VALUES AND PARTICIPATION IN THE PHYSICAL SCIENCES AND ENGINEERING: A COMPARATIVE STUDY

by

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ABSTRACT

In two separate studies, with two different samples, relationships between values, and participation in the physical sciences and engineering or the humanities were investigated for university students. Overall differences by sex, and within the physical sciences and engineering by race (Chinese and white), were also examined.

The first study used the Echo technique to elicit a hierarchy of personality characteristics, individual behaviours, and beliefs about the role of the physical sciences and engineering, and the humanities, in society. Significant differences were found by sex, race, and area of study. The Echo responses were then used to construct a 36 item forced-choice ranking instrument.

The second study used the Echo instrument, and the Rokeach Value Survey, to measure the value priorities of students in the physical sciences and engineering, and the humanities. Significant differences in rankings by sex, race, and area of study were found on both instruments. It was hypothesized that there would be differences in the sensitivity of the two instruments to discriminate between students in the two areas of study. This hypothesis was not supported for all students, but differences were found at the subgroup level. For example, using white males and females only, the Echo instrument more accurately classified female group membership, and the Rokeach Value Survey more accurately classified male group membership.

Significant differences in "traditional" females values were identified for females in science and engineering. Chinese females in this group assigned the highest ranks to family values, honesty, and loving and caring. White females in science and engineering

assigned higher ranks to values of freedom, self-fulfillment, optimism, independence, and being broadminded. Few differences were found between Chinese males and females in science and engineering, or between white males and females in the humanities.

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Dedication

This dissertation is dedicated to my brother Tony who passed away during its completion. Even in his last days he showed his support and respect for my goal. He will be missed.

Chapter One: Introduction

A. Statement of Purpose

In response to the tragedy at Ecole Polytechnique in Montreal in December, 1989, which saw 14 female engineering students shot, many engineering faculties across Canada struck committees and commissions to examine the role of women in engineering. The committee at McGill University prefaced their final report with a three point rationale for increasing women in science and engineering. First, to address the technical personnel shortfalls which will affect Canada's ability to compete in the global economy. Second, to incorporate the certain talents, points of view and experiences of women that are less common among men, intended to have a positive social impact. Finally, to benefit those women who would otherwise, because of cultural discouragement, have missed a rewarding and satisfying career.

The present study is based on the assumption that the McGill rationale is sound, and that there are cultural bases for the underrepresentation of women in the fields of engineering and physical science. If these cultural factors were identified, early intervention could bring about a change in the willingness of young girls to participate in math and science. The present study was designed to investigate the role of value differences between the sexes. Despite many similarities in other characteristics, value differences appear to exist between men and women who enter the fields of engineering and physical science. Differences also exist between women in these, and other fields, but not to the degree which one might expect. Women's values overall exhibit some consistency, but the results of previous research in this area suggest there may be fine differences, either in the values themselves, or in their application, which influence

occupational choice. The disproportionately high representation of Asian women in science and engineering offers a natural comparison group.

B. Background

1. The Labour Market

With only 2.7 scientists and engineers per 1,000 members of the labour force, Canada currently trails as number seven on the list of the top seven industrialized nations. However, it is estimated that employment in the advanced technology sector of the economy will grow at a rate four times that of the general economy over the next decade. Workforce projections suggest that the country will not be able to keep pace with this growth. With over 350,000 already working in advanced technology firms, a recent survey reported that 55% of these companies are experiencing recruitment and retainment problems, and 37% would hire more staff if available (Canadian Labour Management and Productivity Centre, 1990).

To compound the problem, as market requirements are growing, enrollments are dropping. Enrollments of Canadians and permanent residents in undergraduate engineering and applied science have remained stagnant over the last five years at approximately 35,500. Within this number, life science degrees are increasing, but math and physical science degrees are declining[1]. At the same time, the pool of available university-aged population is shrinking. By the year 2003, there will be 250,000 fewer 18-24 year olds in Canada than in 1990. In terms of engineers alone, this means a shortfall for industry of over 30,000 professionals. The universities will also be in need, facing a retirement rate of

[1] Given the increased enrollment in the life sciences, and the equal representation of women in the area, the present study will focus on the physical sciences and engineering. As discussed later, women in biology exhibit characteristics which are similar to women in the social sciences, not those in physical science and engineering.

