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Students' Achievement and Perceptions of School Climate During the Transition from Single Sex Education to Co-education

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In 1999, a non-government school with a long tradition of "boys only" education in South Australia introduced co-education at the secondary school level. The following year, girls were admitted at the primary school level. Educational achievement and perceptions of the psychosocial climate of the school's learning environment were measured in all primary and secondary students at the end of this momentous year and again one year later. Questionnaires measuring students' perceptions of the relationship dimensions of cohesiveness, friction and satisfaction and the personal dimensions of competitiveness and difficulty were administered, together with a test of achievement. Interesting differences were found in student achievement and perceptions of the school's climate, over time and across the grade levels.

Achievement; Perceptions; School Climate; Co-education.

INTRODUCTION

This longitudinal study investigated students' educational achievement and perceptions of the school learning environment during the two-year transition from single sex education to co-education. In 1999, a non-government school in metropolitan Adelaide, South Australia with a 151-year tradition of single sex education for boys, began to offer education to both girls and boys. As the school had been established in 1848 to provide single sex education for primary and secondary school aged boys, the decision to introduce co-education at all year levels was an important innovation. In the first year of the introduction of co-education, girls were enrolled in the Middle School Years 7 to 10 and Senior Years 11 to 12, and in the following year girls were admitted for the first time to the Primary School Years 3 to 6.

The study was conducted during a period of considerable institutional change within the school. In the same year that co-education was introduced initially many other changes were effected. A new school Principal was appointed, new teachers were employed and a Middle School, embracing Years 7 to 10, was formed. A director was engaged to co-ordinate this Middle School. In addition, a building refurbishment and expansion program was initiated.

Single Sex and Co-education

Over the past three decades the relative merits of single sex and co-education for the educational and socio-emotional development of school-aged students, particularly at the secondary school level, have been debated extensively. Some research evidence has been supportive of co-education, while other studies have cited the benefits of single sex education (see, Woodward, Fergusson & Horwood, 1999). In relation to academic achievement, studies of the effects of single sex and co-education at the secondary level have yielded inconsistent results. In general, some studies provide support for the benefits of co-education, (Marsh, 1989, Marsh, Smith, Marsh & Owens, 1988), others support single sex education (Austin,

1977, Lee & Bryk, 1986, Riordan, 1985) and yet others report no differences in achievement (Miller & Dale, 1974, Rutter, Maughan, Mortimer & Ouston, 1979).

The Transition from Single Sex to Co-education

Relatively few studies have examined the effects of the transition from single sex education to co-education on student outcomes. In the mid 1980s in Sydney, Australia, a non-government boys' high school and a non-government girls' high school were reorganized into two co-educational schools. Longitudinal information was collected before, during and after the transition to co-education (Marsh, 1989, Marsh *et al.*, 1988). No significant differences in achievement in Mathematics or English were found across the five years of the study. However, while there was a small decrease in self-concepts for students attending the co-educational classes in the transitional year, there was an overall increase in multidimensional self-concepts before and after the introduction of co-education.

In a similar study conducted between 1985 and 1987 in the United States of America, a single sex girls' secondary school merged with a similar boys' school to form a mixed sex school, located on the two campuses of the two original schools. Girls' attitudes towards mathematics were measured in the single sex situation, with both male and female students studying mathematics surveyed following the merger (Steinbeck & Gwizdala, 1995). Traditional gender differences were found in relation to self-confidence, perceptions of the usefulness of mathematics and classroom behaviour. While the attitudes of the girls from the single sex school remained positive towards mathematics after the merger, their predictions that there would be changes in the climate of the classroom were borne out. Not only did the girls report feeling intimidated, hesitant, uncomfortable and dumb during mathematics lessons in the mixed sex classrooms, they also perceived that teachers gave more attention to the boys (Steinbeck & Gwizdala, 1995).

