

# **Single Sex Schooling**

## **Final Report**

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# Single Sex Schooling<sup>1</sup>

## 1.0 Background

Often associated with increasing student achievement and improving the educational experiences for both girls and boys, single-sex schooling has garnered renewed interest among education professionals, researchers, media, politicians and parents. Our review of current media articles and academic literature suggests that discussions and debates over single-sex schooling are being revived by a campaign in the United States to rescind legislation (Title IX) which prohibits the existence of single-sex public schools; and a growing concern, particularly in the United Kingdom and Australia, over the apparent 'underachievement of boys'.

Advocates of single-sex schooling contend that girls and boys learn differently and, thus, should be educated in separate environments in order to maximize the benefits of school. Supporters of the single-sex system point to provincial, state national and international examination results indicating that students from single-sex schools score higher than students from coeducational schools.

Although they do not necessarily oppose single-sex schooling, some argue that such examination results are misleading because they typically compare the public system to the private system. Prior achievement, socio-economic status (SES), parental support, school traditions and ethos have all been demonstrated to have an effect on student performance. Challengers contend that unless the effects of such variables are controlled the true effects of single-sex schooling cannot be determined.

A further challenge to single-sex schooling includes concerns about equality and privilege. Challengers question a rationale which appears to address inequalities within the school system by separating the sexes and removing opportunities for dialogue and modeling. They argue that 'separate is never equal'; when people are separated on the basis of ascribed characteristics, the dominant group is automatically privileged, and the 'other' subordinated.

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## 1.1 Historical Approaches to Single-Sex Schooling

The renewed interest in single-sex classrooms appears to have evolved within the contexts of three general themes: (1) Feminism and girls' disadvantage; (2) Achievement and the gender gap; and (3) Gender disadvantage revisited: boys' disadvantage.

### *Feminism and girls' disadvantage*

Feminists' concerns about equality and access to education for women have drawn attention to the disadvantages being experienced by girls in schools (Yates, 1998; Lee, Marks & Byrd, 1994)<sup>1</sup>. Researchers began to explore single-sex schools as a means of removing perceived barriers to girls' academic success and ameliorating the effects of a masculinized educational environment. Significant contributions to this discussion have been made by The American Association of University Women (AAUW) with its publications: "How Schools Shortchange Girls"<sup>2</sup> and "Separated by Sex: A Critical Look at Single-sex Education for Girls".<sup>3</sup>

Much of the research in this area seeks to examine the effects of single-sex classes specifically on girls' sense of well-being and their attitudes towards school in general. Researchers attempted to assess the benefit of single-sex schooling for girls using psychological indicators such as self-esteem, confidence, comfort and self-efficacy.

### *Achievement and the gender gap*

As awareness and acknowledgement of sexism and gender-inequities in the classroom have become more prevalent and as female retention and achievement have improved, apprehension about the existence of 'gender gaps' within certain subject areas has led educators, policy-makers and researchers to explore the possible benefits of single-sex classrooms. Much of the research focused on the use of single-sex classrooms as a means of improving girls' enrolment and achievement in subjects which are typically seen as 'male' subjects (science, math, computer science). As we will see later on, a significant portion of the research over the last fourteen years focuses specifically on increasing girls' achievement and enrolment in these subject areas. A concern about boys' performance in such areas as home-economics, fine arts, music and language arts (those subjects typically seen as 'female' subjects) also exists, but to a much lesser extent.

The use of single-sex schooling to increase achievement has received support from governments, such as those in England and Wales, which have begun publishing school exam results. These results publicize the consistent and superior achievements of students graduating from single-sex private and independent schools, with many of the highest scores coming from all-girl schools.<sup>4</sup> Moreover, girls and boys from private single-sex schools were also achieving higher scores in subjects deemed to belong to the 'other' sex. In addition to a possible solution for the achievement gap, single-sex schooling is viewed in some jurisdictions as a means of balancing enrolments in subject areas within the coeducational public system in which there have been extreme imbalances between boys and girls.

### *Gender disadvantage revisited: boys' underachievement*

The publication of the results of large-scale student assessments showing that the average scores for girls are often higher than those of boys in many school subject areas seems to have prompted a change in the focus of discourse of concern from girls to boys, though this change is more apparent within the media than within academic literature. Concern about boys' underachievement appears to be most prevalent in England and Australia, but is becoming a more popular issue in

United States and Canada. National and international reports addressing the results from the Programme for International Student Assessment (PISA), government websites<sup>5</sup>, and national advocacy group websites<sup>6</sup> express concern about the education of boys.

Others, however, have challenged the very notion of boys' underachievement<sup>7</sup>. Yates (1998) and Martino and Meyenn (2002) have discussed what Martino and Meyenn have termed "the moral panic" about boys' underachievement: "a powerful discourse about boys as the 'new disadvantaged' [which] has emerged [and is] driven by a backlash against feminism and a popular perception of boys as failing at school."<sup>8</sup> Gorard et al. (1999) argued that the data on boys' underachievement can be easily misinterpreted. They examined the two most common methods of calculating achievement gaps or boys' underachievement and found each method yields very different results. Gorard (1999) examined what he calls the "politician's error":

The oversimplification of differences between groups generally leads to a stronger 'news' story based on denigrating the performance of at least one educational group, whether it be boys or comprehensive schools, and so to greater public support for 'naming and shaming.'<sup>9</sup>

There is actually very little academic research within the scope of single-sex schooling which focuses primarily on the underachievement of boys, which is surprising given the issue's prominence in the media and the dedication of governments' resources to the issue.

## **1.2 The Research Question**

The purposes of this study were to (a) review recent newspaper articles to determine how the issue of single sex schooling was being defined, and (b) to undertake a systematic review of academic research focussing on single-sex schooling. The primary research question was what, if any, effect does single-sex schooling have on achievement.

## **1.3 Research Strategies**

### **1.3.1 Media Review**

An inventory of newspaper articles published between 2003 and 2004 was created using the *LexisNexis* and *Canadian Newsstand* databases in order to understand how the issue of single-sex schooling was being defined.<sup>10</sup>

Fifty-three newspaper titles are included within the *LexisNexis* 'major papers' source file database and 4675 titles ranging from newspapers to industry magazines are included in *Canadian Newsstand*. Articles were captured using the search terms "single sex class\* or single sex education or single gender class\*; same sex class\* or same sex education or coeducation". After previewing the articles for relevance to the research question at hand, 61 articles were identified and analyzed.

The framing of each article was identified, as were sub-framings where appropriate. Issue definitions (framings) were analyzed to garner a general sense of how single-sex schooling was being presented to the public in newspapers and to serve as a backdrop to and means of comparison with the academic literature reviewed later.

### 1.3.2 Academic Literature

A review of the academic literature devoted to single-sex schooling was limited to studies concerned with K-12 public, private and/or independent school settings engaged in educating all or a portion of students in a single sex environment. We searched for studies published in English between January 1990 and June 30<sup>th</sup> 2004 and, when available, used the “Peer Reviewed” option to limit our search to the strongest papers. Seven databases were searched: *Academic Search Premier*; *ERIC*; *PsycINFO*; *PsycArticles*; *Canadian New Stand – CBCA Education and CBCA Reference*; *CSA – Sociological Abstracts*. Together these data bases include nearly 8700 journals.<sup>11</sup>

The search terms for the literature search were the same as those used in the media search. Articles were initially screened based on titles and abstracts. Duplicate articles identified in different databases were eliminated. This resulted in the identification of 160 articles of potential relevance.

To be included the next phase of the project, papers were required to have investigated the effects of single sex classrooms. By “investigated” we mean that the papers set out to test or compare (using any plausible methodology) the effects of single sex classrooms on students. Papers which did not have an evaluative component such as descriptions of programs, policy and discussion papers were excluded. This reduced the number of studies to 48. Articles were summarized and analyzed for their sound methodology and statistical analysis.<sup>12</sup>

When undertaking reviews of this kind, it is customary to review fugitive literature, unpublished literature that is identified by searching the references contained in the articles published in scholarly journals. We did not search for fugitive literature for a number of reasons. First, this study was undertaken with modest temporal and financial resources. Second and more important in this case, we regard the scholarly literature that we found in peer-reviewed journals rather weak. Scholarly journals typically publish the articles that are methodologically stronger and ones in which the results are more conclusive. For these reasons, we did not think it a prudent use of scarce resources to search for literature that would add little value for the audience of policy makers for which this review was intended.

## 2.0 What is ‘Sound Research’?

We intended that our systematic review of the literature focus on studies conducted in a manner consistent with what is considered to be sound research. We sought research that employed methods appropriate to the nature of the question posed; used systematic, empirical methods that drew on observation or experiment; included measurements or observational methods that provide reliable data; and analyses that adequately support the general findings.

If claims of causal relationships were made, we believed that they required random-assignment experiments or designs that substantially eliminated plausible, competing explanations for the results that were obtained. We sought studies where the design and methods employed were described in sufficient detail that the study could be replicated. We were inclined toward studies that had been accepted by a peer-reviewed journal or reviewed by qualified, independent experts.

### 3.0 Single Sex Schooling in the News

#### 3.1 General Themes

The way that issues are defined by news media often influences how the public, policy-makers, and practitioners view and understand those issues. Our review of recent newspaper articles found that single-sex schooling was defined in five dominant ways: (1) as an *educational benefit* issue;<sup>13</sup> (2) as a *learning styles* issue<sup>14</sup> (girls and boys learn differently, thus require different environments); (3) as a *choice* issue<sup>15</sup>; (4) as a *gender gap* issue<sup>16</sup> (with one hundred percent of these articles arguing or implying that boys are disadvantaged within the current system); and (5) as a *distraction* issue.<sup>17</sup>

A dominant sub-text in these newspaper articles was the potential for single-sex schooling to address and mitigate the disadvantage of boys.<sup>18</sup> Single-sex schooling was presented as a means of helping boys improve their concentration, engagement and thus academic achievement in school. Typically, the newspaper articles focussed on the middle-school age group, defining the period as the ‘hormonal’ years. Boys were identified slightly more frequently than girls as being distracted by the opposite sex.

#### 3.2 Key Representations in the Media

##### *Educational Benefit*

General statements about the educational benefit of single-sex schooling for both girls and boys were plentiful in the newspapers. Improving student achievement was clearly the main focus for many articles and overlapped with most other framings.

But if [single sex classes] allow some otherwise average students to flourish, shouldn't they be available as an option in our public schools?<sup>19</sup>

The pilot summary said that using single-sex groups was a significant factor in establishing a school culture that would raise educational achievement.<sup>20</sup>

Research points not only to higher grades for both sexes, but, ironically to a breaking down of prescribed gender roles.<sup>21</sup>

Burgeoning romantic and sexual feelings also drain students' energy and attention from their academics and activities.<sup>22</sup>

In other words, regardless of the multiple rationales offered for implementing single-sex schools and classrooms, higher student achievement was presented as the main benefit.

##### *Learning Styles*

Closely linked to the educational benefit framing is the argument that single-sex education is useful in addressing the differing learning styles of girls and boys. Recent brain research appears to have influenced some single-sex advocates who argue that girls and boys are “hard-wired” differently and these distinctions influence their learning.

Several studies that have examined gender differences in education have found that boys and girls think differently and benefit from learning in separate classrooms – boys thrive in a competitive environment whereas girls prefer a collaborative approach to learning.<sup>23</sup>

Science shows that boys and girls are hardwired to hone cognitive skills at different times, to experience emotions differently and more importantly to, learn differently...[The way females process information] is something that's instinctive from the 26<sup>th</sup> week of gestation and it doesn't stop when they start school.<sup>24</sup>

Teach boys properly, Sax says, and they will learn.<sup>25</sup>

The girls studied novels such as Jane Austen's 'Pride and Prejudice', while boys read works that would appeal to them more, such as 'Touching the Void' by Joe Simpson, a first person account of mountain survival.<sup>26</sup>

Statements indicating that education needs to be more reflective of the interest of boys, suggests a belief that the curriculum has become 'feminized' to the disadvantage of boys:

The predominance of coursework and the introduction of concepts such as "empathy" in history lessons are considered to be more suited to girls.<sup>27</sup>

The media discourse on *learning styles* represents a binary vision of learning based on sex. Since differences *among* males and females are just as vast the differences between them, there is clearly a danger in promoting *all* girls learn one way and *all* boys learn another. To argue that all girls will be more engaged in 'Pride and Prejudice' rather than 'Touching the Void' is indeed dangerous, particularly if such notions are entrenched in a belief that the preference is biologically determined. Differentiating between curricular resources based on 'natural' sex differences runs counter to the use of multiple genres to breakdown gendered preferences and stereotypes.

### *Choice*

Media presented single-sex schooling as a choice issue for students, parents, school boards and administrators. *Choice* was typically contextualized using liberal notions of reducing government regulations and restrictions on the education system, and ensuring equality of opportunity for students and parents.

