MLET: The Journal of Middle Level Education in Texas

Volume 2 | Issue 1 Article 1

2015

Middle School Single-Gender Science Classes: Self-Concept and Discourse Analysis

Pauline M. Sampson
Stephen F. Austin State University

Gloria J. Gresham Dr.
Stephen F. Austin State University

Melissa M. Leigh
Humble Independent School District

Denice McCormick Myers Ed.D
Stephen F. Austin State University

Middle School Single-Gender Science Classes: Self-Concept and Discourse Analysis

Gewertz (2007) and Sax (2005) recently discovered a rise in the use of single-gender classrooms as a placement option for students. The use of single-gender classrooms is a highly debated topic. One supporting view is that students focus better when appropriate teaching strategies are used that relate to gender differences in learning styles (Spielhagen, 2006). An opposing view is that implementing single-gender instruction is a form of segregation and removes gains for equality in women's education (Johnson, 2004). At times, the strategy of implementing single-gender instruction is an attempt to increase the percentages of females in science careers and to control male behavior in schools (Bracey, 2006).

Traditionally, when compared to females, males perform better on science achievement tests, enroll more in upper-level science classes, and work more in science careers (Brooks, 2011; Lee, Chen, & Smerdon, 1996; Weinburgh, 2000). One suburban school district planned the implementation of single-gender science classes in their middle school as an attempt to increase the percentage of females taking classes for science careers while increasing the self-concept of all students and increasing higher levels of discourse. Administrators at one middle school in a large, suburban school in a southwestern district in the United States were faced with data revealing females were not selecting to participate in upper-level science courses at the rate of males, and in science courses, females were more passive when compared to males. To combat these concerns, single-gender instruction was implemented to increase female self-concept in science and to foster female interest in pursuing upper-level science courses in middle school and high school.

To add to the body of knowledge on middle school single-gender instruction, two university professors approached the principal, assistant principal, and assistant superintendent to

request permission to study the campus implementation of eighth grade single-gender science instruction because much of the current research in middle school single-gender instruction targeted urban, inner city schools or single-gender schools (e.g., Ferrara & Ferrara, 2004; Patterson, 2012; Singh, Vaught, & Mitchell, 1998; Spielhagen, 2011; Sullivan, 2009; Tully & Jacobs, 2010; Watson, Quatman, & Edler, 2002). For this study, the school was a suburban middle school. A year-long quantitative study from September 2011 through May 2012 of the three, coeducational, eighth grade classrooms taught by one teacher was implemented documenting the effects of single-gender classroom instruction on the areas of science self-concept and classroom discourse

Review of Literature

Since the focus of this study was how single-gender science instruction changed science self-concept and discourse, a review of literature in these areas was conducted. First, the effect of single-gender classroom instruction on self-concept was examined. One of the earlier studies on self-concept in single-gender classrooms was conducted by Dunn *et al*. (1984). Dunn found that females believed single-gender classes were boring and less enjoyable than mixed-gender classes. Gray (1987) showed females participating in single-gender mathematics and science instruction exhibited gains in achievement and attitude, and these gains were sustained for several years. In 1996, Durost investigated the effects of single-gender eighth grade Algebra instruction over a seven year period and discovered that females participating in single-gender instruction enrolled in more math and science courses in high school, were more likely to consider careers associated with math, and had more self-confidence in their mathematical ability. Ferrara and Ferrara (2004) reviewed a three-year single-gender instruction initiative implemented in New York and found that in the single-gender classes, females participated more

and were less self-conscious about their work. Implementing an experimental, post-test-only methodology to determine the effect of single-gender instruction on self-esteem, Belcher, Frey, and Yankeelov (2006) indicated that students participating in single-gender classrooms had significantly higher school-related self-esteem, but there were no significant differences in self-esteem specifically related to peer interactions. Also in 2006, Salomone's research indicated that single-gender instruction may increase self-confidence and broaden interests especially among middle school students. Ursula and Hannover (2008) revealed that females who participated in single-gender instruction had a better self-concept of their ability in subjects such as physics when compared to females in mixed-gender classes. Viets (2009) investigated single-gender instruction in middle schools in the Midwest. He found that students exhibited higher self-esteem, and female test scores in mathematics increased. Also in 2009, Sullivan studied the effects of single-gender instruction on self-concept and discovered that the initiative increased self-concept.