In 1996 a single sex non-government boys' school in Adelaide, South Australia became co-educational. Academic achievement, optimism, pessimism and overall explanatory style were measured in all primary and secondary boys in Years 3 to 10 in the last year of single sex education, during the transitional year and one year after the introduction of co-education (Yates, 2000). In the first year of the study, data were also collected from all primary and secondary girls in Years 3 to 10 in a comparable single sex girls' school. By comparison with the girls, the boys in the single sex school had higher scores on the Word Knowledge tests (Thorndike, 1973) used as the general measure of educational achievement. These gender differences were significant at Year 3 at the primary school level and the secondary levels of Years 8, 9 and 10. In both the year of transition and the year following the introduction of co-education, increases were evident in the boys' achievement, particularly in Years 4, 5, 9, 10, 11 and 12. There was also a significant decrease in optimism and in total explanatory style associated with the transition to co-education, particularly for boys in Years 8 and 9, but this trend was not evident one year later.

School Climate

The climate of a school has an important effect on student learning (Fraser, 1994). While much of the research into school climate has focused on teachers' perceptions (Fraser, 1994), many studies have indicated that students' perceptions of the psychosocial aspects of the learning environment of their classroom are clearly related to motivational and achievement outcomes (Fraser, 1998). A meta-analysis of studies involving 17,805 students in 823 classes in eight subject areas across four nations revealed that student achievement was enhanced in classrooms with greater Cohesiveness, Satisfaction and Goal Direction and less Disorganization and Friction (Haertel, Walberg & Haertel, 1981). The concepts of Cohesiveness, Satisfaction, Goal Direction, Disorganization and Friction used in the measurement of classroom climate have their origins in Moos' (1974) scheme for classifying human environments. Cohesiveness, Satisfaction and Friction scales are encompassed within

the Relationship Dimensions (Moos, 1974) whereas Goal Direction and Disorganization are part of the System Maintenance and Change Dimensions that include scales of Difficulty and Competitiveness. While these three dimensions have been studied in many different environments (Fraser, 1998), they have not been measured at the school level during the transition from single sex education to co-education.

AIMS

The aims of this study were to:

1. measure student educational achievement and perceptions of school climate during the transition from single sex education to co-education;
2. monitor and evaluate changes in students' educational achievement and their perceptions of the climate of the school over time; and
3. examine Year level differences in achievement and perceptions.

METHOD

Participants

In 1999, the study involved all students in Years 3 to 11 in the school (N = 484), with girls being present only in Years 7 to 11. In 2000, all students in Years 3 to 12 participated (N = 597). The numbers of boys and girls in Years 3 to 12 in 1999 and 2000 who participated in the study are presented in Table 1.

Table 1. Number of students by Year level and gender in 1999 and 2000

	1999	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8	Yr9	Yr10	Yr11	Yr12	Total
Boys	25	31	34	40	40	49	71	75	78			441
Girls						9	2	3	16	13		43
Total					49	51	74	91	91			484
2000												
Boys	19	33	31	37	45	54	52	76	78	80		505
Girls	5	3	7	9	6	17	6	4	20	15		92
Total	24	36	38	45	51	71	58	80	98	95		597

Instruments

Word Knowledge Tests

A general measure of educational achievement was obtained from the *Word Knowledge Test 1, 2 or 3* (Thorndike, 1973). These tests have been used previously in international studies as a general assessment of students' underlying achievement and scholastic aptitude. Each test consists of 40 word pairs, with the student asked to rate whether the words are the same or opposite in meaning. Thirteen word pairs are common to Test 1 and Test 2 and twenty items are common to Test 2 and Test 3. One word pair is common to all three tests. Sample items from Test 1, Test 2 and Test 3 are presented in Table 2.