The Bush Administration believes that loosening the regulations will give teachers, parents and kids, a broader choice in education... This proposed regulation is yet another example of our efforts to provide maximum flexibility to help states and schools provide the best education possible for their students.<sup>28</sup>

Education Minister Christy Clark has been promoting choice and variety in the provincial system, and this [single sex schooling] is an area where students should have choice.<sup>29</sup>

The whole school-choice [movement] has created certain healthy expectations in poor parents, that they too have the right to choose education for their children.<sup>30</sup>

The proposed rules would broaden the options considerably, allowing school districts to launch single-sex classes to provide more choices or to meet the particular educational needs of their students.<sup>31</sup>

...Edmonton public schools were 'drowning in bureaucracy and mismanagement' but responded to parents' and teachers' concerns by reinventing themselves. The Edmonton public system introduced greater choice and now has 30 different programs [some of which are] single-sex programs.<sup>32</sup>

Generally missing from the *choice* discussion is the issue of access and equity. Liberal notions of *choice* are premised on an assumption that all parents, schools, and districts are equal and that parents and students have equal access to information, finances, transportation, childcare and other resources which facilitate choice. Therefore, the creation of single-sex schools as a means of introducing more *choices* in education speaks primarily to those parents, educators and administrators who are most able to take advantage of the alternatives being offered.

### *Gender Gap*

The *gender gap* issue frames single-sex classes as a strategy to address the 'underachievement of boys'. However, implicitly (and sometimes explicitly) the message is not that we are concerned about how well boys are performing, rather we are concerned about girls doing better than the boys.

The study, commissioned by ministers in a bid to stop boys falling further behind, suggests male-only lessons could help bridge the gap which has seen girls outperforming boys at every level.<sup>33</sup>

In mixed classes, you couldn't see that some of these boys have a superior capacity.<sup>34</sup>

Girls do better than boys in 93 percent of Quebec high schools – and that's at the root of the pro-segregation movement.<sup>35</sup>

After years of education and parents fretting about girls, it seems the boys are the ones in trouble...They trail girls miserably in national reading and writing tests. Boys are barely holding their ground in the traditional strongholds of math and science...<sup>36</sup>

The question missing from discussion about boys' underachievement is *which boys are 'underachieving'?* Poor achievement is not a problem affecting *all* boys; specific groups of boys (*and* girls) are not achieving as well as other groups of boys (*and* girls).

### *Distraction*

The *distraction issue* included two related sub-texts which were directly tied to gender. The framing of the *distraction issue* appeared to be bound to the sexualization of girls and to negative, disruptive behaviours of boys: girls distracted boys on a sexual/hormonal level, while boys distracted girls with their disruptive behaviour.<sup>37</sup> The newspaper accounts promoted the image of boys performing physically for girls, and girls "primping" and using their sexuality to distract boys.

Huff, King's principal, said single-sex classes may help reduce what she calls the "dumbing down" phenomenon – boys who refuse to give correct answers, do their work or pay attention because 'its just not cool to be smart'...They noted that the girls wore fairly skimpy clothes for a few days – but once they realized the boys were not around for most of the day, they began wearing less revealing outfits.<sup>38</sup>

With no girls distracting his attention, Laroche, 15, has gone from failing math last year to a 94-percent average this year... 'When there's a hot girl in class you tend to look at her and not concentrate,' he said.<sup>39</sup>

Girls are able to focus more on academics without having to worry about pleasing the guys.<sup>40</sup>

[In single sex classes,] the girls aren't vying for the boys' attention and the boys aren't trying to impress the girls.<sup>41</sup>

Some articles implied that boys were more disadvantaged by *distraction* than girls because boys were already "behind" the girls academically; whereas, girls (because they were seen to have an academic advantage) were viewed as simply being bothered by boys.<sup>42</sup> Indeed, the "poor behaviour" of boys was presented as having a detrimental effect on the academic performance of girls. This, as demonstrated by some of the above quotes, was not the case when referring to the "sexualized behaviour" of girls.

### 3.3 Influences on Media

When addressing the notion of differing learning styles for girls and boys, media often included references to recent brain research as evidence of the need for pedagogy to address physiological differences between the genders. Based on the significant number of citations in the articles, it appears that media has recognized Dr. Leonard Sax, the Executive Director of the National Association for Single Sex Public Schools (NASSPE) as the "expert" in the field of single-sex K-12 schooling. Dr. Sax is both a family physician and Psychologist whose interest in single-sex schooling resulted from his frustration with what he identifies as the American public school system's neglect of gender differences, especially physiological differences which effect learning.

NASSPE's homepage clearly outlines what Dr. Sax sees as three basic "facts" about boys and girls:<sup>43</sup>

- The brains of girls and boys differ in important ways. These differences are genetically programmed and are present at birth.
- Girls and boys have different learning styles, in part because of those innate, biologically-programmed differences in the way the brain works.
- As a result: single-sex schools offer unique educational opportunities for girls, and for boys

According to the NASSPE, the key advantage of single-sex schooling is that teachers are able to customize the learning environment and better address the different learning styles of girls and boys. Other listed advantages are boys will bully less in single-sex boys classes; girls will feel freer to explore more non-traditional subject areas; and girls will be less likely to become pregnant.<sup>44</sup>

In terms of the evidence provided to support the assertions of the NASSPE, the website includes a page dedicated to research evidence supporting single-sex schooling. On this page is the heading: "Third category of evidence: academic studies comparing single-sex schools with coed schools." The academic studies cited include those conducted by Cornelius Riordan, who, during the 1980s, found that Catholic school students in single-sex schools outperformed those in coeducational schools. It is important to note, however, that Riordan's studies were comparisons among Catholic schools only and not comparisons between public and private schools. Moreover, in a later publication, Riordan asserted that the performance difference referred to in the 1980s no longer existed in studies conducted in the 1990s.<sup>45</sup> Riordan argued that single sex schools only

demonstrate an effect for students who have typically been disadvantaged (low socioeconomic status, females, racial/ethnic/religious minorities). Therefore, he concluded that the disappearance of the performance difference among students within the two Catholic school types is the result of Catholic schools becoming increasingly affluent in the 1990s and the students less susceptible to the effects of single sex instruction.

### **3.4 The Importance of Media Representations**

The interpretation of “evidence” by media, parents and education professionals is an important consideration when evaluating the rise in popularity of a new educational concern. This topic has been addressed by authors such as Yates (1998), Martino and Meyenn (2000), and Arnot (2002) who discuss what they deem to be an ill-founded and constructed concern about the ‘underachievement of boys’. Taking it a step further, Gorard (1999), Mills (2004), and Datnow et al. (2001) have addressed the issue of the role of media on influencing public education policy relative to single-sex classrooms and the importance of creating policies which reflect sound research and analysis. They argue that too many education policies and programs are the result of ad hoc initiatives that are reactions to public pressure structured by media attention.<sup>46</sup>

It is important to be cognizant of the fallibility of media. Quotes and interpretations of statements made in media scrums are subject to the construction of the reporter. However, the purpose of this exercise was to analyse how media presented the issues to the public. Accuracy in the media, though a concern, is not the issue; rather it is the public’s willingness to accept, without critical analysis or evidence, the framing of issues and the conclusion presented in the newspapers.

## **4.0 Single-Sex Schooling in the Research Literature**

The academic research devoted to single-sex schooling reflected, albeit imperfectly, the issues defined in the newspaper articles. Many studies examined the possible academic benefits of single-sex environments for students and explored psychological and social effects in subject areas where males or females were over or under represented. Missing from the research was the strong emphasis or concern about the perceived disadvantage of boys which appears to be so prevalent in the media articles.

### **4.1 General Themes**

There are four general and often intersecting foci in research comparing single-sex and coeducational schooling: (1) *Achievement* – as measured by standardized test scores and grades; (2) *School subjects* – most often Math, Science (physics & biology), English, and physical education; (3) *Attitudinal* – these include feelings, opinions and thoughts about one’s classroom or school environment, school subjects, or self; and (4) *Sexism and gender stereotyping* in the classroom. Many of the studies combined several themes.

#### **4.1.1 Achievement**

The majority of studies reviewed found no significant differences in academic achievement once prior achievement and socio-economic factors were controlled.<sup>47</sup> The challenge for researchers is to first unravel and differentiate among variables of influence on achievement, and then control for them appropriately. Young and Fraser (1990) contend that:

The popular claim these days that single-sex schools are superior to coeducational schools in reducing sex differences is not supported by convincing evidence from past research. In most countries, single-sex schools tend to be private, whereas co-educational schools tend to be government; therefore, this hypothesis is very hard to test in an unconfounded way.<sup>48</sup>

The importance of controlling for socio-economic status (SES) has been stressed by Marsh and Rowe (1996), and Younger and Fraser (1990), with the latter pointing out that controlling for SES also has its problems. Using the research of White (1982) and Carpenter & Hayden (1987), Young and Fraser contend that different measures of SES result in varying strengths of correlation to academic achievement. They point out that White found:

Traditional measures used to define social-economic status (parents' income, educational attainment and occupation) showed relatively weak positive correlations with academic achievement, while home atmosphere was much more strongly correlated to academic achievement.<sup>49</sup>

Carpenter and Hayden found that the influence of SES on academic achievement varied among different cultural environments.<sup>50</sup>

The issue of the effects of SES on student achievement is also connected to the issue of comparing coeducational public schools to single-sex private schools.<sup>51</sup> In a recent OfSTED report, the creation of a 'distinctive ethos' through the recruitment of 'like' students was found to positively influence school performance.<sup>52</sup> Similarities such as high SES, prior achievement, parental support, and gender are all factors which help to create an environment of distinction and an increased attachment and commitment to school for students. The existence of a school ethos and its possible contribution to student achievement levels was consistently mentioned in studies assessing single-sex schooling and achievement benefits.<sup>53</sup>

While it is understandable how one might draw a parallel between the academic successes of students in private schools and the single-sex environment in which many of them learn, it is incorrect to do so. Study after study demonstrated no significant achievement differences between students educated in single-sex and co-educational settings.

#### **4.1.2 School Subjects**

Some studies focusing on achievement did so within the context of specific subject areas. Math and science generated the most interest<sup>54</sup>, while language arts, computer technology and physical education appeared in the literature less frequently. Studies examining single-sex education and math and/or science frequently did so relative to effects on girls only.

General findings were mixed with some studies finding an increase in math and/or science achievement<sup>55</sup> and others finding no significant achievement differences.<sup>56</sup> Variations in the findings are likely the result of different assessment tools and methodologies used by the researchers. For instance, some studies used teacher assessments and classroom grades to determine student improvement, while others used standardized tests. Some used both forms. A problem arises when different assessments garner different results. This problem appeared in a study conducted by Singh et al. (1998). The authors found that when compared to boys in single-sex classes, girls and boys in co-educational classes, girls from the single-sex science classes scored lowest on the state Basic Skills Science test; yet, they received the highest classroom grades.<sup>57</sup> This phenomenon was also noted by Watson et al. (2002). Here authors found a

correlation of  $r = .35$  to  $.56$  between teachers' ratings and standardized test scores when attempting to designate students as 'high achievers'.<sup>58</sup>

Some of the research focused more directly on the effects of single-sex classrooms and enrolment in non-traditional subject areas for male and female students (i.e., upper level science and math for girls and upper level language arts for boys), rather than achievement. These studies generally concluded that the single-sex environment had a positive influence on enrolment in these types of classes for both boys and girls, and that single-sex students articulated more positive attitudes towards 'non-traditional' subjects than their peers taught in co-educational settings.<sup>59</sup>

Improved enrolment in 'non-traditional' subject areas by both boys and girls may not necessarily be the result of single-sex environments. Other variables may be influencing students' choices and behaviour. The problem of comparing single-sex private schools to coeducational public schools was most often noted. As Marsh (1991) argued, such comparisons are troubling because single-sex schools are typically academically selective and their students generally "come from higher socioeconomic backgrounds, and may be more highly motivated and differ from coed students on a variety of other pre-existing variables..."<sup>60</sup> Students within the private school single-sex setting, it is argued, are more likely to be academically focussed and encouraged (by parents and the school ethos) to engage in all courses deemed to be beneficial to future post-secondary studies without regard for the stereotypically gendered nature of the subject.

#### 4.1.3 Attitudinal

Linked closely to the theme of using single-sex classes to break down barriers of gendered subject areas is the theme of students' attitudes and sense of well-being in the comparative school settings. Studies found girls reported feeling less anxiety and more confidence within the single-sex classroom<sup>61</sup> and that they expressed more positive attitudes towards stereotypically 'male subjects' such as math and physics while enrolled in a single-sex class.<sup>62</sup>

There is substantial agreement throughout the literature that girls taught in a single-sex environment benefit psychologically and socially. Girls in these studies repeatedly reported that they enjoyed the single-sex environment more than the coed environment when given a choice, and that they felt more comfortable and less disturbed by disruptive behaviours in a single-sex classroom. Comments such as the following are common in the literature.