Classrooms are social systems where members are expected to participate and contribute (Gee, 1999; Gresalfi, Martin, Hand, Geeno, 2009; Holland, Skinner, Lachicotte and Cain, 1998; Jungwirth, 1991). For this study, oral contributions displayed by participants were defined as discourse. Duschl and Gitmoer (1997) believed discourse analysis was important as a formative assessment tool. Lindsay concurred (1990) by stating that analyzing discourse was an important method because it showed the way multiple forces react to form instruction. Nathan and Knuth (2003) revealed how discourse changed from teacher-centered instruction to more student-centered instruction; however, these researchers did not connect this relationship to student achievement. Later, Webb, Nemeer, and Ing (2006) indicated that students reproduced the discourse of the teacher when in cooperative learning settings. Also studying cooperative

learning and discourse, Gillies (2006) indicated that students showed more mediated-learning interactions and displayed fewer disciplinary comments when in cooperative learning settings. Lam, Law, and Shum (2009) studied discourse in writing classrooms and coded for person speaking, type of response, and categorized the higher order thinking type of the response. Lam, et. al discovered that discourse analysis showed a positive association between high cognitive level of utterance and better educational effects. A similar format of discourse analysis formed the basis for the observation protocol used in this current study.

Methodology

Prior to beginning the 2011-2012 academic year, the suburban school district in this study offered a voluntary single-gender science program for eighth grade students at one of the district's middle school campuses. The participants in the study included one teacher who taught one female gender classroom, one male gender classroom, and three sections of mixed gender classrooms for a total of 101 students.

The design was an exploratory and quasi-experimental design. In an exploratory design one data set provides a supportive, secondary role based primarily on the other type of data (Creswell & Clark, 2011). The present study used a quantitative design to determine the effect of single-gender classrooms on the academic self-concept of eighth grade students using Marsh's (1990) Academic Self-Concept Scale Academic Self-Descriptive Questionnaire I (ASDQ1). The ASDQ1 was administered early in the school year and again at the end of the school year to determine if there was a change. This questionnaire was placed on SurveyMonkey, and each of the students completed the questionnaire in the computer lab at their school. Students answered the items on a Likert scale of *definitely false, false, mostly false, more false than true, more true than false, mostly true,* and *true.* A control group of students in mixed-gender classes was

administered the same scale to determine what differences, if any, occurred between the three groups.

Once each semester, one researcher coded the utterances of one female-gender science class, one male-gender class, and one mixed-gender class to document patterns of discourse. Utterances were coded as T for teacher speaking, S for student speaking, or C for a group of students speaking simultaneously. Student utterances were then coded as one (1) for male or two (2) female. The utterances were coded as one (1) eliciting, two (2) offering response, or three (3) demanding/directing. The next coding was the cognitive level of the utterance. The cognitive level was either low level one (1) as knowledge, comprehension, application or high two (2) as analysis, synthesis, or evaluation according to the levels of thinking displayed in Bloom's Cognitive Taxonomy (Bloom, 1984).

Data Sources

Sample

The sample of this study was a suburban district in Texas in the first year of implementation of eighth grade single-gender science classes at the middle school. Prior to the school year, notices of the implementation of eighth grade single-gender science instruction were sent home to parents, and parents who were interested returned permission slips to the campus administrators for their children to participate. All students whose parents provided permission were enrolled in the eighth grade single-gender science classes. The remaining eighth grade students were placed in coeducational eighth grade science classes. After all eighth graders were placed in science classes for the academic year, there was one single-gender female classroom with 13 participants, one single-gender male classroom with 11 participants, and three mixed-gender classrooms with 77 participants.

Discourse

The one class of single-gender female students and the one class of single-gender male students were observed to analyze discourse. The control group of one mixed-gender class was also observed to analyze discourse, selecting a matched class with the same teacher and subject area. Observations of the matched classes occurred on the same day. Descriptive statistic level means and standard deviations were calculated by low or high category levels of utterances based on the levels of Bloom's Taxonomy (Bloom, 1984), by classroom types for males in the single-gender classroom and males in the mixed-gender classroom or females in the single-gender classroom and females in the mixed-gender classroom, by types of utterances (eliciting, offering, or demanding/directing), and by speaker (teacher, student, choral) (see *Table 1*).