School Climate

Primary school students' perceptions of the climate of the school were measured with *My School Inventory*, while the *School Learning Environment Inventory* was used to ascertain the perceptions of the students at the secondary school level. *My School Inventory* was adapted from *My Class Inventory* (see, Fisher and Fraser, 1981; Fraser, Anderson and Walberg, 1982) and the *School Learning Environment Inventory* had its origins in the *Learning Environment*

Inventory (Anderson & Walberg, 1974); Fraser, Anderson and Walberg, 1982). *My School Inventory* and the *School Learning Environment Inventory* contained five common sub-scales measuring students' perceptions of the Relationship and Personal Development Dimensions (Moos, 1974) of the school during the transition to co-education. The Relationships Dimensions, measured through three sub-scales of Cohesiveness, Friction and Satisfaction, tapped the nature and intensity of personal relationships, the extent of student involvement and the degree of mutual support and help within the school learning environment. The Personal Development Dimensions assessed in two sub-scales of Competitiveness and Difficulty, measured students' personal growth and self-enhancement during the transitional process. Sample items from the Relationship and Personal Development Dimensions within *My School Inventory* (MSI) and *School Learning Environment Inventory* (SLEI) are presented in Table 3.

Table 2. Sample items from Word Knowledge Test 1, Test 2 and Test 3

Word Knowledge Test 1		
1	quick	slow
40	scarce	rare
Word Knowledge Test 2		
1	savoury	insipid
40	obvious	indisputable
Word Knowledge Test 3		
1	acquire	dispel
40	ephemeral	eternal

Table 3. Sample items for the Relationship and Personal Development Dimensions within *My School Inventory* (MSI) and *School Learning Environment Inventory* (SLEI)

Relationship Dimensions:		
Cohesiveness		
MSI	Item 28	Children in our school like each other as friends
SLEI	Item 31	Students in the school are frequently personal friends
Friction		
MSI	Item 2	Children are always fighting with each other
SLEI	Item 6	There is constant bickering among student
Satisfaction		
MSI	Item 16	Most children say the school is fun
SLEI	Item 73	Students look forward to coming to classes
Personal Development Dimensions		
Competitiveness		
MSI	Item 24	Some students try to do their work better than the others
SLEI	Item 30	Students compete to see who can do the best work
Difficulty		
MSI	Item 3	In our school, work is hard to do
SLEI	Item 54	Students tend to find the schoolwork hard to do

Procedure

The test of educational achievement and the questionnaire measuring perceptions of the school climate were administered to all students in their classrooms in October, 1999 and October, 2000 at the same time and on the same day across the school.

Academic achievement: Students in Years 3 to 7 were administered *Word Knowledge Test 1* (Thorndike, 1973), those in Years 8 to 10, *Word Knowledge Test 2* (Thorndike, 1973) while *Word Knowledge Test 3* (Thorndike, 1973) was completed by boys and girls in Years 11 and 12.

School Climate: Primary school students in Years 3 to 7 were administered *My School Inventory*, with the *School Learning Environment Inventory* given to the secondary level students in Years 8 to 12. To provide a common group for equating purposes students in Years 8 and 9 also completed *My School Inventory*.

Analysis

The validity of the word knowledge tests and the school climate questionnaires were examined with QUEST (Adams and Khoo, 1994) and all non-fitting items deleted. The Rasch scaling procedure (Rasch, 1960; 1966) was used to calibrate the word knowledge tests and questionnaires to bring them to common interval scales. A single *Word Knowledge* scale of achievement was formed using the common item linking procedure, with the calibration based on students who answered all items. *School Environment* Scales were formed for the Relationship Dimensions sub-scales of Cohesiveness, Friction, Satisfaction and the Personal Development Dimensions sub-scales of Competitiveness and Difficulty, found in both the *My School Inventory* and *School Learning Environment Inventory*, using the common persons linking procedure. Case scores were then estimated concurrently for the *Word Knowledge* Scale and five sub-scale dimensions of the *School Environment* for all students from Years 3 to 11 for 1999 and Years 3 to 12 for 2000.