Girls reported that they felt more comfortable and liked science and mathematics more in a single-sex setting. They were more likely to take risks even if they resulted in mistakes because they were supported by their classmates and free from the embarrassment caused by the presence of boys. The single-sex environment made the girls feel empowered and smart.<sup>63</sup>

This was not, however, the case for boys. When asked which class or school type they preferred, boys were typically indifferent or they preferred coed classes. Those who indicated a dislike of single-sex classes explained that the all-boys classrooms were often disruptive, hostile and aggressive: "boys suggested that in boys-only classes there were 'more fights, more noise, and more cheating.'"<sup>64</sup> While some girls' feelings of intimidation appear to be alleviated in the single-sex setting, it seems that some boys experience heightened feelings of intimidation and bullying in all-boys classes.

Boys are competitive and can be derogatory of one another's success unless it is a friend's success. Some boys seem to become the butt of all comments and put-downs,

i.e., taking the place of the girls in the class...The quieter, more reserved boys...were pushed aside by the louder, more boisterous types in the boys' classes.<sup>65</sup>

Jackson (2002) reported similar findings and cited Askew and Ross (1990) stating that "boys-only environments are characterised by an increased incidence of bullying because here weaker boys 'take the place' of girls and provide 'a "butt" for proving masculinity'."<sup>66</sup>

The role of single-sex schooling relative to students' increased or decreased sense of comfort and safety within the classroom is an interesting and important topic, and as with all the themes identified in this review of the literature, this one overlaps considerably with the theme of sexism and gender stereotyping.

#### **4.1.4 Sexism and Gender Stereotyping**

Much of the literature reviewed in this report addressed the relationship between the benefits of single-sex schooling and the issue of sexism and gender stereotyping in schools.<sup>67</sup> The mere existence of single-sex schools and classrooms signals a discrepancy or inequality within schools based solely on gender.

Debates surrounding the (il)legitimacy of the 'separate but equal' argument have occurred for decades and have on occasion made for unlikely bedfellows. Feminist and social justice advocates have found themselves supporting and campaigning for the same single-sex schools initiatives and policies as members of the neo-conservative, Christian right – though often approaching the issue from differing ideological perspectives.<sup>68</sup>

In a similar fashion, feminists and social justice advocates have also found themselves on opposing sides of the argument. While some maintain that single-sex schooling will help to 'level the playing field' by providing girls with safe, unthreatening learning environments where girls can thrive and develop their confidence, others contend that the 'hidden curriculum' which privileges masculinity and patriarchy will continue to thrive unless policy initiatives seek to circumscribe male hegemony and inequalities (re)produced through the 'curriculum-as-usual' model of education.<sup>69</sup>

With regard to the literature reviewed here, Lee et al. (1994) articulated some of the common findings in research on sexism in the classroom: "males receive more attention from teachers and generally dominate classroom activities." In addition, there is a tendency to gender stereotype according to subject areas, particularly in math and science where "the sources of disadvantage for girls in the sciences are numerous and insidious – including male-focused examples and illustrations in textbooks, differential expectations of teachers, disapproval of peers and the lack of role models."<sup>70</sup>

Teachers, with the lenses and preconceptions they bring to the classroom, also have profound effect on their students' awareness of the issue. While exploring and assessing the existence of sexism and gender stereotyping in single-sex versus coeducational schools, some researchers exposed the addition of a teacher-variable at work which may supersede the influence of school type and the work that policy makers believe they are making at breaking down gender stereotypes and sexism in schools. Lee et al. (1994) found:

male students [at all-boys schools] were learning to value women as sex objects and were sometimes socialized to maintain control and power over women in sexual interactions. In addition to classroom discussions, examples of sex-role stereotypes were found in classroom decorations; for instance...the wall of a calculus class in [a]

boys' school was decorated with a woman wearing a bikini swimsuit, with her arms raised...The classroom walls [of another boys' class] were decorated with photos of male groups and drawings, including one cartoon of a bare-breasted woman.<sup>71</sup>

A study by Madigan (2002) resulted in a teacher being identified as possessing gender and racial stereotypes. This teacher worked in a program for students with learning disabilities, the majority of whom happened to be minorities.

Coed Class Teacher: It might be stereotyping, but Latino girls wear different makeup, unbelievably sexy outfits, as though they're ready to lay down on the floor and have sex right then and there...All the girls (Latinas), I think, want to have babies, and lead their family to a better life. They are miserable at home and can't do what they want...we're talking about 14 and 15 years old.<sup>72</sup>

Although his beliefs were articulated to the researcher, female students in his coed class reported feeling less engaged in school than the female students who were in a single-sex class within the same program. The author of the study questioned whether the coed students' reduced scores were in fact the result of the coeducational environment or the attitudes of the teacher.

Incidences such as those described above, coupled with the examples from other studies indicating a concern over the creation of a 'masculine hierarchy' for the purposes of bullying within some all-boys classes<sup>73</sup>, highlight a deeper concern of sexism and gender equity issues within the school system.

## **5.0 Gaps**

Returning to the initial question of whether or not single-sex schooling benefits academic achievement, one realizes that the issue is much more complex. Research in the area of single-sex education has consisted of a number of themes, some of which address achievement, others less so. All the research, however, seeks to examine the different ways in which education can be structured and delivered to best meet the needs of students. The challenge is to ensure that new policies and programs meet the needs of all students without privileging some and without reproducing gender stereotypes.

It is important, therefore, to ensure that treatment effects are indeed being measured, and not other influencing variables. Much of the literature acknowledges this concern and attempts were made in some cases to control for variables such as SES and prior achievement. Notably missing from the research however, were studies which controlled for teacher effect. It would be interesting and beneficial to the debate to explore the nature of the effect of the teacher. Just as SES and prior achievement are important variables to student success, so too is the relationship and pedagogical strategies of the teacher. Many studies made reference to the influential role that a teacher or teachers played in their studies<sup>74</sup>, yet there still appears to be a serious gap in the current research with respect to the effects teachers may have on the outcomes of single-sex schooling.

## **6.0 Methodological Issues**

We found few studies which met the criteria of good research. Most studies used samples of convenience. These studies compared single-sex private or denominational schools to public

coeducational schools, or made comparisons between Catholic single-sex and coeducational schools only.<sup>75</sup>

The difficulty in comparing single-sex and mixed-sex schools is that existing enrolment in either school type implies pre-existing assumptions on the part of parents about what is best for their children. By the time parents choose a school for their child they have likely contemplated the benefits of the chosen school type; possible detrimental effects of the 'other' type of school; school discipline policies; academic focuses; social benefits or deterrents, and so on. One can also assume that these same beliefs have been passed on to the children, either overtly or subtly. Furthermore, teachers and administrators are probably equally as confident in the benefits of their particular school type, thereby creating climates that reflect these beliefs. Thus, it is important for studies to address these concerns, for if these variables are not controlled, the methodology may be considered flawed and the results weak or even invalid and unreliable.

Further concerns arise when researchers examine single-sex and coeducational schooling by comparing public coeducational schools to private, Catholic or Independent schools. There are inherent differences between the public and private school systems, as well as differences in student backgrounds and characteristics. As noted above, pre-existing assumptions, and thus differences, already exist when parents make calculated choices to enrol their child in either the public or private system. As a consequence, studies must attempt to control for these differences if the results are to be considered valid and meaningful.

Many studies did not adequately control for the socio-economic, parental, or motivational background or prior achievement of the students. Nor were the studies able to eliminate the influence of teachers or other programmatic changes that might have influenced the outcomes. Most attempts to control for pre-existing differences through the imposition of statistical controls were inadequate. Even when control had been imposed by statistically equating non-equivalent groups, results were often overstated.

## **7.0 Conclusions**

Given that few studies were identified as meeting the criteria of rigorous research, we cannot make conclusive statements about the effects of single-sex school. We can, however, identify common themes in the research: single-sex schooling benefits certain (typically disadvantaged) students' academic achievement;<sup>76</sup> there are psychological and social benefits for girls in single-sex classes;<sup>77</sup> when given the choice, girls generally prefer single-sex classes whereas boys typically prefer coeducational classes;<sup>78</sup> there are no measurable differences between single-sex and mixed-sex schooling on a variety of variables;<sup>79</sup> single-sex classes assist in breaking down sex-role stereotypes and 'genderization' of subject areas, whereas coeducational settings reinforce them.<sup>80</sup>

Many of the studies concede that the research on single-sex schooling is inconclusive.<sup>81</sup> Yet, there is also a general agreement that single-sex environments add to girls' comfort and engagement in school due to diminished feelings of intimidation and harassment by boys and increased attention from teachers.<sup>82</sup>

## **8.0 Recommendations**

The research we reviewed is too tenuous to support the organization of single-sex classrooms or schools. However, a number of studies suggest a policy direction worth pursuing.<sup>83</sup> These studies

argue that the conditions that give rise to differences in achievement and climate can be addressed without organizing separate classrooms or schools for males and females. They argue that schools need to implement policies and practices which ensure equality of opportunity for males and females and eliminate sex discrimination in instruction and the management of student behaviour.<sup>84</sup>

Jackson (2002) challenges the introduction of 'curriculum-as-usual' single-sex classes as a strategy to alleviate perceived difficulties in the classroom.

It is also important to point out that girls should not be blamed for the bad behaviour of the boys, nor should girls be encouraged to adopt caretaking and civilising roles. Clearly, girls-only classes seemed to have many positive effects for girls. However, curriculum-as-usual boys' classes may do nothing to challenge the macho or 'laddish' cultures inherent in schools; indeed, it may be the case that they actually exacerbate them. As such, curriculum-as-usual single-sex boys classes are unlikely to offer the solution that many schools are hoping for.<sup>85</sup>

A question that policy makers must consider is: What is our purpose for initiating public single-sex classes and schools? If in fact it is about improving achievement for students, then one must consider the sound research which suggests the single sex environment itself does not have an effect on achievement. Rather, what changes in a single-sex classroom is the 'gendered climate' and established order based upon degrees of femininity and masculinity. Simply stated, girls generally feel more comfortable and less intimidated in single-sex classes; and conversely, boys generally prefer the "normativity" of mixed sex environments. The question which needs to be asked and answered is: Why is this so? And, if single sex schooling produces the opposite effects for boys and girls, can improvement for one group be justified at the expense of a decline for the other?

**Canadian Newsstand Search Strategy**

<b>SEARCH TERMS</b>	<b>LIMITERS</b>	<b>DATA BASE</b>	<b>DATE RANGE</b>	<b>FULL TEXT ONLY</b>	<b>RESULTS/NOTES</b>
single sex class* or single sex education or single gender class*	In "citation and article text"	Canadian Newsstand	01/01/2003 - present	No	82 captured and reviewed
same sex class* or same sex education or gender segregation AND NOT "same-sex"	In "citation and article text"	Canadian Newsstand	01/01/2003 - present	No	9 additional articles
single sex class* or single sex education or single gender class*	In "citation and article text"	ABI/INFORM	01/01/2003 - present	No	No additional articles located There are [tabs] which appear on the results page for this data base: [magazines]; [trade publications]; [newspaper]; [scholarly journals]. – I did not select [scholarly journals] at this point re: framing exercise.
coeducation or segregated class*	In "citation and article text"	ABI/INFORM	01/01/2003 - present	No	No additional articles located
coeducation or segregated class*	In "citation and article text"	CBCA Education	01/01/2003 - present	No	No additional articles located
single sex class* or single sex education or single gender class*	In "citation and article text"	CBCA Education	01/01/2003 - present	No	No additional articles located
single sex class* or single sex education or single gender class*	In "citation and article text"	CBCA Reference	01/01/2003 - present	No	2 additional articles

**LexisNexis Search Strategy**

<b>Step 1 “News Category”</b>	<b>Step 2 “News Source”</b>	<b>Step 3 “Search Terms” &amp; “Limiting Options”</b>	<b>Step 4 “Date Range”</b>	<b>Step 5 “Specific Publications”</b>	<b>Results/Notes</b>
General News	Major Papers	same sex class or single sex class or single gender class or co education	2003-2004	None	- results: 86 articles - Printed results (33) - many irrelevant hits due to “co education” –resulted in company education
General News	Major Papers	single gender or single sex education or same gender education or same sex education	2003-2004	None	- printed 13 additional articles
General News	Major Papers	Co-education or parallel education	2003-2004	None	- no additional articles

## Academic Literature Search Strategy

Database	Restrictions	Command-line	Date	Results
EBSCOhost – Academic Search Premier; ERIC; American Humanities Index; PsycArticles; PsycINFO	Advanced Search Peer reviewed journals only Jan 1990 – July 2004	single sex class* or single gender class* or same sex class*  single sex education or single gender education or same sex education	July 8, 2004	Academic SP: 71 ERIC: 107 PsycINFO: 15 PsycArticles: 297 American Hum.: 2
CBCA Proquest – CBCA Education	- “scholarly journals including peer reviewed” - “citation and article text”	single sex class* or single gender class* or same sex class*  single sex education or single gender education or same sex education	July 8, 2004	22  25
CSA Internet Data Base Service – Sociological Abstracts	- “exact phrase” - “anywhere” in the text - Limited to: Journal Articles only; English only 1990 – 2004	single sex class* or single gender class* or same sex class*  single sex education or single gender education or same sex education	July 8, 2004	3/9  2/10

## Article Summaries

### Achievement

**Baker and Jacobs (1999)** used qualitative methods to investigate the effects of single-sex mathematics and science classes on middle school students by assessing a number of variables, including achievement, pedagogy, attitude, empowerment, peer interactions and teacher-student interactions. The authors conclude that, although girls seemed to fair better in the single-sex classes, ultimately both girls and boys “lost because the teachers did not make the kinds of curricular and pedagogical changes that would have best suited them” (p.6). For a number of reasons, readers should be cautious about the conclusions drawn. Many of the students were students for whom English was a second language, some learners spoke no English, and others were gang members. The school was located in a low socio-economic area with a highly transient population. In addition, because teachers wanted to move through the courses and introduce new topics to the classes at the same time, the girls often had “free-time” in class, while the boys were blamed for slowing down the pace of the courses. The structure of the program and the demographics of the students make for an interesting case study, but not one from which strong conclusions should be drawn.