Table 1

Descriptive Statistics Bloom's Taxonomy Levels and Utterance Types

MALES		BLOOM'S TAXONOMY LEVEL	UTTERANCE TYPE
Single-Gender Male	Mean	1.24	1.97
Classroom	N	377	377
	Std. Deviation	.427	.652
Males in Mixed-Gender	Mean	1.33	2.05
Classroom	N	199	199
	Std. Deviation	.472	.584
Total	Mean	1.27	2.00
	N	576	576
	Std. Deviation	.445	.630

FEMALES

Single-Gender Female Classroom	Mean	1.18	2.08
	N	544	544
	Std. Deviation	.383	.649
Females in Mixed-Gender Classroom	Mean	1.33	2.05
	N	199	199
	Std. Deviation	.472	.584
Total	Mean	1.22	2.07
	N	743	743
	Std. Deviation	.414	.632

Bloom's Taxonomy Level 1 = Basic/Low, 2 = Abstract/High

Utterance Level 1 = Elicited, 2 = Offered, 3 = Demanded

Chi-square analyses, using the Crosstabs function in Predictive Analytics SoftWare [PASW Statistics 18] (SPSS, 2009), were calculated to determine percentages of occurrences and to detect categorical differences between Bloom's Taxonomy level and class types for males (see *Table 2*);

Table 2

Chi-Square Analysis Bloom's Taxonomy Levels Between:

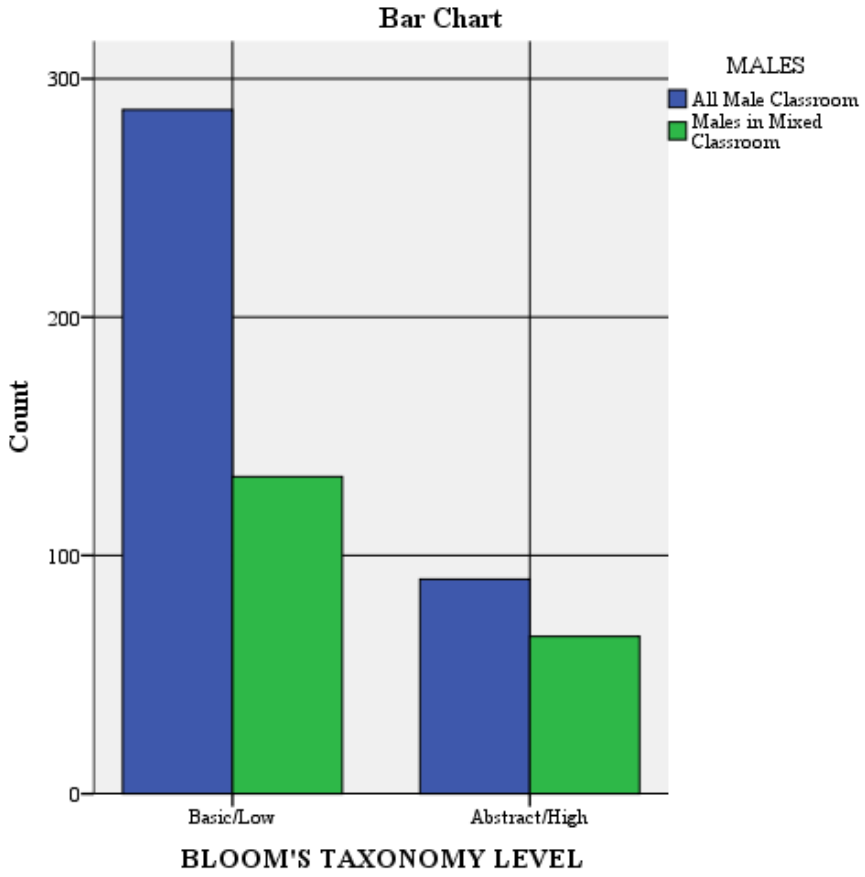
Class Types for Single-Gender Males and Males in the Mixed-Gender Class

			Single-Gender Male Classroom	Males in Mixed-Gender Classroom	
BLOOM'S TAXONOMY LEVEL	Basic/Low	Count	287	133	420
		Expected Count	274.9	145.1	420.0
		% within BLOOM'S TAXONOMY LEVEL	68.3%	31.7%	100.0%
		% within MALES	76.1%	66.8%	72.9%
	Abstract/High	Count	90	66	156
		Expected Count	102.1	53.9	156.0
		% within BLOOM'S TAXONOMY LEVEL	57.7%	42.3%	100.0%
		% within MALES	23.9%	33.2%	27.1%
Total		Count	377	199	576
		Expected Count	377.0	199.0	576.0
		% within BLOOM'S TAXONOMY LEVEL	65.5%	34.5%	100.0%
		% within MALES	100.0%	100.0%	100.0%