RESULTS

The results of the univariate analyses of variance for the *Word Knowledge* Scale and five sub-scales of *School Environment*, undertaken with the case estimate scores, are presented in Table 4. Differences between the means were examined across the Year levels and over time. In view of the relatively small numbers of girls in both 1999 and 2000, gender differences are not examined. Significant differences were found across the Year levels for Word Knowledge, Cohesiveness, Friction, Satisfaction and Difficulty, across time for Friction, Satisfaction, and Competitiveness and between the boys and girls for Cohesiveness only. It should be noted that when testing for statistical significance the student, rather than the class was used as the unit of analysis. While students at the primary school level are grouped in classes within the school, students at the secondary level change classes according to the subjects that they are studying. It was necessary therefore to focus the analysis at the student level, but it is recognized that this assumption may not be completely appropriate at the primary school level, where the class is probably the operational unit.

Table 4. Analysis of Variance: Word Knowledge and School Environment Sub-Scales by Year level and Time

Variable	Year	Time
Word Knowledge	F = 24.62***	NS
Cohesiveness	F = 4.91***	NS
Friction	F = 23.60***	F = 10.06***
Satisfaction	F = 59.45***	F = 38.88***
Competitiveness	NS	F = 3.83*
Difficulty	F = 26.20***	NS

***p<.001, **p<.01, * p<.05, NS= Not Significant

Note: F based on 262 degrees of freedom for the error item.

Educational Achievement

The results of the *Word Knowledge Scale* for all students in 1999 and 2000 are presented in Figure 1.

In both 1999 and 2000 there is an overall significant trend of increasing achievement across the Year levels ($F = 24.62, p < .001$). There is a marked improvement in achievement for students in Years 5 and 6 in 2000, with a slight drop in Year 8 for the same year. Relative to 1999 there is also an increase in achievement in Years 9 and 10 in 2000 and from Year 11 in 1999 to Year 12 in 2000. There is a slight decrease in Year 11 over the same period.

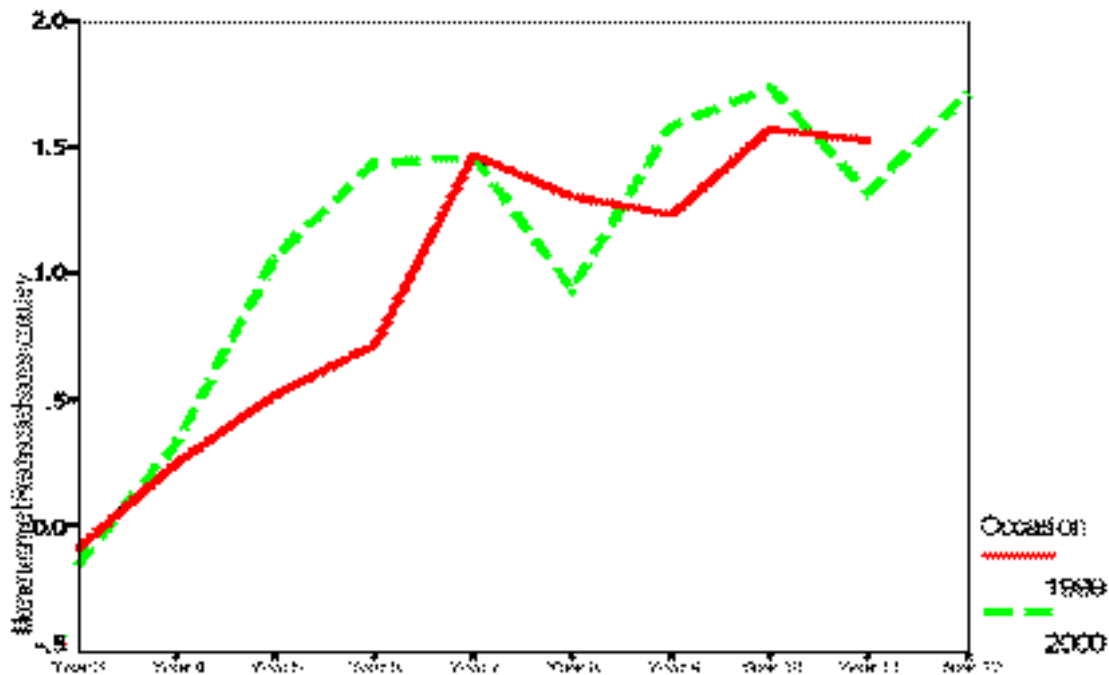


Figure 1: Word Knowledge scores for 1999 and 2000

School Learning Environment

Results of students' perceptions of the school learning environment in 1999 and 2000 are presented separately within the three Relationship Dimensions of Cohesiveness, Friction and Satisfaction and the two Personal Development Dimensions of Competitiveness and Difficulty.