**Baker et al. (1995)** investigated the relationship between grade 12 mathematics achievement and the proportion of single-sex schools in four countries using data from the International Educational Assessment’s (IEA) Second International Mathematics Study (SIMS) , hypothesizing that “achievement differences will be largest in countries where the proportion of single-sex schooling is small.” Using achievement data from two countries: Belgium and New Zealand, which had relatively high percentages of single-sex schools, 68 and 43 percent respectively, and two countries which had relatively low availability of single-sex schooling: Thailand with 19 percent and Japan with 14 percent, Baker et al. determined that “systems with more even mixes of sex groupings among schools show little or no between-sector achievement differences in contrast to systems with uneven mixes.” The authors found that context also played a significant role. The authors noted that the higher achievement of girls educated in single-sex schools in Thailand may be due to the fact that in Thailand most single-sex schools are in Bangkok and tend to be elite schools for girls, whereas coeducational schools are seen to offer more opportunities for boys. This, they argued, may explain their findings of higher achievement differences for girls, but not boys in single-sex schools.

In contrast, while there was a significant difference in achievement between single-sex schools and coeducational schools in Japan, the effect was reversed. Single-sex schools in Japan produced significantly lower achievement scores than coeducational schools, again, particularly for girls. Baker et al. attributed this result to the context of single-sex schools in Japan, which were oriented toward “traditional female roles” and less toward academic achievement.

The authors found no achievement differences between single-sex and co-educational schools in Belgium and New Zealand where single-sex schools were more abundant and state controlled.

The work of Baker et al. indicates that variables such as SES and school context need to be considered when evaluating the effects of single-sex education.

**Gilson (1999)** examined the effects of single-sex classes on girls’ achievement and attitudes towards mathematics by comparing single-sex and coed mathematics classes in private middle

schools in the United States. All schools were members of the National Association of Independent Schools which typically served middle to upper income families.

Students completed a questionnaire designed to assess their perceptions towards mathematics (ie. their ability, their efforts, their 'academic identity in math', and their interests in the subject). Test score data were also collected using the students' spring Comprehensive Testing Program III (which test ability and achievement) results. Pearson's  $r$  was used to identify any significant correlations between achievement, ability, school type and grade. At  $p < 0.05$ , the only correlation was between ability and achievement (ie. ability is a good predictor of achievement). A chi-square was used to determine whether school type affected mathematics course selection, but no association was found. Finally, there were also no significant differences found between school type and attitudes towards mathematics or mathematics achievement. Gilson concluded that SES and parental support for academic achievement are likely more significant influences on academic attitudes and achievement of students than the educational setting itself.

**Lepore and Warren (1997)** conducted a comparative study of single-sex and coeducational Catholic schooling to determine whether or not there were academic and social-psychological difference between students educated within the different environments, and whether any differences favoured one gender over the other. They also explored the possible influence pre-enrolment differences.

Using data from the National Educational Longitudinal Study (NELS) 1988, the authors selected cases where grade 10 students were enrolled in Catholic single-sex and coeducational schools, excluding students from schools that reported enrolment of greater than 25% in vocational programming and students who did not attend the same school for grades 10 through 12. These restrictions reduced to 67% the girls in single-sex Catholic schools, and 80% in the coeducational schools. Lepore and Warren found no significant differences in achievement once SES and prior achievement were controlled. Nor did they find any significant differences in psycho-social test scores.

**Manger and Gjestad (1997)** took a slightly different approach to evaluating variables which may influence student performance in mathematics. The authors explored the possibility of a relationship between the ratio of girls to boys and achievement in third grade mathematics classes. Forty-nine third grade classes were randomly chosen in the Norwegian city of Bergen, which included a total of 440 girls and 484 boys. Data were gathered using two instruments: a 100 item math quiz based on the national curriculum (administered by the teacher over the course of two 35 minute sittings) and a 25 minute nonverbal reasoning test administered by the researcher. Although mean scores were typically greater for both boys and girls when the classes had a majority of girls, the authors found no significant relationship between the proportion of boys and girls in a class and mean achievement scores.

**Marsh and Rowe (1996)** undertook a reanalysis of studies by Rowe (1988) and Rowe, Nix, and Tepper (1986) that compared single-sex and coeducational mathematics classes within a coeducational school. Rowe (1988) and Rowe, Nix, and Tepper (1986) used a true experimental design involving random-assignment to class-types. The reanalysis of Rowe et al. (1986) provided no support for the claim that single-sex classes promoted higher achievement for either girls or boys. Only one of four variable, belief in the equality of the sexes, was affected significantly by the intervention, and it was affected negatively for girls attending single-sex classes. The reanalysis of the Rowe et al. (1988) found no significant differences in achievement or confidence for girls attending single-sex girls and mixed sex classes. The achievement of boys attending single-sex classes were significantly greater than those achieved by boys attending mixed-sex classes.

In an Australian study, **Mulholland et al. (2004)** investigated a school-based initiative to provide single-sex classes to English and mathematics year 9 students to address the underachievement of boys. Students were not randomly assigned to single sex or coeducational classes; parents were asked to discuss single-sex classes with their children and then chose the class type in which the student would enrol during the second half of the year. Seven coed and two single-sex classes were created for English and three coed and two single-sex classes were created for mathematics.

Authors used a standard pre-test post-test design and found that after controlling for pre-test achievement, neither gender nor class type were significant factors in post-test standardized English scores. Although there was no significant interaction between gender and class type, both single-sex girls and boys demonstrated a significant increase ( $p < .05$ ) in achievement at the classroom level in English. Although class type was not related to mathematics achievement for either boys or girls, girls' overall performance in the math classroom increased.

SES and parental support may have had an influence on the results of this study. Little information is offered about the school initiating the project except that pre-test standardized scores for both boys and girls were appreciably higher than the national average: 74% of the study group scored higher than the 50<sup>th</sup> percentile in English and close to half the group scored at the 75<sup>th</sup> or higher percentile in mathematics. These scores suggest that the school may have had entrance standards or an increased emphasis on academics and achievement. Parent participation in the establishment of the initiative also indicates substantial parental interest and support of their children's schooling.

**Robinson and Smithers' (1999)** used standardized government test scores to assess any quantifiable differences in school-type effect once schools were matched for SES, selectivity and academic tradition. The authors found that overall, single-sex schools produce students with higher average scores than coeducational schools; however, when matched on the aforementioned variables, there were no significant differences. Robinson and Smithers also explored the differences between high performing, highly selective single-sex schools, noting a difference between those which were day schools and those which were boarding schools. Boys in selective single-sex day schools did extremely well, especially at those schools which were rich in history and tradition. The authors conclude that "the outstanding performance of the single-sex schools...has much more to do with academic selection, socioeconomic background and the standing of the school itself than with the segregation of the sexes" (p.23).

Robinson and Smithers study interviewed 127 first-year students at a high ranking university. Of the 127 interviews, 100 were selected to ensure equal representation from all school types (single-sex/coed, girls/boys, independent/state). Further data collection arose from a questionnaire sent to students from three other universities who had participated in an earlier project conducted by the authors. The interviews and questionnaire responses were combined and analysed for general themes regarding students' perceptions and experiences at their school type.

The authors found that students' views about their previous schools were influenced by gender and school type. Girls who attended single-sex schools favoured the academic advantages of their school, while coed girls favoured the social advantages. There were no significant differences for boys overall. When school rating was broken down into independent/state and single-sex/coed, the authors found a significant difference between independent and state schools for in academic rating: girls from independent schools favoured academic advantage more so than girls from state schools, regardless of gender composition.

**Seitsinger et al. (1998)** evaluated the results of one school's experimentation with single-sex math classes for students in grades six and seven. The administration's intent was to increase girls' attitude towards and achievement in math. The researchers used a pretest-posttest design to test for achievement gains, and questionnaires and interviews to measure attitude change. Although both boys and girls demonstrated improved scores, the authors found no significant differences between mean achievement scores for males and females. Unlike much of the research on the effects of single-sex instruction and girls' attitude towards math, Seitsinger et al. found that, at this particular school, attitudes towards math were high to begin with and did not significantly change over period studied.

It should be noted that the sample size was relatively small (63) and that only 8 students and 4 teachers were interviewed. Also, the school itself was a small, private preparatory school with a majority low income minority population. 91% of the student population was attending on half to full scholarships. Given these unique characteristics of the school and sample, it would be unwise to generalize from these results to schools that did not share the same characteristics.

**Singh et al. (1998)** compared the attendance and achievement of African American grade five student attending two single-sex and two coeducational inner-city schools, using both standardized tests and classroom grades. Citing Riordan (1994), Ascher (1992) and Narine (1992), the authors were particularly interested in the benefits single-sex schooling might afford African American males.

Singh et al. found that compared to their co-ed peers, single-sex girls performed significantly better on *Iowa Basic Skills Tests* (IBST) in math ( $p < .05$ ), but, although the girl's math grades were significantly higher than both groups of boys, there was no significant difference between the grades earned by girls in single-sex and co-ed schools. Boys in the single-sex classrooms scored the lowest in math; significantly lower ( $p < .05$ ) than the co-ed boys. In science, single-sex girls scored the lowest on the IBST, yet they achieved significantly higher grades ( $p < .05$ ) than their co-ed peers. As a group, co-ed classes scored significantly higher than single-sex classes ( $p < .01$ ) on the IBST test in science, but there was no significant differences between boys and girls. The coed classes scored significantly higher on the IBST social studies test, but there was no significant difference among the classes in terms of grades.

Results of the attendance variable revealed significantly higher average attendance for the single-sex classes at  $p < 0.05$ , with the coed boys missing the highest number of classes overall ( $p < 0.01$ ).

**Smith (1996)** conducted a 10 year study of two single-sex schools (one female, one male) in Australia which switched to coeducational. Smith was interested in examining possible effects on student self-concept and academic achievement due to the change in school type. The study included 1300 students in grades 7 through 11. In terms of academic achievement, particular attention was given to the subject areas of English and mathematics. The author used the Marsh Self-Description Questionnaire-II to measure girls' and boys' self-concept. All students were administered the test at the end of 1982, the year before the transition from single-sex to coeducation, and then again in years 1984, 1985 and 1993. Measures of academic achievement were collected using the results of externally moderated achievement tests at the end of all students' grade 10 year, from 1982 to 1986.

Smith concluded that, after an initial decrease in the first year of the change over, student self-concept increased substantially for both boys and girls in the coeducational environment. He also found no effect on academic achievement on grade 10 test scores in English and mathematics. However, he did note that public examination scores tended to decline in grade 12 at the former all-

girls school. Enrolment tended to decrease at the former all-girls school over time, whereas the reverse was true for the former all-boys school.

A variety of factors complicate interpretation of the results of this study. The former all-girls school converted from an academically selective school to a comprehensive school which was marketed as an environmental awareness and dance/drama specialty school. The former all-boys school was transformed into an academically selective coeducational school. Thus, the differences in the student populations and the academic emphases make systematic comparisons difficult. Furthermore, Smith provided little information about the schools prior to the initial changes from single-sex to coeducational, stating only that both were 'located in a predominantly middle class area of Sydney' (p.5). No statistical analyses were provided.

**Warrington and Younger (2001)** and **Younger and Warrington (2002)**, using case study of one comprehensive coeducation high school where the majority of classes were taught in single-sex classrooms, asserted that instruction in single-sex classrooms contributes to higher achievement for both boys and girls. Despite the fact that both girls and boys at this school achieved better results on General Certificate of Secondary Education (GCSE) examinations than the national average, Warrington and Younger found that the girls consistently outperformed the boys.

29% of enrolled students came from outside the school's catchment area and 74% of those students' parents said that the single-sex delivery of the curriculum had a positive influence on their choice to send their child to this particular school. Thus, the conclusions the investigators make about the effect of single-sex classrooms are likely limited because of the importance parents placed on educational achievement and their decision to send their children to the school studied because of the single-sex classes offered.

Younger and Warrington (2002) warn about the "dangers in implementing single-sex classes without coherent staff development programmes which address teaching and learning strategies, and which 'include reflection on sex segregation and coeducation by the pupils involved' "(p.371).