Chi-Square Tests	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.696[a]	1	.017		
Continuity Correction[b]	5.235	1	.022		
Likelihood Ratio	5.595	1	.018		
Fisher's Exact Test				.018	.012
Linear-by-Linear Association	5.686	1	.017		
N of Valid Cases	576				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 53.90.

b. Computed only for a 2x2 table



Females (see *Table 3*);

Table 3

Chi-Square Analysis Bloom's Taxonomy Levels Between:

Class Types for Single-Gender Females and Females in the Mixed-Gender Class

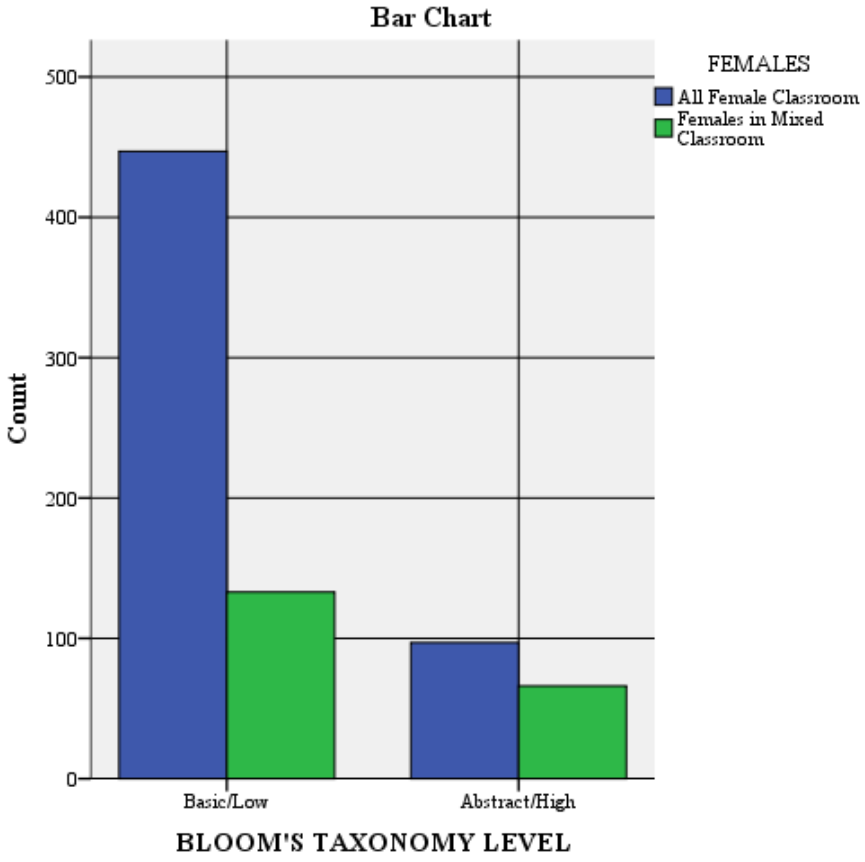
			Single-Gender Female Classroom	Females in Mixed-Gender Classroom	
BLOOM'S TAXONOMY LEVEL	Basic/Low	Count	447	133	580
		Expected Count	424.7	155.3	580.0
		% within BLOOM'S TAXONOMY LEVEL	77.1%	22.9%	100.0%
		% within FEMALES	82.2%	66.8%	78.1%

	Abstract/High	Count	97	66	163
		Expected Count	119.3	43.7	163.0
		% within BLOOM'S TAXONOMY LEVEL	59.5%	40.5%	100.0%
		% within FEMALES	17.8%	33.2%	21.9%
Total		Count	544	199	743
		Expected Count	544.0	199.0	743.0
		% within BLOOM'S TAXONOMY LEVEL	73.2%	26.8%	100.0%
		% within FEMALES	100.0%	100.0%	100.0%

Chi-Square Tests	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	20.007[a]	1	.000		
Continuity Correction[b]	19.122	1	.000		
Likelihood Ratio	18.876	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	19.980	1	.000		
N of Valid Cases	743				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 43.66.

b. Computed only for a 2x2 table



Types of utterances and class types for males (see *Table 4*);

Table 4

Chi-Square Analysis between Utterance Types:

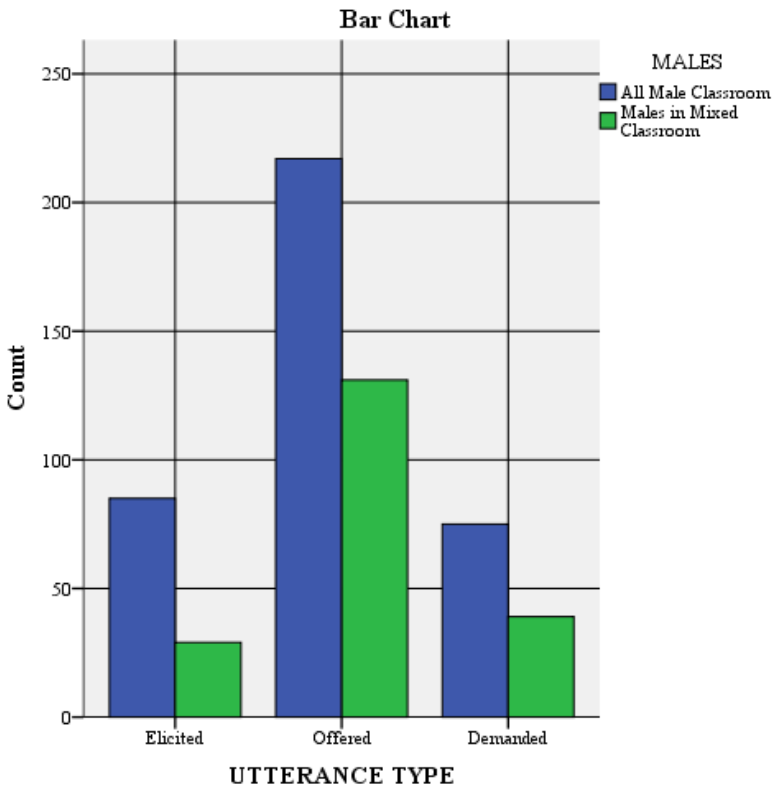
Between Single-Gender Males and Males in the Mixed-Gender Class

			All Male Classroom	Males in Mixed Classroom	
UTTERANCE TYPE	Elicited	Count	85	29	114
		Expected Count	74.6	39.4	114.0
		% within UTTERANCE TYPE	74.6%	25.4%	100.0%
		% within MALES	22.5%	14.6%	19.8%

	Offered	Count	217	131	348
		Expected Count	227.8	120.2	348.0
		% within UTTERANCE TYPE	62.4%	37.6%	100.0%
		% within MALES	57.6%	65.8%	60.4%
	Demanded	Count	75	39	114
		Expected Count	74.6	39.4	114.0
		% within UTTERANCE TYPE	65.8%	34.2%	100.0%
		% within MALES	19.9%	19.6%	19.8%
Total		Count	377	199	576
		Expected Count	377.0	199.0	576.0
		% within UTTERANCE TYPE	65.5%	34.5%	100.0%
		% within MALES	100.0%	100.0%	100.0%

Chi-Square Tests	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.664[a]	2	.059
Likelihood Ratio	5.860	2	.053
Linear-by-Linear Association	1.936	1	.164
N of Valid Cases	576		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 39.39.



Females (see *Table 5*).

Table 5

Chi-Square Analysis between Utterance Types:

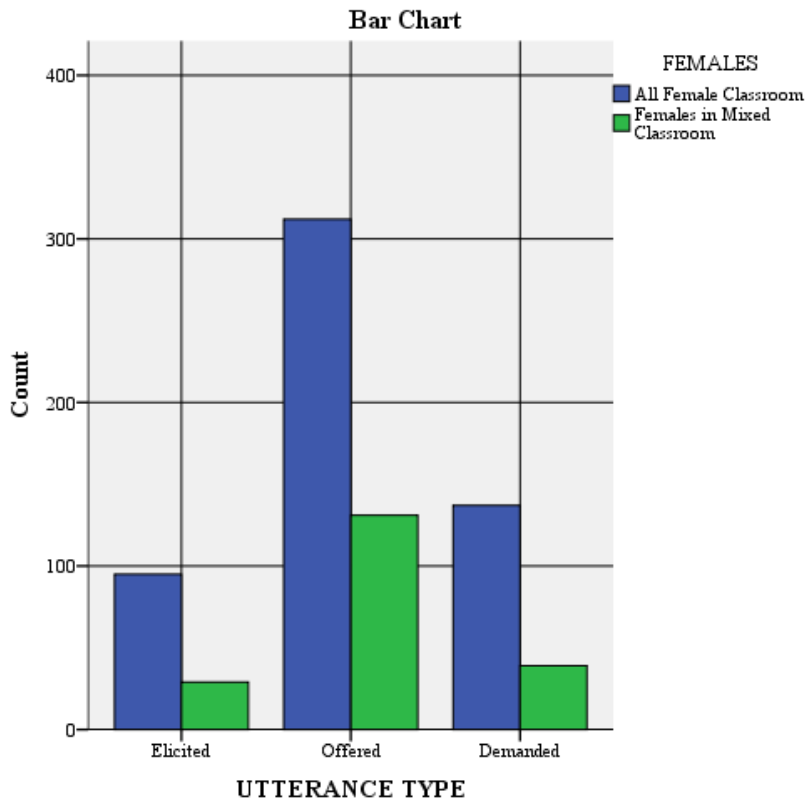
Between Single-Gender Females and Females in the Mixed-Gender Class