Relationship Dimensions:

The Relationship Dimension of Cohesiveness

The student cohesiveness sub-scale measures the extent to which students know, help and are supportive of one another within the school. The sub-scale was formed from seven *My School Inventory* items and seven items from the *School Learning Environment Inventory*. The results for all students from Years 3 to 11 in 1999 and Years 3 to 12 in 2000 are presented in Figure 2.

In Figure 2 there is a noticeable and significant improvement in cohesiveness across the school from 1999 to 2000 ($F = 4.81, p < .001$). Students entering Year 3 in 2000 report very high levels of cohesion. There is also a high level of cohesion in Year 6 in 2000. Students from Year 9 who have the lowest level of cohesiveness in 1999 report much higher levels of cohesion in

Year 10 in 2000. Students in Year 12 in 2000 also give evidence of slightly more cohesiveness than the previous year.

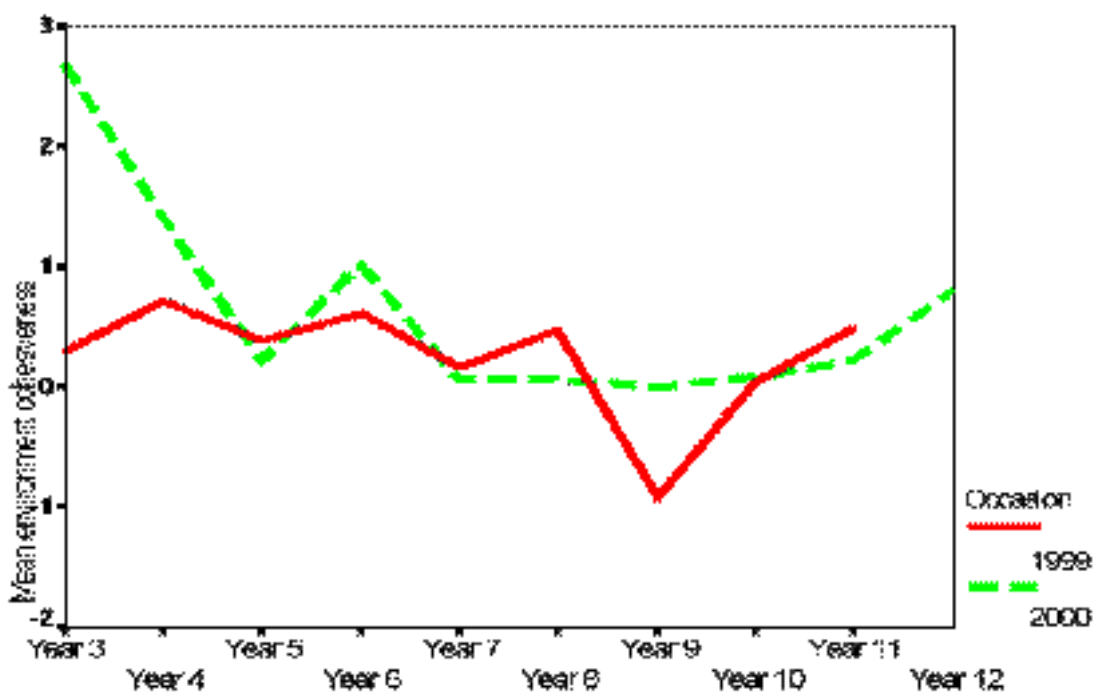


Figure 2: Relationship Dimension: Cohesiveness scores 1999 and 2000

The Relationship Dimension of Friction

This dimension is concerned with the extent to which students are uncooperative, mean, argumentative and are in conflict with each other within the school. *My School Inventory* contains eight items to measure perceptions of friction, while the *School Learning Environment Inventory* has 7 Friction items. The results for the Friction sub-scale for all students in 1999 and 2000 are presented in Figure 3.

