Physics 20 was more involving and affiliative than Physics 10 when compared to the males in the single- and mixed-sex classes. Females in the single-sex class also reported that Physics 20 was more orderly and organized than Physics 10. The males in the single-sex class believed the opposite was true. Females in the single-sex class indicated that the teacher exerted more control in Physics 10 than in Physics 20, and differed from the males in the mixed-sex class who perceived the teacher to exert more control in Physics 20. It appears that females found the single-sex context to be more engaging, interactive, methodical, and less restrictive than the mixed-sex environment. Not surprising, females in the single-sex class had a stronger preference for the gender-specific context when compared to the males in the single-sex class and the students in the mixed-sex class.

As this study progressed, we discovered that many fundamental questions have yet to be addressed in the single-sex literature. For example, would single-sex classrooms (in a mixed-sex school) and single-sex schools differentially influence academic performance, and would the intrinsic characteristics of these two environments be comparable? Do male and female teachers differ in how they influence students in the single-sex classroom? How would the intrinsic characteristics of the single-sex class differ at the elementary, junior high, and senior high levels? Are the intrinsic characteristics of the single-sex class consistent across subject areas? What factors cause a student to either like or dislike single-sex education, and would these factors differ across sex? Do parents like single-sex education? Are the achievement and attitude gains found in single-sex schools stable over time?

The results of this study provide a starting point for investigating the intrinsic characteristics of the single-sex classroom. Females reported that the single-sex context was distinct on four CES-R categories--involvement, affiliation, order/organization, teacher control--that may help

explain why these students differed from the males in the single-sex classes and students in the mixed-sex classes on achievement and attitude measures. These findings should encourage researchers to continue the study of single-sex education as we attempt to understand the intrinsic characteristics of this instructional context.

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Footnotes

¹The Classroom Environment Scale-Revised is available from the first author upon request.

²Physics 10 and 20 marks were percentages. Consequently, analyses were conducted on transformed scores using the arcsine transformation, as advocated by Winer (1991).

Table 1

Means and Standard Deviations for the Henmon-Nelson, Family Income, Workload and Content Difficulty Items, and Attendance as a Function of Group

Category	Single-Sex Class				Mixed-Sex Class			
	Male		Female		Male		Female	
	M	SD	M	SD	M	SD	M	SD
Henmon-Nelson ^a	117.2	17.2	121.2	6.7	23.4	12.2	114.8	15.1
Family Income ^b	38.3	6.6	41.8	11.6	42.3	4.3	48.9	11.6
Item 1 (Homework)	2.8	0.7	3.1	0.9	3.0	1.1	3.5	1.2
Item 2 (Topics)	3.6	0.5	2.9	1.2	3.1	1.3	4.0	0.5
Item 3 (Keep Up)	3.3	0.5	3.1	0.7	3.2	1.1	3.5	1.1
Absenteeism	4.1	2.8	2.8	2.2	7.1	5.7	3.3	3.7

^aStandard age scores. ^bThousand dollars per year.

Table 2

Means and Standard Deviations for Physics 10 and 20 as a Function of Group

Category	Single-Sex Class				Mixed-Sex Class			
	Male		Female		Male		Female	
	M	SD	M	SD	M	SD	M	SD
Physics 10	68.4	9.6	78.0	9.9	71.9	12.4	78.1	12.5
Physics 20	61.9	9.9	76.4	10.1	66.6	15.9	81.2	14.1

Table 3

Means and Standard Deviations on the Classroom Environment Scale - Revised as a Function of Group

Category	Single-Sex Class				Mixed-Sex Class			
	Male		Female		Male		Female	
	M	SD	M	SD	M	SD	M	SD
Involvement	2.3	0.7	3.4	0.8	2.3	0.7	2.9	0.9
Affiliation	3.2	0.7	4.0	0.5	2.9	0.4	3.3	0.5
Task Orientation	3.2	0.7	3.3	0.4	3.4	0.7	3.9	0.5
Competition	3.3	0.5	3.7	0.6	3.4	0.7	3.9	0.7
Order/Organization	2.4	0.7	3.3	0.8	2.7	0.5	2.9	0.6
Rule Clarity	2.7	0.8	2.8	0.2	2.8	0.6	2.9	0.7
Teacher Control	2.7	0.7	2.5	0.2	3.4	0.5	3.1	0.7
Innovation	2.9	0.7	3.0	0.5	2.4	0.6	2.8	0.4

Note. The scale ranged from 1 to 5, with higher mean scores corresponding to more agreement in favor of Physics 20 and lower scores corresponding to more agreement in favor of Physics 10.