			FEMALES		
			Single-Gender Female Classroom	Females in Mixed-Gender Classroom	Total
UTTERANCE TYPE	Elicited	Count	95	29	124
		Expected Count	90.8	33.2	124.0
		% within UTTERANCE TYPE	76.6%	23.4%	100.0%

		% within FEMALES	17.5%	14.6%	16.7%
	Offered	Count	312	131	443
		Expected Count	324.3	118.7	443.0
		% within UTTERANCE TYPE	70.4%	29.6%	100.0%
		% within FEMALES	57.4%	65.8%	59.6%
	Demanded	Count	137	39	176
		Expected Count	128.9	47.1	176.0
		% within UTTERANCE TYPE	77.8%	22.2%	100.0%
		% within FEMALES	25.2%	19.6%	23.7%
Total		Count	544	199	743
		Expected Count	544.0	199.0	743.0
		% within UTTERANCE TYPE	73.2%	26.8%	100.0%
		% within FEMALES	100.0%	100.0%	100.0%

Chi-Square Tests	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.404[a]	2	.111
Likelihood Ratio	4.467	2	.107
Linear-by-Linear Association	.265	1	.607
N of Valid Cases	743		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 33.21.



Self-Concept

Self-concept was measured by the ASDQI (Marsh, 1990) with an internal consistency measure of reliability ranging from .881 to .941 for the response scales. The number of male participants (*n*=11) was roughly equal to the number of females (*n*=13) from the single-gender classes. Approximately three-quarters of the students were in mixed-gender classes (*n*=77). Each of the subject specific self-concepts related to how confident the students felt about their ability in each subject area (math, physical education, language arts, science, social studies, art, and music); however, only the responses from the science statements were used in this study.

Results

Discourse

Data indicated that the thinking level of utterances for females in the single-gender female classroom had the highest number of low-level utterances followed by the males in the single-gender male classroom. There were less low-level utterances for females and males in the mixed-gender classroom. The number of high-level utterances overall was lower in all classrooms compared to low-level utterances. There were relatively equal numbers of high-level utterances for females in the single-gender female classroom and for males in the single-gender male classroom (97:90) compared to both genders in the mixed-gender classroom (66:66). The females in single-gender female classes performed more abstract/high level thinking when compared to females in the mixed-gender classes. This was also true in the single-gender male class. However, the data plots showed differences for the thinking level of utterances between males in single-gender classrooms and males in mixed-gender classroom (287:133 and 90:66) and females in single-gender classrooms and females in mixed-gender classroom (447:133 and 97:66), which was supported by the detection of significant differences within gender groups in the Chi-Square analyses (*Tables 2* and *3*):

1. Males Pearson Chi-Square Value with continuity correction 5.235; *p*-value = 0.017
2. Females Pearson Chi-Square Value 20.007 with continuity correction 19.122; *p*-value = 0.000

The analysis of the type of response, whether an elicited response, an offered response, or a demanded/directed response, answered individually or in chorus, showed that females offered responses more often than males and at a larger frequency in the single-gender female classroom. There were less offered responses by both females and males in the mixed-gender classrooms.

The number of elicited responses by females (199) and males (199) were equal in the mixed-gender classroom, and the number of demanded responses by females (29) and males (29) were also equal. Overall, females in the single-gender female class offered responses (544) more often than males (377) in the single-gender male class. Elicited responses in the single-gender female class (95) were similar to the number of elicited responses in the single-gender male class (85).