The results show some very interesting and significant differences in the pattern of students' perceptions of friction across the school ($F = 23.60, p < .001$) in both years of the study. ($F = 10.06, p < .001$). The trend from 1999 to 2000 is for an overall decrease in perceptions of friction across the school. This is particularly evident in 2000 in Years 4, 7, 9, 10 and 12. Students at the primary school level have comparatively low levels of friction, particularly in Year 3 in 2000. There is an increase in the perception of friction in Year 7 and Year 10 in 1999. The pattern for the Year 7 students continues on into Year 8 in 2000 but changes for the Year 10 students as they move into Year 11 in 2000.

The Relationship Dimension of Satisfaction

This dimension measures students' overall perceptions of happiness, pleasure and contentment with the school environment. There are nine items in *My School Inventory* and seven items in the *School Learning Environment Inventory* measuring satisfaction.

The results for the relationship dimension of satisfaction for all students for 1999 and 2000 are presented in Figure 4.

By far the biggest and most significant change in perception of the school climate from 1999 to 2000 is reflected in the dimension of satisfaction. With the exception of Year 5 where there is a slight decrease and Year 10 which does not change over time, students overall clearly report higher levels of satisfaction with the school in 2000 than they do in 1999 ($F = 38.88, p$

< .001). Interesting and very significant trends are evident across the year levels in both years (F = 59.45, p > .001). Overall students at the primary school level are very satisfied, but particularly so in Year 3 and Year 6 in 2000. Satisfaction decreases across the Middle School Years 7 to 10, although this is much less so in 2000 than it is in 1999. The negative levels of satisfaction, clearly evident in Year 11 in 1999 improve in Year 12 in 2000, as is the case from Year 10 in 1999 to Year 11 in 2000.



Figure 3: Relationship Dimension: Friction scores 1999 and 2000



Figure 4: Relationship Dimension: Satisfaction scores 1999 and 2000

Personal Development Dimensions

The Personal Development Dimension of Competitiveness

The competitive dimension of personal development is concerned with the extent to which students are ambitious, keen to outdo each other and view the other as rival contestants. The sub-scale is formed from seven items in *My School Inventory* and seven items in the *School Learning Environment Inventory*. The results of the competitiveness dimension for 1999 and 2000 across the school are presented in Figure 5.