**Wong et al. (2002)** examined gender and school type effects on achievement on 45000 Hong Kong students. In Hong Kong, ten percent of public schools are single-sex and thus do not simply cater to elite or religiously affiliated families. These schools do, however, practise streaming based on gender. In high school, girls are streamed into the stereotypically 'female areas' of arts and social sciences, whereas boys are generally streamed into the 'male areas' of math and science. A student sample was selected from a list of 1997 graduating exam registers.

The graduating exam (HKCEE) is an assessment of student performance and generally consists of eight to nine subjects. An aggregated score is also calculated for all students based on English + a student's best five subjects. Universities require a core set of subjects, being English, science and mathematics. Wong et al. used a multilevel model of analysis which controlled for "prior achievement, gender, arts or science stream, coeducational or single-sex schools and the two- and three-way interaction terms" (p832). After controlling for prior achievement, the authors found that single-sex education benefited girls in English, the sciences and the arts, whereas boys from coeducational schools benefited more than their co-educated peers in all subject areas. Wong et al. argue that these are similar findings to those in the UK and Australia. The findings should be interpreted with caution since students who had repeated a grade in secondary school or who had previously taken the graduating examinations were eliminated from the original sample (35,000), removing almost fifty percent of the students.

**Young and Fraser (1990)** used secondary data analysis to examine whether there were differences in the science achievement of grade 9 students attending independent, Catholic and government, single-sex and co-educational schools in Australia. They found no significant differences in boys' or girls' overall science achievement in government, Catholic and independent co-educational schools, although there were some significant sex differences among individual test questions with girls scoring higher on some items and boys higher on others.

Because SES and science achievement were related, the study controlled for SES using a 44 variable indicator of SES derived from data from the Australian Bureau of Statistics. Each school was assigned an average SES based on its geographic region. The researchers examined each school individually for face validity, concluding that the assigned school SES did represent that of its students. Once SES was controlled, girls in single-sex schools demonstrated significantly higher science achievement than their co-educational peers ( $p < 0.10$ ), as did boys in single-sex schools ( $p < 0.05$ ). The authors cautioned that higher scores for single-sex private and independent schools and the presence of a significant difference were likely influenced by the absence of government single-sex schools.

### **Attitudinal and Psycho-Social Difference**

**Baker (2002)** performed further analysis on the same program after it had existed for three years. He found that of the six initial assumptions which led to the development of the program (single-sex classes would increase girls' achievement; lead to better attitudes in math and science; greater feelings of empowerment and self-concept; more opportunities for participation and leadership), all but one were supported. Single-sex classes did not improve girls' achievement.

Baker concluded that the effect of single-sex classes on boys' achievement was unclear; though he did note that the boys-only environment seemed to have a negative impact on boys' affect. The increased disruption, hostility and discipline issues in the boys' classes were said to have an impact on decreased feelings of self-concept, empowerment and intelligence for boys. Baker was careful not to blame the single-sex environment, but suggested that further research must be done in the areas of curriculum and pedagogy in order to meet the academic and social needs of middle-school aged boys.

In an effort to explore how policy informs practise, **Blair and Sanford (1999)** investigated three single-sex classroom programs to examine how the pedagogical and curricular practises of teachers related to their program philosophies and goals. Some of the stated goals for these three programs included increasing girls' confidence in themselves as capable students, and providing an opportunity for girls to explore their competencies in 'traditionally male' subject areas such as math, science and technology. Issues of safety, bullying and intimidation were also explored. The authors were interested in how gender issues were addressed by staff in these programs and how students perceived gender issues in their schools. Blair and Sanford used the AICE (access, inclusion, climate, empowerment) Model of Equal Opportunity to evaluate the programs.

The authors examined the philosophies of the programs and their implementation. They also explored teachers' awareness of these philosophies and how, or if, teacher's practise and pedagogies were reflective of the intent and philosophies of the programs in which they taught. Blair and Sanford did find that the programs helped teachers to (re)examine their own pedagogy as well as issues of gender and equity. They also concluded that these programs had been established with no clearly articulated education policy as a foundation, rather they seemed to be reflective of local ad hoc policy initiatives. The authors also outlined the rationales given by teachers and administrators for the creation of single-sex classes.

**Brutsaert and Bracke (1994)** explored the effects of single-sex and coed schooling on elementary students' self-esteem, sense of mastery, stress, fear of failure, sense of belonging in school, and school- and study commitment. The data used for this study were collected as part of a larger study taking place in Belgium. The study group was a stratified random sample of 3116 students from 100 elementary schools. Because public single-sex schools no longer existed in Belgium, the authors chose 60 private Catholic schools from within the larger sample for this particular study – 16 girls-only; 16 boys-only and 28 co-educational schools. The data source was a questionnaire administered to the students. A researcher was present in classroom to answer questions and clarify terms, however it is unclear as to whether s/he actually administered the questionnaire.

Brutsaert and Bracke concluded that there were some differences in effects for girls and boys. They noted that coed boys scored significantly lower on scales measuring self esteem ( $p < 0.01$ ); study commitment ( $p < 0.01$ ); and school commitment ( $p < 0.001$ ); and significantly higher on school belonging ( $p < 0.01$ ). For girls, the only statistically significant result was that girls in single-sex tended to feel a lower sense of belonging in school ( $p < 0.01$ ) than their coed peers.

After examining the influence of the gender composition of staff, results indicated a negative correlation between the prevalence of female teachers and psycho-social well-being for boys, with alpha levels ranging from  $p < 0.5$  to  $p < 0.001$ . The authors also suggested that single-sex girls' lower scores in 'sense of belonging in school' were negatively influenced by the preponderance of female teachers in the all-girls school environment. Thus, Brutsaert and Bracke concluded that the differential effects of single-sex versus coed schools on boys' and girls' psycho-social well-beings were more a reflection of the gender make-up of the staff (i.e., mostly women) in mixed sex schools, rather than the presence of the opposite sex students.

**Derry and Philips (2004)** investigated differences in experiences for both students and teachers in coed and girls-only PE classes. Each of the 18 classes was video-taped and teachers were equipped with microphones. These tapes were reviewed and teachers' and students' behaviours were then coded and analysed. Additional data was collected via two questionnaires completed by students. All data were gathered during a single class.

Authors found that all-girl PE classes allowed for increased skill-learning time and more student initiated interactions with teachers. In addition, teacher time management, teacher initiated positive verbal interaction and motivational feedback from teachers were all significantly higher ( $p < .05$ ) in the all-girls PE classes.

Care was taken to ensure similarity between the classes in terms of size, total minutes of instruction and units taught. However, because the study included a one-time video/audio taping of each class, it is likely that both students and teachers 'performed' differently under these circumstances than they otherwise might have. It also seems likely that time constraints may have been a factor in this study. Students had to change into and out of their gym clothes, participate in a normal class with regular amounts of instructional time and fill out a questionnaire all within the regular class time. Given that most high school classes range from 60-75 minutes in length, a single class would not provide sufficient data to make the analysis meaningful.

**Dunlap (2002)** reported on a case study designed to explore the effects of separating girls and boys for grade 5 mathematics classes in a Christian private school. The author used her own grade five class and that of a colleague's for the study. For seven weeks, Dunlap instructed an all-boys math class and her colleague instructed the girls' math class. Prior to the division of the genders,

all students completed a questionnaire designed to assess girls' attitudes toward school subjects, school, college and careers. The same survey was used in the post-test.

Using a Chi-Square test, Dunlap determined that there was a significant difference between the girls' pre and post-test attitudes regarding the benefit of single-sex math classes ( $p < 0.05$ ), indicating in their written responses that believed the single-sex environment benefited their learning. The author found no significant difference in achievement over the course of the seven week single-sex trial, nor was there a difference in the girls' attitudes and opinions about the subject of mathematics itself.

The issue of the under-representation of girls in the sciences, especially physics, is a popular one. **Gillibrand et al. (1999)** cited recent reports from Ofsted and OECD which support this observation. In 1994 Ofsted reported that boys outnumbered girls in upper level physics classes at a rate of almost 4:1.<sup>2</sup> Gillibrand et al. conduct a three year longitudinal study at a coeducational comprehensive school in England which sought to address the 7:1 gender ratio in physics at the school. The staff hoped that, by offering a girls-only physics class, the number of 14 year old girls who wanted to study physics for General Certificate of Secondary Education (GCSE) would increase, along with their confidence and achievement levels.

Gillibrand et al. studied 58 girls over a two year period, 47 of whom chose to enrol in the single-sex class. The authors stated that the SES and sociocultural backgrounds of the students were 'fairly homogeneous', however no further details were presented. Gillibrand et al. used a variety of qualitative and quantitative outcome measures. All the students completed a physics anxiety scale to determine their levels of confidence in the subject area and all were interviewed individually. These measurements occurred twice, once at the beginning of their course and once at the end. The authors also used classroom observations and GCSE scores.

Standard *t* tests revealed that although the increases in confidence were significant for year 1 and 2 single-sex cohorts ( $p < 0.0003$ ), there was also a rise for the girls in the coed cohort which led to a statistically non-significant difference between the single-sex and coed classes overall, despite a disparity between the number of students enrolled in the two conditions (47 in the single sex classes and 7 in the coed classes). The authors found that increased confidence was positively correlated to GCSE scores, and that both higher confidence scores and being in the single sex classroom were 'strongly associated' with students' choice to proceed to A-level physics the following year.

**Granleese and Joseph (1993)** sought to examine the effects of single and coed school environments on adolescent girls' perceptions of self and global self-worth. The authors administered a survey to 143 students from a single sex Protestant school and 24 from a Protestant coed school. The substantially smaller coed sample was the result of efforts to minimize demographic differences. Participants completed the "Self-Perception Profile for Children". Mean scores and standard deviations were compared for statistical significance.

Although girls from both school types scored similarly on 'global self-worth', the best predictors for self-worth were significantly different. The best predictor of global self-worth for girls attending coed schools was physical appearance ( $p < 0.025$ ), while the best predictor for single-sex attendees was behavioural conduct ( $p < 0.05$ ). Granleese and Joseph concluded that higher scores on the behaviour conduct measure by girls in single-sex schools "suggests that they may allow themselves

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<sup>2</sup> Ofsted (1994) in Gillibrand et al. (1999). Girls' participation in physics in single sex classes in mixed schools in relation to confidence and achievement. *International Journal of Science Education*, Vol. 21(4), 349-362.

to engage in less rigid role requirements” than girls from coed schools, and that this may therefore lead to greater gender role flexibility later in life (p.529). The authors indicate that their assumption that higher behaviour conduct scores indicate less rigid gender role requirements may not be accurate.

The difference in predictors of self-worth is worth further investigation to determine whether or not school type has an effect on adolescents’ value set and the hierarchy of those values as they reflect one’s self-worth.

**Lirgg (1994)** conducted a study examining the perceived classroom environment of single-sex and coeducational physical education classes. A total of 389 students from four “middle-class” high schools and middle schools were separated into single-sex or coed PE classes for a ten lesson basketball unit. Students were in grades six, seven or nine. Originally, each school had four coed PE classes. Two out of the four classes at each school were randomly chosen to become single-sex classes. Male teachers taught the boys-only classes and female teachers taught the girls-only classes. Each teacher taught both a single-sex and a coed class.

Teachers were given 10 identical lesson plans which were created by the researcher, with input from the teachers involved. On the 11<sup>th</sup> day of instruction, students completed three classroom environment scales. These scales measure student perceptions from three points of reference: environment for the class overall; environment for own gender; and, environment for opposite gender (only completed by coed class).

Lirgg found that generally, girls perceived the single-sex PE environment more favourably, while boys reported the single-sex environment as least favourable. Some differences were revealed between single-sex and coed climates depending on gender; however boys and girls in the same coed classes generally viewed the class climate in a similar way. Teacher gender did not reveal any influence, though the teachers were not blind to the nature of the study.

**Marsh (1991)** examined the relationship between academic self-concept, students’ orientation and commitment to school, and resulting academic outcomes. Using *High School and Beyond* (HSB) data, Marsh sought to investigate any existing differences between the academic self-concept of public and Catholic school students, and he sought to determine whether or not any noted differences may account for the acknowledged differences in Catholic/public school achievement.

Marsh argued that studies including single-sex and coed school comparisons are most often hindered by unequal group comparisons such as comparing private single-sex student populations to public coeducation populations. He argued that these comparisons are invalid because single-sex private schools are typically academically selective and their students generally “come from higher socioeconomic backgrounds, may be more highly motivated and differ from coed students on a variety other pre-existing variables that probably invalidate the interpretation of single-sex/coed comparisons” (p.328). Confounding this dilemma is the near impossibility of finding existing public single-sex schools in the United States.

For the purposes of this study, Marsh looked at academic choice, affective and postsecondary growth outcomes and standardized test scores of students who were sophomores in 1980 and seniors in 1982 involved in the HSB study. He examined the differences between private and public schools; and, single-sex and coed schooling environments within the Catholic sector only because he believed it was important not to generalize possible differences across the public/private school domain. Other variables considered were a variety of background variables

(for the purposes of exposing any pre-existing influences), sophomore, senior and discipline policies.