Self-Concept

The indicators of self-concept related to school in general and science specifically showed significant differences in only three descriptors in the ANOVA after using a Bonferroni adjustment for Type I error: *10b. I am hopeless when it comes to science* between the all female class and the mixed gender class (p=.011); *12c. I learn things quickly in science* between the all male class and the mixed gender class (p=.038); and *16b. I have always done well in the science class* (p=.024). There were 19 statements for self-concept in this study. Eight of the statements related to students' perceptions of their self-concept in science.

The mixed-gender classroom and single-gender classrooms showed significant differences after Bonferroni adjustment at (.046) for both comparisons of self-concept in science and overall school. Females tended to believe more than males that they were unable to master the subject of science in school. Males in the mixed-gender classrooms showed a significant difference in their self-concept in performance in science classrooms. The males had a significant difference at .024 for their response to always doing well in science classes, and .038 for their response to learning things quickly in science. Whether the females were in the single-gender classroom or the mixed-gender classroom, they had significantly lower responses to doing well in science.

Conclusions

Students at one southwestern, suburban district in the United States were voluntarily divided into one single-gender male, one single-gender female, or three mixed-gender science classrooms. Researchers observed these classes to record data on the level of thinking displayed by students and the patterns of discourse showing elicited, offered, and demanded/directed responses in classroom participation in each of the classes. Students were also surveyed to determine self-perceptions in science ability.

The study findings included self-concept changes as well as discourse analysis. Overall, the self-concept for females was low in science. The self-concept of females in eighth grade needs to be considered as a major factor related to their performance during that grade level especially in looking for ways to increase their participation in science courses. This research study differed from the findings of Ferrar and Ferrra (2004) that showed females exhibiting less self-consciousness in single-gender classes as well as the work of others showing improved self-esteem for females in single-gender classrooms (Belcher, Frey, & Yankeelov, 2006; Salomone, 2006; Sullivan, 2009; Ursula & Hannover, 2008; Viets, 2009) The discourse analysis in the current study indicated that males and females used higher level of utterances when in single-gender classrooms.

Historically, females are underrepresented for participation in science fields. Methods to increase their representation are being investigated, and the increased use of single-gender science classrooms is one method. School district leaders are choosing single-gender classrooms in an effort to increase female participation in science. The present study revealed “food for thought” for teachers and leader-practitioners. Single-gender classrooms may not be a successful

strategy to increase science self-concept for females but may be a strategy to increase higher level discourse for all students.

Limitations of this study were that the research was conducted at one middle school; therefore, the results cannot be generalized to other schools. Another limitation was that this was the first year of single-gender instruction for this teacher at the middle school studied. It was the first year of single-gender instruction for this campus and little professional development for the teacher was offered.

Further study could analyze whether or not the teacher's discourse changed as a result of single-gender as compared to mixed-gender classrooms. Additionally, a qualitative study including focus groups with campus leaders, students, and the teacher could help explain reasons for research findings. According to this study, single-gender instruction increases discourse for males and females but does not increase the science self-concept of females.

References

Belcher, C., Frey, A., & Yankeelov, P. (2006). The effects of single-sex classrooms on classroom environment: Self-esteem and standardized test scores. *School Social Work Journal, 31*(1), 61-75.

Bloom, B. S. (1984). *Taxonomy of educational objectives: Book 1cognitive domain*. New York, NY: Longman.

Bracey, G. W. (2006). Single sex education – No easy answer. *Principal Leadership*, December.

Brooks, T. (2011). *Effects of single-gender middle school classes on science achievement and attitude*. (Doctoral dissertation). Retrieved from ProQuest (#3445013).

Cresswell, J. W., & Clark, V. L. (2011). *Designing and conducting mixed methods research* (2nd Ed.). Thousand Oaks, CA: Sage Publications.

Dunn, J., Hammonds, B., & Watson, I. (1984). *The all-female mathematics class at Hawker College.* Canberra: ACT School Authority.

Durost, R. (1996). Single sex math classes: What and for whom? One school's experiences. *Science Education*, Feb., 27-31.

Duschl, R. A., & Gitomer, D. H. (1997). Strategies and challenges to changing the focus of assessment and instruction in science classrooms. *Educational Assessment*, 4, 37–73.

Ferrara, P., & Ferrara, M. (2004). Single-gender classrooms: Lessons from a New York middle school. *ERS Spectrum*, Summer.

Gee, P. (1999). *An introduction to discourse analysis: Theory and method*. London: Routledge.