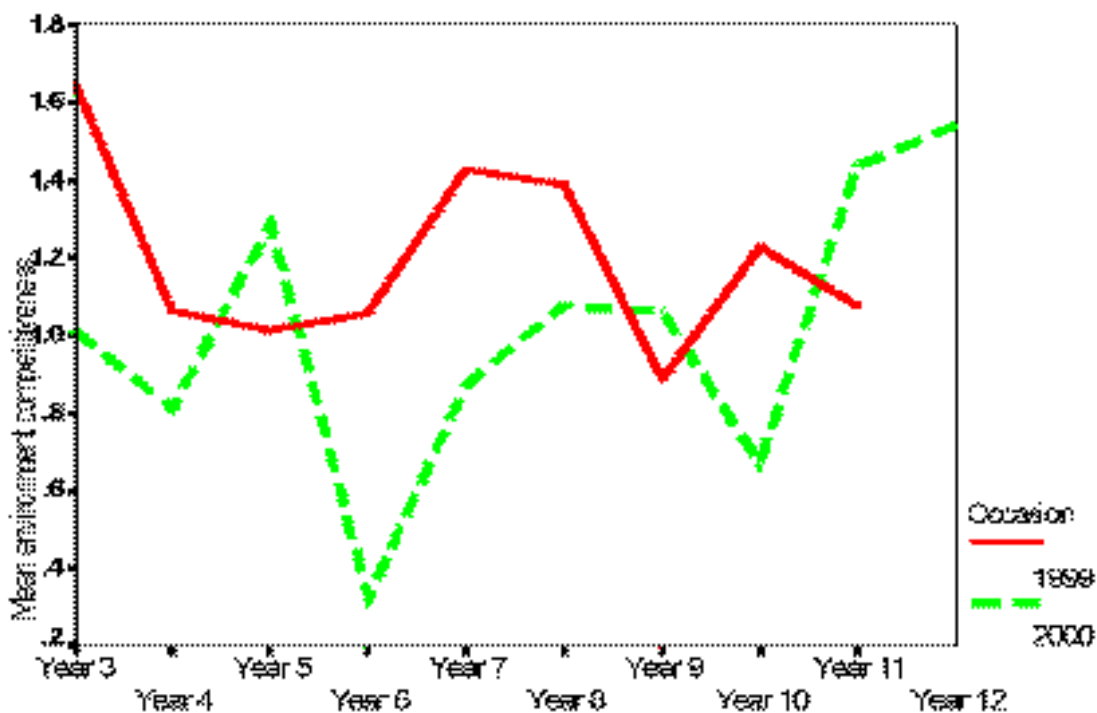


Figure 5: Personal Dimension: Competitiveness scores 1999 and 2000

Figure 5 shows a very interesting pattern of competitiveness across the school. Overall, there is a significant decrease in competitiveness over time ($F = 3.83, p > .05$), particularly in Years 3, 4, 6, 7, 8 and 10 in 2000. Contrary to this general pattern, there is an increase in competitiveness in Years 5, 11 and 12 in 2000. In 1999, highest levels are reported in Years 3, 7 and 8, and in 2000 in Years 5, 11 and 12. Students in Year 6 report the lowest levels of competitiveness in 2000.

The Personal Development Dimension of Difficulty

The items in both *My School Inventory* and the *School Learning Environment Inventory* for this dimension are concerned with the extent to which students perceive schoolwork to be demanding, complicated and troublesome. *My School Inventory* contains eight items measuring difficulty while the *School Learning Environment Inventory* has seven items for this dimension.

The results for the difficulty dimension across Years 3 to 11 in the school in 1999 and Years 3 to 12 in 2000 are presented in Figure 6.

Overall, in both 1999 and 2000, students do not perceive their schoolwork to be difficult. There are significant differences in perception of difficulty between students in the primary school years and those in the Middle and Senior years ($F = 26.20, p < .001$) in both 1999 and 2000, with Senior students in Years 11 and 12 only reporting levels of difficulty above the mean.

Year 3 students report work to be more difficult than do their counterparts in Years 4, 5 and 6 in both 1999 and 2000, although their perceptions of difficulty are less so in 2000. The biggest change in the perception of schoolwork difficulty is with students in Years 7 and 8 in 2000. Students in Year 6 in both 1999 and 2000 and Year 5 in 2000 only express the lowest levels of perception of difficulty across the school.