A total of 10,507 students were selected from the initial HSB second follow-up sample. These students met two criteria for the study: students were from a Catholic or a public school; and attended the same school in 1980 and 1982. To compensate for the oversampling of Catholic school students in the HSB design, Marsh weighted the responses. Furthermore, Marsh compensated for the cluster sampling in the HSB (which, he argued, resulted in standard errors underestimating the sampling variability)<sup>3</sup> resulting in a reduction of the nominal sample to 4378, however a sample size of 4000 was used for tests of significance.

The results of this secondary data analysis demonstrated significant differences on all achievement scores and academic orientation variables between public and Catholic schools; however, no significant differences were found between single-sex and coed Catholic schools. Neither single-sex policies, nor discipline policies, nor academic self-concept were found to demonstrate an influence on public/Catholic differences. Marsh concluded that Catholic schools were more academically demanding of their students and, as such, the public/Catholic differences were most likely attributable to the greater academic emphasis and orientation of Catholic schools than to any other variable such as single-sex versus coed school types.

**McEwen et al. (1997)** conducted a follow-up study examining the impact of school type on A-level science enrolment and achievement, using the same questionnaire employed in a study involving 21 grammar schools in Northern Ireland ten years earlier. Authors noted that principals from the original schools were invited to participate in the current study; however it is unclear how many actually accepted the invitation. Furthermore, in the original study, the 21 schools were selected to 'reflect the demographic profile of Northern Ireland' and again, without confirmation of the current number of schools and the demographic representation of each, it is difficult to determine whether the sample was comparable or representative.

Two researchers visited each school and administered questionnaires to lower sixth form students. The results of this study demonstrated an overall increase in the number of girls taking A-level science courses, and an overall decrease for boys; however, boys are still taking more science courses than girls. McEwen and Knipe noted that, similar to previous studies by Bell (1989)<sup>4</sup> and Ainley (1994)<sup>5</sup>, this study demonstrated that girls achieve higher scores than boys in all areas with the exception of physics. The results of this study also suggest that both girls and boys are more likely to enrol in A-level sciences if they attend coeducational schools and girls in coeducational school are more likely than their single-sex peers ( $p < 0.001$ ) to enrol in multiple science classes.

Procedural information about the study and the questionnaire used was limited. For example, in the abstract, the authors make a distinction about girls in Catholic schools without providing information about the denominational breakdown of schools in the study: "Among girls overall, the average number of science A-levels was higher in 1995 than in 1985, *except for girls in Catholic schools*" (emphasis provided).

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<sup>3</sup> For a more detailed account of Marsh's sampling strategy see pp.332-333.

<sup>4</sup> Bell, J. (1989) A comparison of science performance and uptake by fifteen year-old boys and girls in co-educational and single-sex schools. *APU Survey Findings, Educational Studies*, 15, pp.193-203.

<sup>5</sup> Ainley, J. (1994) Multiple indicators of high school effectiveness, paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, 4-8 April.

**Norfleet James & Richards (2003)** wanted to test the perception that single-sex schools produced long-term benefits for boys. They compared the educational attitudes, post-secondary majors, and career skill-sets among graduates of 12 schools; 3 from each school type: single-sex day schools, single-sex boarding schools, coeducational day schools and coeducational boarding schools. The researchers mailed surveys to 2300 graduates. Their results were based on the surveys returned by 412 graduates. The authors concluded that graduates of single-sex boys schools demonstrated greater long-term benefits than their coed peers, arguing that single-sex schools were more effective at breaking down “stereotypical educational preferences”. They found that single-sex boys had more positive attitudes towards English, history and reading in general; chose to major in the humanities more often; and used communication and reading skills in their careers more than their coed peers. Readers should be cautious in generalizing from the conclusions drawn from the replies of those who returned the survey, since those who returned the surveys may differ from those who did not in ways that would confound the results obtained with personality or other characteristics of those who replied.

**Steinback and Gwizdala (1995)** conducted a pretest - post-test experiment using an all-girl Catholic college preparatory school which was scheduled to merge with a similar all-boys school. Authors were specifically interested in girls’ attitudes towards mathematics both pre and post the transition to a coeducational facility.

A questionnaire measuring students’ self-confidence in their math ability was administered to 353 girls at the single-sex school as well as to female students in two other private coeducation schools. The data indicated that the girls from the single-sex school exhibited greater confidence in math than their peers in the private mixed schools.

In the second part of the study, girls from the single-sex school were asked to hypothesize what their classroom environments would be like after the merger. Girls from the mixed schools were asked to comment on the environments of their current mathematics classrooms. The responses of the girls in the single-sex school revealed apprehension over “feeling intimidated, dumb, uncomfortable and hesitant” (p. 2) in the next year’s mixed gender classes. Girls currently enrolled in mixed gender math classes reported positive feelings, yet, at the same time, frequently mentioned similar feelings as those mentioned by the single-sex group.

The following year, after the two single-sex schools merged, researchers used the same questionnaire to survey 697 students, 173 of whom had taken part in the initial survey. The data analysis was two-fold: 1) analysis of paired responses of those girls who had taken part in both years of the study; 2) a chi-square test comparing the responses of boy and girls in the second year’s test.

Steinback and Gwizdala found no significant differences between the single-sex girls’ responses over the two years. Acknowledging the importance of teacher effects, the authors noted that girls whose responses had changed (between the pre-test and posttest) regarding the differential treatment of boys and girls stated that it was dependent upon the teacher. The authors observed that “the changes were not as negative as the students had predicted in year 1” (p. 4).

The results of the chi squared analysis indicated significant differences between boys and girls in their level of self-confidence in mathematics. Authors also noted a significant difference ( $p < 0.001$ ) between girls and boys when asked whether girls or boys ‘are better in math’, or whether ‘there is no difference’. Nearly 90% of girls and 75% of boy chose ‘no difference’. Meanwhile, 20% of boys said ‘boys were better’, with only 7% of the girls agreeing with the statement. This was not, however, shown to be statistically significant.

**Streitmatter (1997)** conducted a qualitative study of a girls-only mathematics class in a mostly middleclass coeducational public school in the United States. The class was initiated by the school principal after reading a newspaper article about the benefits of single-sex math classes for girls. The principal chose 24 of the top female math student at the school and placed them into a single class with a female mathematics teacher for the beginning of a new school year. Neither the students nor their parents were informed of their inclusion in the experimental single-sex class. Data for the study consisted of observation notes, a group discussion and interviews with 14 of the students the first year and 4 of those same students (chosen randomly) again in the second year.

Despite the lack of a comparison group, Streitmatter concluded that girls in single-sex math classes were more willing to engage in risk-taking, feeling more comfortable at being challenged if their initial answers were incorrect, and more willing to speculate on answers involving new problems or concepts in front of the class. Also, during the interviews, all the interviewees indicated that they preferred the single-sex math class to their other coeducational classes.

As part of a larger study, **Streitmatter (1998)** sought to examine the effect of classroom composition on a group of female high school physics students. The author used an ethnographic design to identify and extrapolate common themes regarding how the girls felt about themselves as physics students and how they compared the single-sex versus coeducational class environments. Fourteen girls chose to be in the coed class while the remaining 32 chose the new single-sex class. Of the 32 students in the single-sex class, Streitmatter randomly selected 12 to conduct pre and post-experience interviews with. She found unanimous agreement among those interviewed: everyone would recommend the class to a friend; they all enjoyed being in an all-girl class where they didn't have to "perform for boys".

In a study examining boys' attitudes toward school, **Tickner (1992)** compared the questionnaire responses of fourth grade boys from a single-sex and a coeducational private school in San Francisco. A total of 62 boys were surveyed (39 from the single-sex school and 23 from the coeducational school). Results of the Pearson R indicated no significant difference in attitudes toward school between boys in single-sex and coed schools. To the degree that there was a difference in overall mean scores, coeducational male students demonstrated slightly more positive attitudes towards school.

**Treanor et al. (1998)** examined differences in preferences and perceptions of students in middle school single-sex and coeducational PE classes. Four hundred and sixty-six students completed questionnaires administered by their teachers during the last week of school. Students engaged in coeducational PE classes during the first half of the school year, and then switched to single-sex classes for the last half. The researchers were not involved in the design of the classes and as a result, were simply conducting an evaluative description of the a teacher initiated change

Results showed that students who indicated that they "liked PE" were more likely to show a slight preference for single-sex classes ( $p < 0.001$ ). Results also indicated a correlation between competition, gender, and class type. Boys tended to compete harder in single-sex classes, whereas girls tended to compete harder in coeducational classes. This suggests that boys may have moderated the aggressive behaviour in the coed classes or reported that they moderated their behaviour in such classes, where the opposite may have been true of the girls.

## Sexism and Gender Stereotypes

**Bornholt (2001)** explored the connection between students' attitudes towards certain subject areas and the likelihood of selecting those subjects for further study. Bornholt thought it was reasonable to assume that a student's achievement in a particular course would have the greatest influence on future enrolment in the same subject area. The findings of this study suggest, however, that student's perceptions of courses, such as mathematics and English, are in fact most influential when choosing future enrolment.

The author used questionnaires and tests, administered by a single researcher, to determine students' attitude towards a subject and actual achievement in the subject. Participants were 930 students between the ages of 11 and 16, from three non-academically selective, government schools. The three schools (one coed; one all girl's school; one all boy's school) were said to all have the same SES indicators.

Analysis using a MANOVA ( $p < 0.001$ ) led to the conclusion that senior course selection intentions at the coeducational school were reflective of traditional gender stereotyping: boys favoured math, while girls favoured English. Actual performance in math was correlated to math intentions for all groups except the coed girls, and perceived usefulness influenced future course selection intentions in math and English, for boys and girls in both single-sex schools and the coed school.

Influenced by research indicating that girls educated in single-sex schools tended to be more likely to enrol in stereotypically masculine subjects areas, such as math and physics, **Brutsaert (1999)** explored the possible influence of school type on how girls and boys perceived themselves in terms of gender stereotypical traits. A total of 6427 students aged 14 to 15 completed a questionnaire which measured gender identity, inhibition (reflecting classroom behaviour), academic performance, and parental support. The researcher controlled for variables such as school type, school SES, parental SES and curriculum.

Brutsaert found that girls in coed schools demonstrated greater compliance with traits traditionally acknowledged as feminine when compared to their peers from single-sex schools; however, coed girls also indicated greater identification with traditionally masculine traits. Brutsaert hypothesized that coed girls' identification with traditional female traits and values reflected their need for acceptance by their peer group, presumably one which included boys, although this was not made clear. The author also noted that previous studies had indicated that "girls may feel that teachers consider boys to be the more valued students" (p. 351), and thus, their identification with male traits may have been a 'survival' strategy in relation to teachers.

'Gender intensification' was the focus of a study by **Colley and Comber (1994)**. The authors were interested in the hypothesis that, as girls move into adolescence, they adopt more rigid gender specific behaviour. Using 648 11-12 year olds and 485 15-16 year olds from both single-sex and coeducational comprehensive schools, the researchers asked participants to rank school subjects in order of preference. A descriptive method of analysis was employed using Wilcoxon matched-pairs signed-ranks tests. Each school subject was compared to 12 others and then assigned a score in accordance to the number of times it was shown by the Wilcoxon test to be significantly preferred. The results indicated that school type had an effect on younger girls and younger boys, with less gender stereotyping in school subject preferences demonstrated among students in single-sex schools. For older students, school type did not show an effect, however, gender did. Older girls in both single-sex and coed schools preferred art, whereas, older boys preferred math, science and PE.

The study did not control for the influence of teachers on student preference for subjects. The questionnaires were administered by the students' teachers. Students – especially younger students - may have been influenced by the teacher administering the instrument, leading them to rank that teacher's course higher than might otherwise have been the case had a researcher administered the survey.

**Campbell and Evans' (1997)** examination of math anxiety levels in single-sex and coeducational classrooms led them to conclude that girls 'flourish' in single-sex settings. Using the MARS-A (Mathematics Anxiety Rating Scale for Adolescents) the authors conducted a pretest - posttest comparison at a small Catholic preparatory school. Students were not randomly assigned to a class; rather each chose their desired classroom composition. Campbell and Evans found that the mean posttest score for girls in the single-sex class was significantly different from that of the coed class at an alpha level of  $p < .005$ . Moreover, they found that the mean anxiety score decreased for single-sex girls while it increased for the girls enrolled in the coed math class. The authors determined that "the presence of males in the class apparently had an intimidating affect on the females, thus contributing to their increased level of mathematics anxiety" (p.336).

**Crombie et al. (2002)** attempted to account for girls' under-representation in computer science courses at the high school level. They compared girls' attitudes towards computer science among those in single-sex computer classes and those in mixed-sex classes. Participants included 63 girls from all-female classes, 155 boys and 32 girls from mixed classes, over a three year period.

The authors found that girls in the single-sex class reported higher levels of perceived teacher support, confidence and future academic and occupational intentions than girls in the mixed class, and similar levels of perceived teacher support to that of males in the mixed class. The authors found no differences in perceived parental support or grades among any of the groups.