Gewertz, C. (2007). Black boy's educational plight spurs single-gender schools. *Education Week, 26*(42), 1-25.

Gillies, R. M. (2006). Teachers' and students' verbal behaviors during cooperative and small group learning. *British Journal of Educational Psychology,* 76, 271-287.

Gray, A. (1987). Are girls the problem? Co-education revisited. *Forum of Education*, 46, 34-46.

Gresalfi, M., Taylor, M., Hand, V., & Greeno, J. (2009). Constructing competency: An analysis of student participation in the activity systems of mathematics classrooms. *Educ Stud Math*, 70, 49-70. Doi:10.1007/s10649-008-9141-5.

Holland, D., Skinner, D., Lachicotte Jr, W., & Cain, C. (1998). Identity in cultural worlds. Cambridge, MA: Harvard University Press.

Johnson, A. E. (2004). Single-sex classes in public secondary schools: Maximizing the value of a public education for the nation's students. Retrieved from http://www.lexisnexis.com/us/Inacademic/frame.do?tokenKey=rs.

Jungwirth, H. (1991). Interaction and gender: Findings of a microethnographical approach to a classroom discourse. *Educational Studies in Mathematics*, 22, 263–284, doi:10.1007/BF00368341

Lam, S., Law, Y., & Shum, M. S. (2009). Classroom discourse analysis and educational outcomes in the era of education reform. *British Journal of Educational Psychology*, 79, 617-641.

Lee, V., Chen, X., & Smerdon, B. *(*1996). *The influence of school climate on gender differences in the* achievement *and engagement of young adolescents.* Washington, DC: American Association of University Women Educational Foundation. Chicago, IL: Saint Xaviar University. (ERIC Document Reproduction Service No. ED407077)

Lindsay, J. S. (1990). Classroom discourse analysis: A review of the literature with implications for educational evaluation, *Journal of Research and Development in Education, 23,* 107-116.

Marsh, H. W. (1990). The structure of academic self-concept: The Marh/Shavelson model. *American Psychological Association, 82*, 623-636.

Nathan, M. J., *&* Knuth, E. J. (2003). A study of whole classroom mathematical discourse and teacher change. *Cognition and Instruction, 21*{2)*,* 175-207.

Patterson, G. A. (2012). Separating the boys from the girls. *Kappan*, *93*(5), 37-41.

Salomone, R. (2006). Single-sex programs: Resolving the research conundrum. *Teachers College Record*, *108*(4), 778-802.

Sax, L. (2005). The promise and peril of single-sex public education: Mr. Chips meets Snoop Dogg. *Education Week, 48*(2), 34-35.

Singh, K., Vaught, C., & Mitchell, E. (1998). Single-sex classes and academic achievement in two inner-city schools. *Journal of Negro Education*, (67), 157-166.

Spielhagen, F. R. (2011). It all depends…: Middle school teachers evaluate single-sex classes. *Research in Middle Level Education Online*, *34*(7), 18.

Spielhagen, F. R. (2006). How tweens view single-sex classes. *Educational Leadership*, *63*(7), 68-69, 71-72.

Sullivan, A. (2009). Academic self-concept, gender, and single-sex schooling. *British Educational Journal, 35*, 259-288.

Sullivan, A., Joshi, H., & Leonard, D. (2010). Single-six schooling and academic attainment at school and through the lifecourse. *American Educational Research Journal*, *47*(1), 6-36.

Tully, D., & Jacobs, B. (2010). Effects of single-gender mathematics classrooms on self perception of mathematical ability and post engineering paths: An Australian case study. *European Journal of Engineering Education, 35,* 455-467.

Ursula, K., & Hannover, B. (2008). When being a girl matters less: Accessibility of gender-related self-knowledge in single-sex and coeducational classes and its impact on students' physics-related self-concept of ability. *British Journal of Educational Psychology*, 78, 273-289.

Viets, A. (2009). Same gender classrooms and student achievement. (Doctoral Dissertation), UMI. (3372345).

Watson, C. M., Quatman, T., & Edler, E. (2002). Sex Roles, 46(9/10), 323-335.

Webb, N. M., Nemer, K. M., & Ing, M. (2006). Small-group reflections: Parallels between teacher discourse and student behavior in peer-directed groups. *Journal of the Learning Sciences*, 15, 63-119.

Weinburgh, M. (2000). *Gender, ethnicity, and grade level as predictors of middle school students' attitudes toward* science. (ERIC Document Reproduction Service No. ED442662)