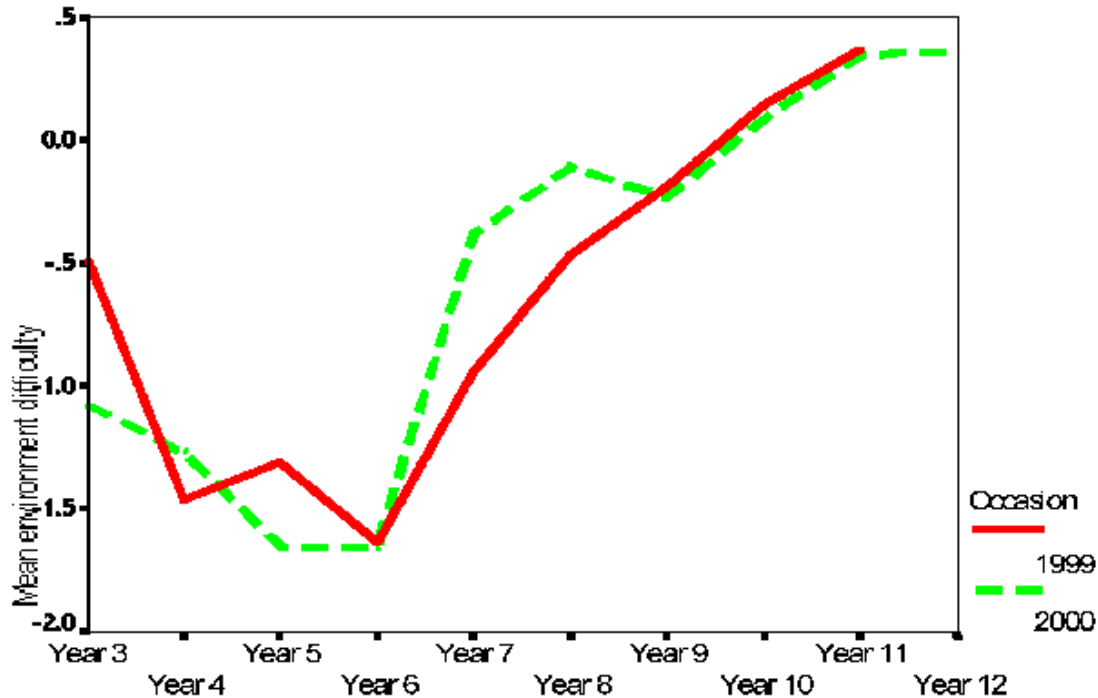


Figure 6: Personal Dimension: Difficulty scores 1999 and 2000

Summary of Results

In the transition to co-education the following trends were evident across the school:

1. a steady and significant pattern of growth in general achievement across the year levels, with marked increases evident in Years 5, 6, 10 and 12 in 2000
2. in the Relationship Dimensions of the school climate:
 - increases in levels of student cohesiveness from 1999 to 2000
 - significant reduction in perceptions of friction in 2000, and
 - greatest improvement evident in students' satisfaction with their school life

However, the pattern of increasing friction and decreasing satisfaction across the year levels does not change over time.

3. in the Personal Development Dimensions of the school climate:
 - a marked decrease in competitiveness between students in 2000, and
 - a decrease in perceptions of the difficulty of schoolwork in Years 3 to 10 in 2000, although there is a pattern of increasing difficulty of schoolwork across the year levels in both years.

DISCUSSION AND CONCLUSIONS

The information presented in this study is unique because it captures both primary and secondary students' perceptions across the school over time, in a climate of considerable institutional change. The increases in educational achievement and the positive changes in the Relationship Dimensions of Cohesiveness, Friction and Satisfaction and Personal Development Dimensions of Competitiveness and Difficulty would indicate that the introduction of co-education and associated structural changes in the school had positive benefits for student outcomes.

These results lend support to the benefits of co-education for student achievement cited by Marsh (1989) and Marsh *et al.*, (1988). The findings also suggest that the relationship between the Relationship and Personal Dimensions and student achievement found in a very large number of studies (Haertel, Walberg & Haertel, 1981), may operate not only at the level of the climate of the classroom, but also at the school level. Clearly, primary and secondary students in this school have responded positively to the change from single sex education to co-education, both in terms of their achievement and their perceptions of the psychosocial climate.

It should be noted that this study has been conducted only over the two year period within which co-education was phased into the school. In two of the three studies of the transition from single sex to co-education (Marsh *et al.*, 1988; Steinbeck & Gwizdala, 1995; Yates, 2000) negative changes were evident in student characteristics that were not maintained once the transitional period had passed (Marsh *et al.*, 1988; Yates, 2000). The conduct of the third study (Steinbeck and Gwizdala, 1995) prior to and during the merger of two single sex campuses precludes investigations of whether girls' negative perceptions of the climate of the classroom were maintained over time. In light of these transitional differences, it is therefore planned to continue with this study annually until 2003 to ascertain whether the trends evident within the transitional period are maintained over time. It is also anticipated that over this time the proportion of girls in the school will increase.

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