Students were not randomly assigned to class type and all students chose to enrol in computer science, indicating their affinity for the subject area.

**Jackson and Smith (2000)** surveyed and interviewed 11 to 13 year olds in a coed comprehensive school in England where students had been placed into single-sex math classes for Year 7 and half of Year 8 before being returned to mixed math classes half way through Year 8. 108 students were surveyed and 11 were interviewed.

Jackson and Smith found that most (80%) of the girls reported feeling more confident, and wished to remain in single-sex math classes; while 65% felt that the single-sex environment actually helped their progress in math. Just over half the girls stated that they enjoyed math more in a girls-only environment, and 38% said the biggest difference was that they were not ridiculed or embarrassed when they answered a question incorrectly.

The difference between girls' and boys' feedback, however, was strikingly different. Seventy-two percent of boys reported that they preferred the coed math classes, and 33% stated that they felt less confident in the boys-only class. Sixty-four percent did not want to enter the Year 8 single-sex math class and 59% reported that the single-sex environment made no difference to their progress in math. Almost a third of the boys stated that the worst thing about the boys-only class was the increased punishment, fighting and roughness in the class.

In a later published article reflecting on the same study, **Jackson (2002)** questioned the benefit of single-sex 'curriculum-as-usual' for boys, arguing that research suggests that boys-only classes increase incidence of bullying and reinforce the "macho and 'laddish' cultures evident in schools; in

part, because they reinforce hegemonic forms of masculinity and also because they are purported to be linked to an anti-school ethos. She went on to suggest that single-sex classes are often introduced in an effort to assist girls in “male-dominated” subject areas, and that it should not be assumed that single-sex classes will be beneficial for boys as well. Adding material that encourages boys in single-sex classes to reassess gender and the construction of masculinity, argued the author, would be much more significant and beneficial than the standard “curriculum-as-usual” structure.

In a three year case study, **Leder and Forgasz (1994)** examined the short and long term effects of single-sex instruction on students’ attitude and performance in mathematics and concluded that single-sex instruction did not produce any benefit or detriment to boys or girls. Researchers surveyed grade 10 students in newly initiated single-sex classes at a coed state school in Australia, as well as students from lower grades; post single-sex instruction students; and parents. Questionnaires, interviews and performance data were collected and analyzed.

Overall findings included no significant difference between the performance levels of girls and boys (as reported by teachers); females were less likely ( $p < 0.05$ ) to hold gender stereotypic views of math; still, girls were more likely to attribute their failures to lack of ability ( $p < 0.05$ ), whereas males were more likely to attribute their successes to ability ( $p < 0.05$ ). Seventy-three percent of females compared to 25% of males reported that they enjoyed their single-sex class. When asked to explain what they liked about the single-sex environments, girls responded that they “felt free of the intimidation they had experienced from males in mixed classes” and boys reported that “they felt less pressure without females around”. Also, boys’ main reason for not liking the single-sex class was that they felt “the classes were less disciplined without girls” (p. 15). The authors inferred that the grade 10 girls seemed to be much more supportive of single-sex classes than their male peers; however, during the grade 11 interviews with students a year later, this difference appeared to be minimal. In addition, girls in grade nine were more enthusiastic than boys about perceived benefits of their future single-sex math class. Mothers tended to be more supportive than fathers of the single-sex classroom environment.

The most frequently reported negative effect of the single-sex class, according to the girls, was the changing of teachers: “I have had four different teachers in one year...Every time I start to understand the way one teacher teaches, I have a change of teacher. This makes it difficult. I was an A student last year” (p.14).

**Lee et al. (1994)** questioned if and how the gender composition of schools affected the “occurrence, form and severity of sexism in the classroom”. Using a stratified two stage probability sample, the authors selected 21 schools from the membership list of the National Association of Independent Schools which served over 900 schools in the United States. Students, teachers and administrators completed survey questionnaires; interviews, school records, classroom observations and field notes were also gathered for analysis purposes. The observer identified and recorded how issues of gender were addressed, and whether it was done implicitly or explicitly. A second researcher completed the coding and analysis of the data.

Lee et al. found no evidence of sexism in fifty-five percent of the 86 classes observed, while close to half the classes demonstrated evidence of equity. The authors developed a six level severity of sexism hierarchy. The distribution of different forms of sexist incidents between the three types of schools (boys-only, girls-only, coed) demonstrated that the frequency of incidents were not as differentiated as the severity of the incidents. Still, coed schools recorded the greatest number of total sexist incidence, while single-sex girls schools recorded the least.

'Gender reinforcement' (the least severe type of sexist incident) occurred most frequently in both single-sexed school types; while 'gender domination' (the third most severe types of sexist incident) was the most frequently occurring form of sexism in coeducational schools. 'Gender domination' was defined as one gender dominating discussions or teachers being more attentive to one gender over the other, which, of course, could only occur in a co-educational environment. The authors found that 'sex-role stereotyping' occurred with the same relative frequency in both single-sex school types; however they found no incidence of such incidences in the coed schools. Finally, 'active discrimination' and 'explicitly sexual incidents' (the two most severe forms of incidents) occurred solitarily in coed schools and boys-only schools respectively.

Readers should note that the sample was composed of elite independent schools in the United States where the average income of the students' families was \$130,000 per year at the time of the study. Differences noted in the study were not tested for statistical significance nor were observers or raters blind to the purposes of the study.

**Madigan (2002)** studied 9 students aged 15-18, the majority of whom resided in low socio-economic neighbourhoods, to ascertain the impact of single-sex classes on the retention of Latina students in special education classes using data from a number of sources: observations; single-sex and mixed-sex focus group discussions; individual interviews with students, teachers and an administrator; class assignments and homework; and questionnaires.

The author concluded that a greater sense of safety and well-being was expressed by girls enrolled in the single-sex class. Although no statistical data was provided, girls in the single-sex program reportedly attended school more regularly than those in the coeducational class. Teacher characteristics may have been a confounding variable however, especially for the girls in the coeducational class. One coed teacher was identified as having little in common with the girls and being uninformed about the Latina experience. He was quoted as saying: "It might be stereotyping, but Latino girls wear different makeup, unbelievably sexy outfits, as though they're ready to lay down on the floor and have sex right then and there...All the girls [Latinas], I think, want to have babies, and lead their family to a better life. They are miserable at home and can't do what they want...we're talking about 14 and 15 years old" (p.15). This teacher taught Latinas in the coeducational special education class. The coeducational girls' absences and lower feelings of comfort, safety and well-being, compared to those in the single-sex class, may have had more to do with teacher characteristics than it did the gender make-up of the class.

**Martino and Meyenn (2002)** interviewed seven Year 8 English teachers at a middle-class, Catholic coeducational school in Perth, Australia to examine the connection between gender issues, pedagogy and single-sex classroom environments. They proposed that the single sex education debate tended to ignore the influences of curriculum and pedagogical practices of the teacher on both academic and psycho-social student outcomes. The school had recently implemented single-sex classes as a strategy to improve boys' achievement and participation in English; however the authors' interests focused on teachers' perceptions of single-sex classrooms and how teacher's notions of gender informed their pedagogical practises.

Martino and Meyenn concluded that using the single-sex strategy in and of itself will not necessarily have an impact on social and academic outcomes for students. They aver that it is a teacher's assumptions and beliefs about gender that will have the greatest impact on the effectiveness of the single-sex strategy. They argued that "the effect of enhancing teacher knowledges about the social construction of gender...will be a more nuanced and critically reflective analysis of single-sex strategies in their capacity to reinforce gender stereotypical behaviours as opposed to creating spaced for interrogating and problematizing masculinities in the English classroom."

**Parker and Rennie (2002)** undertook a qualitative study using notes and reflections from teachers; questionnaires from students; and classroom observations conducted by a research assistant and as well as by themselves to examine single and mixed-sex classrooms to determine which were more conducive to gender-inclusive instructional strategies, particularly in math and science. The study was part of the larger *Single-Sex Education Pilot Project* initiated by Australia's Ministry of Education, aimed at improving participation and achievement outcomes for girls in math and science, and increasing teacher awareness of gender issues in the classroom.

Parker and Rennie found that the implementation of gender-inclusive strategies was more successful in single-sex setting for both girls and boys. According to the authors, the success of such strategies was linked to issues of classroom management. Within the all-girls environment, classroom management was less of an issue and thus allowed for greater time and space to implement different teaching strategies and address issues of gender more comprehensively. Similarly, the success of gender-inclusive strategies for the all-boys classes was most successful when the teachers addressed issues of classroom management prior to or in association with a new strategy.

The authors also noted that while sexual harassment was eliminated in the girls' classes, harassment and intimidation was still an issue with the boys. Both teachers and students identified that within the boys-only classes, a hierarchy was established in such a way as to replace the position of girls in the class with the "weaker" boys: "Boys are competitive and can be derogatory of one another's success unless it is a friend's success. Some boys seem to become the butt of all comments and put-downs, i.e., taking the place of the girls in the class...The quieter, more reserved boys...were pushed aside by the louder, more boisterous types in the boys' classes" (p.892). This phenomenon was also noted in Jackson (2002).

Parker and Rennie concluded that the degree to which teachers were successful in implementing gender-inclusive strategies was dependant upon the degree to which they felt supported by colleagues, parents and the community.

**Signorella et al. (1996)** challenged the notion that girls in single-sex schools show less stereotyping, arguing that most single-sex research occurs in elite or denominational schools and is not representative of the general population's experience. Signorella et al. conducted a cross-section, longitudinal study of students from two private schools: one was a three year old coeducational school; the other a 104 year old all-girls school which was in the first year of transition into a coeducational school.

Students in grades two through twelve completed two surveys, one at the beginning of the year and one at the end. Student in grades two through five were given the *Children's Occupations, Activities, and Traits – Attitude Measure* and the *Attitudes Toward Women Scale for Children*; while students in grades six through 12 were given the *Occupations, Activities, and Traits – Attitude Measure* and the *Attitudes Toward Women Scale for Adolescents*. Questionnaires were scored and compared for differences in tendency toward gender stereotyping.

The authors could find no evidence of a single-sex schooling effect on gender stereotyping. They observed that, regardless of school type, all girls in the study were less likely to stereotype at the end of the year than at the beginning.

**Stables (1990)** examined "the polarization of subject interests between the sexes" in single-sex and coeducational school settings. He administered the Subject Preference and Perception of Subject

Importance Questionnaire to more than 2300 13-14 years old students in seven coeducational and six single-sex comprehensive schools (three all-girls, three all-boys) in England. These data were actually the result of an earlier study conducted by Stables looking at differences between genders and school types in Third Year option choices (Stables, 1986). School populations were representative of rural, urban and suburban areas, and all demonstrated comparable academic ability.

Stables found that boys and girls attitudes towards subjects are more polarized in coed schools than they are in single-sex schools. He found that drama, biology and languages were more liked by boys in single-sex schools than those educated in coeducational schools. School types had an effect on students' preference for Physics and physical sciences for both boys and girls: boys from coeducational schools and girls from single-sex schools demonstrated higher preferences. Modern languages were preferred more by single sex students (boys and girls) than by coed students. In terms of 'Perception of Subject Importance', neither gender nor school type showed an influence.

Female students were designated as 'high achievers' using teacher ratings, GPAs and standardized test scores. Correlations between the designation tools were moderate with teacher rating and GPA:  $r = .50$  to  $.73$ ; teacher rating and standardized test scores:  $r = .35$  to  $.56$ ; and GPA and standardized test scores:  $r = .59$  to  $.64$ .

Students completed *The Career Aspirations Questionnaire* which included a brief demographic section, two career related questions and fourteen 'self-report true-false or multiple choice instruments' (p. 327). Students were also given a list of 131 occupations to help them with their choices but were also advised to add occupations if their careers of choice were not on the list. Respondents' career choices were given a value using the *The Nakao-Treas Socioeconomic Index* and a 'difference' score was determined by subtracting the realistic career score (what they actually envisioned themselves doing in the future) from the ideal career score (what they would choose to do if their options were limitless).

The authors found that adolescent girls from single-sex schools had higher realistic and ideal career aspirations than their coed peers, while as a group, 'moderately high achievers' in general had a significantly higher mean realistic career score than the other groups ( $p < 0.01$ ). As the authors point out, an interesting and curious result was that of the lowest 'ideal career' scores, found in the 'superior achievers' group. Finally, Watson et al. found gender to have no significant influence on the scores.

**Thompson (2003)** looked at the effect of school type on young women's choice of college majors. She compared girls who had been educated in single-sex private schools, coeducational private schools, and coeducational public schools. The author wanted to explore the "sex-traditionality" of the women's choices when deciding on a college major. Thompson hypothesized that women who attended single-sex high schools would be more likely to choose gender neutral or traditionally male disciplines than their coeducated peers.

Thompson used data collected on sophomores involved in the longitudinal study on high school students called 'High School and Beyond' (HS&B). HS&B made use of various instruments including student and school questionnaires, student records, and standardized test results. It used a 'two-stage' sampling technique where 1122 schools were selected at the first stage and then a random selection of 72 seniors and sophomores from each school were selected for the survey and follow-up on four occasions over the next ten years.

In order to analyze the data, Thompson divided college majors into three categories which were reflective of to the percentage of males and females in each discipline according to the *Digest of Educational Statistics* (1985-86): Male majors (0-33% female); mixed majors (34-67% female); and, female (68-100% female). She used a multinomial logistic regression model “which consecutively added sophomore year controls and senior year mechanisms, assessed the effect of each variable on the all-girls’ school variable. Interactions were also tested to examine how the effects of certain variables depend on the school environment” (p.267).

Thompson found that girls educated at single-sex high schools majored in fields designated as “female” less frequently than their coeducated peers. Women who graduated from single-sex (private) schools enrolled in more advanced math and science in college than girls from coed high (public) schools. Finally, sophomore and senior high school girls indicated greater feminist attitudes than those from the coeducational schools. The absence of single-sex public schools in the study required that comparisons be made between private single-sex schools and public co-educational schools that attract students from different backgrounds.

**Watson et al. (2002)** compared the differences between the career aspirations of high achieving female students at single-sex and coeducation schools. Two samples were used for this study: (1) 704 coed students in grades 6-12; and, (2) 494 grade 10 and 12 female students from single-sex and coed schools. All of the coeducational schools were public with the exception of one elementary school. The coed sample was determined to be ethnically diverse with a mean SES of 59.23 as scored by *The Nakao-Treas Socioeconomic Index*. Because the study took place in the United States where single-sex public schools are prohibited under Title IX, it is assumed that the single-sex schools were private. The authors noted that while the ethnic diversity of the school types were similar, the mean SES (65.93) of the single-sex schools was significantly higher than the coed schools. Nonetheless, the authors chose to use ANOVAs rather than ANCOVAs because SES scores and outcome variables were found to be uncorrelated.

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## Endnotes

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<sup>1</sup> Yates (1998) and Lee et al. (1994)

<sup>2</sup> AAUW (1992)

<sup>3</sup> AAUW (1998)

<sup>4</sup> Gillibrand et al. (1999)

<sup>5</sup> <http://www.dest.gov.au/schools/boyseducation/default.htm>;

<http://www.literacytrust.org.uk/Database/Boys/boysgovt.html#schools>;

<http://www.pisa.oecd.org/knowledge/summary/f.htm>

<sup>6</sup> <http://www.singlesexschools.org/sax>.

<sup>7</sup> See, for example: Arnot et al. (1999); Salisbury et al. (1999)

<sup>8</sup> Martino, W. & Meyenn, B. (2002).

<sup>9</sup> Gorard, S (1999)

<sup>10</sup> See appendices A and B

<sup>11</sup> See Appendix C

<sup>12</sup> See Appendix D for full article summaries.

<sup>13</sup> See, for example: Alberni Times (2003); Braid (2004); Brueningsen and Grant (2003); Danese (2004); Duffy (2003); Finlay (2004); Grossman (2003); Henry (2003); Baily-Hutchison (2003); Knapp and Meyers (2003); Knight (2004); McDougall (2003); Nanaimo Daily News (2003); Nygren (2003); Polak (2003); Reiss (2003); Raspberry (2004); Smyth (2003a); Seidman (2003a); Sokoloff (2003); Times Colonist (2003); Vancouver Sun (2003);

<sup>14</sup> See, for example: Braid (2004); Brueningsen and Grant (2003); Davila (2004); Dohy (2004); Donsky (2003); Findlay (2003); Kelly (2003); Knapp and Meyers (2003); McDougall (2003); Owens (2004); Polak (2003); The Province (2003); Riess (2003); Schmidt (2003a); Smyth (2003b); Times Colonist (2003); The Vancouver Sun (2003);

<sup>15</sup> See, for example: Brueningsen and Grant (2003); Baily-Hutchison (2003); Knight (2004); The Province (2003); Raspberry (2004); San Diego Tribune (2003); Schmidt (2003a); Seidman (2003a); Sokoloff (2003); Smyth (2003c); Teicher (2003); The Vancouver Sun (2003); Wall Street Journal (2004).

<sup>16</sup> See, for example: The Advertiser (2003); Henry (2003); Knapp and Meyers (2003); Markusoff (2003); The Province (2003); Sokoloff (2003); Seidman (2003a) (2003b); Times Colonist (2003); Schmidt (2003a) (2003b); Smyth (2003a).

<sup>17</sup> See, for example: Alberni Times (2003); Brueningsen and Grant (2003); Donsky (2003); Henry (2003); Knight (2004); Nanaimo Daily News (2003); Polak (2003); Reid (2004); Riess (2003); Seidman (2003a); Teicher (2003).

<sup>18</sup> See, for example: Braid (2004); Duffy (2003); Henry (2003); Ottawa Citizen (2003); Schmidt (2003b); Seidman (2003a), (2003b); Smyth (2003a); Sokoloff (2003); Times Colonist (2003); Vickers (2003).

<sup>19</sup> Baily-Hutchison (2003).

<sup>20</sup> Henry (2003).

<sup>21</sup> Findlay (2004)

<sup>22</sup> Brueningsen and Grant (2003).

<sup>23</sup> The Province (2003)

<sup>24</sup> Schmidt (2003).

<sup>25</sup> Braid (2004).

<sup>26</sup> Henry (2003).

<sup>27</sup> Henry (2003).

<sup>28</sup> Knight (2004)

<sup>29</sup> Times Colonist (2003)

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- <sup>30</sup> Teicher (2003)
- <sup>31</sup> Wall Street Journal (2004)
- <sup>32</sup> Smyth (2003)
- <sup>33</sup> “The Advertiser” (2003)
- <sup>34</sup> Seidman (2003a)
- <sup>35</sup> Seidman (2003b)
- <sup>36</sup> Schmidt (2003)
- <sup>37</sup> See, for example: Donsky (2003); Polak (2003); Schmidt (2003); Seidman (2003a); Seidman (2003b); Reiss (2003); Teicher (2003).
- <sup>38</sup> Donsky (2003)
- <sup>39</sup> Seidman (2003a)
- <sup>40</sup> Riess (2003)
- <sup>41</sup> Polak (2003)
- <sup>42</sup> Teicher (2003)
- <sup>43</sup> National Association for Single Sex Public Education, <http://www.singlesexschools.org/home-nasspe.htm>; Retrieved October 27, 2004.
- <sup>44</sup> National Association for Single Sex Public Education, <http://www.singlesexschools.org/home-nasspe.htm>; Retrieved October 27, 2004.
- <sup>45</sup> Riordan, C. (1998)
- <sup>46</sup> Blair and Sanford (1999)
- <sup>47</sup> See, for example: Baker et al. (1995); Seitsinger et al. (1998); Young and Fraser (1990)
- <sup>48</sup> Young and Fraser (1990), p.10
- <sup>49</sup> White (1982) cited in Young and Fraser (1990) p. 9.
- <sup>50</sup> Carpenter & Hayden (1987) cited in Young and Fraser (1990) p.9
- <sup>51</sup> See, for example: Baker et al. (1995); Mulholland et al. (2004); Singh et al. (1998); Warrington and Younger (2001); Young and Fraser (1990)
- <sup>52</sup> Arnot et al. (1998)
- <sup>53</sup> See, for example: Baker et al. (1995); Blair and Sanford (1999); Marsh (1991); Robinson and Smithers (1999); Seitsinger et al. (1998); Warrington and Young (2001)
- <sup>54</sup> See, for example: Baker (2002); Baker et al. (1995); Baker and Jacobs (1999); Bornholt (2001); Brutsaert (1999); Campbell and Evans (1997); Dunlap (2002); Gillibrand et al. (1999); Gilson (1999); Jackson and Smith (2000); Leder and Forgasz (1994); Manger and Gjestad (1997); McEwen et al. (1997); Parker and Rennie (2002); Singh et al. (1998); Seitsinger et al. (1998); Streitmatter (1997) (1998); Steinback and Gwizdala (1995); Young and Fraser (1990);
- <sup>55</sup> See, for example: Baker et al. (1995); Seitsinger et al. (1998); Young and Fraser (1990)
- <sup>56</sup> See, for example; Baker (2002); Manger and Gjestad (1997); Seitsinger et al. (1998);
- <sup>57</sup> Singh et al. (1998) p. 163
- <sup>58</sup> Watson et al. (2002). p. 328
- <sup>59</sup> See, for example: Norfleet James & Richards (2003); Stables (1990).
- <sup>60</sup> Marsh (1991). p. 328.
- <sup>61</sup> See, for example: Crombie et al. (2002); Gillibrand (1999); Jackson and Smith (2000)
- <sup>62</sup> See, for example: Campbell and Evans (1997); Dunlap (2002); Streitmatter (1997);
- <sup>63</sup> Baker (2002), p.19.
- <sup>64</sup> Jackson (2002), p.44.
- <sup>65</sup> Parker & Rennie (2002), p.892.
- <sup>66</sup> Jackson (2002), p.44.

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<sup>67</sup> See, for example: Blair and Sanford (1999); Bornholt (2001); Brutsaert (1999); Campbell and Evans (1997); Colley and Comber (1994); Crombie et al. (2002); Granleese and Joseph (1993); Heyward (1995); Jackson (2002); Lee et al. (1994); Monaco and Gaier (1992); Mensinger (2001); Madigan (2002); Martino and Meyenn (2003); Norfleet James and Richards (2003); Rennie and Parker (1997); Stables (1990); Thompson (2003); Watson (1997)

<sup>68</sup> See, for example; Yates (1998); Arnot (1999); Arnot (2002)

<sup>69</sup> See, for example; Yates (1998); Arnot (1999); Arnot (2002)

<sup>70</sup> Lee et al. (1994), p.97.

<sup>71</sup> Lee et al. (1994), p.106 & 108.

<sup>72</sup> Madigan (2002), p.15.

<sup>73</sup> See endnotes #35 & #36.

<sup>74</sup> See, for example: Leder and Forgasz (1994); Lee et al. (1994); Madigan (2002); Martino and Meyenn (2002); Parker and Rennie (2002); Steinback and Gwizdala (1995); Watson et al. (2002)

<sup>75</sup> See Appendix D for summaries of the research

<sup>76</sup> See, for example: Baker and Jacobs (1999); Madigan (2002); Rennie and Parker (1997); Riordan (1998); Seitsinger et al. (1998); Singh et al. (1998); Smith (1999); Streitmatter (1998); Wong et al. (2002); Young and Fraser (1990).

<sup>77</sup> See, for example: Baker (2002); Blair and Sandford (1999); Campbell and Evans (1997); Crombie et al. (2002); Crombie (1999); Derry and Philips (2004); Dunlap (2002); Granleese and Joseph (1993); Jackson (2002); Jackson and Smith (2000); Madigan (2002); Monaco and Gaier (1992); Mulholland et al. (2004); Parker and Rennie (2002); Rennie and Parker (1997); Streitmatter (1997), (1998); Walter (1997); Watson (1997).

<sup>78</sup> See, for example: Baker and Jacobs (1999); Dunlap (2002); Jackson (2002); Jackson and Smith (2000); Leger and Forgasz (1994); Lirgg (1994); Strange et al. (2003); Streitmatter (1997); Treanor et al. (1998); Warrington and Younger (2001).

<sup>79</sup> See, for example: Baker (2002); Brutsaert (2002); Dunlap (2002); Gillibrand et al. (1999); Gilson (1999); Harker (2002); Jackson and Smith (2000); Leger and Forgasz (1994); Lepore and Warren (1997); Lirgg (1994); Manger and Gjestad (1997); Marsh (1991); Marsh and Rowe (1996); McEwen et al. (1997); Mulholland et al. (2004); Robinson and Smithers (1999); Smith (1996); Ticker (1992); Warrington and Younger (2003).

<sup>80</sup> See, for example: Blair and Sandford (1999); Bornholt (2001); Brutsaert (1999); Colley and Comber (1994); Granleese and Joseph (1993); Norfleet James and Richards (2003); Stables (1990); Thompson (2003).

<sup>81</sup> See, for example: Hagg (2002); Young and Fraser (1990)

<sup>82</sup> See, for example: Baker (2002); Blair and Sandford (1999); Campbell and Evans (1997); Crombie et al. (2002); Crombie (1999); Derry and Philips (2004); Dunlap (2002); Granleese and Joseph (1993); Jackson (2002); Jackson and Smith (2000); Madigan (2002); Monaco and Gaier (1992); Mulholland et al. (2004); Parker and Rennie (2002); Rennie and Parker (1997) Streitmatter (1997), (1998); Walter (1997); Watson (1997).

<sup>83</sup> See, for example; Crombie et al. (2002); Jackson (2002); Lee et al. (1994); Martino and Meyenn (2002).

<sup>84</sup> See, for example: Datnow et al. (2001); Lee (1998); Martino and Meyenn (2000); Yates (1998)

<sup>85</sup> Jackson (2002) p. 46.