35-40% by the end of the century (May, 1990), and therefore adding to the demand at the Ph.D. level. Canada only graduates 1200-1300 Ph.D.s in the natural sciences and engineering annually.

Canada will not be unique in its predicted scientific shortfall, similar situations exist throughout the developed world. The United States is predicting a shortfall of 450,000-750,000 natural scientists and engineers by the year 2000, an increase of 30% in new engineering jobs, and 52% in computer science. The shortfall for Ph.D.s could be as high as 150,000 from 1995-2010, as American universities experience a retirement pattern similar to Canada (Pool, 1990).

American enrollment patterns also mirror Canadian trends, threatening to add further pressure to the Canadian system. In the two decades from 1968-1988, the percentage of American students planning to major in math at college dropped from 4% to 1%. The corresponding figures for physics and chemistry were 3 and 1.5% (Tifft, 1989). At the same time, the number of Ph.Ds awarded to foreign students rose from 1 in 4, to 1 in 3 (Pool, 1990).

In order to address the predicted shortfall of skilled scientists and engineers over the next two decades, national science agencies in many countries are moving to encourage the participation of groups which are currently underrepresented (Science Council, 1984; National Science Foundation, 1983). In Canada, women represent over 50% of the population and yet only approximately 11% of employed scientists and engineers- of 170,000 engineers, only 3% are women (Statistics Canada, 1990). Corresponding figures in the United States are only slightly better at 16% and 4% respectively (National Science Foundation, 1990). However, in engineering there has been recent progress, Canadian enrollments for female engineering students have improved in the 1990-91 academic year, a phenomenon some attribute to the Montreal massacre. At the University of Guelph 38% of the first year engineering students are female, and corresponding figures for Queen's

the first year engineering students are female, and corresponding figures for Queen's University and the University of New Brunswick are 20% and 18% (Canadian Press, 1990). South of the border, MIT is showing a similar trend with a 35% female first year class, while the traditional women's colleges (Smith and Bryn Mawr) continue to register 27-30% in the sciences (Tifft, 1989).

The American government is also targeting underrepresented minority groups. Hispanics represent 9% of the workforce and only 2% of scientists and engineers, corresponding figures for blacks are 12% and 2%. However, one minority is overrepresented in the science and engineering workforce. There are no figures available for Canada, but Asian-Americans represent 2% of the total American workforce, and 5% of scientists and engineers.

The Asian-American science and engineering workforce exhibits several unique characteristics : 27% do not hold U.S. citizenship compared to 1% of whites; employment rates are rising at twice the rate for whites; male Asians are more likely to be engineers than scientists (56% of males), more likely to be computer specialists, less likely to be in environmental studies; and overall, less likely to be in management. However, Asian women are more likely than white women, and less likely than black women, to be in management. In terms of doctoral women in colleges and universities, Asian women are least likely to be in tenure-track positions (43% Asian, 59% white, 64% black) but most likely to have tenure.

Differences also exist at the college level. Compared to whites, blacks, and Hispanics, Asian-American university students have more high school math and calculus courses, and are more likely to aspire to a doctorate. They earn 6% of the natural sciences and engineering master's degrees, 18% of the Ph.D.s, and 15% of all postdoctoral awards. In addition, while white students typically have parents with a higher level of education than the norm, Asians report a wider range, with more parents holding degrees, and more

who do not have high school (National Science Foundation, 1990). Asians also persist at their studies more than any other ethnic group, exhibiting lower losses from each stage of post secondary education after college entry (Berryman, 1983).

Given the above, what can be done to deal with the expected science shortfall? In the 1970s, the per capita rate of female Ph.D.s returned to its previous highest point, reached during the 1920s. However, despite growth during the 1970s, the number of female Ph.D.s in North America has remained flat since 1983, with a similar situation at the undergraduate level (National Science Foundation, 1990). In the sciences, women continue to avoid what is termed the "physical sciences" but have reached almost equal, and in some cases greater, participation than men in the biological and life sciences. What makes these areas different from the physical sciences and engineering? Are there clues in the very recent data showing increased female engineering enrollments in programs which focus on environmental issues? (Young, 1990). Sheila Tobias suggests that we will solve the problem of a science shortfall by asking not who does science and why, but by asking who doesn't and why not (Tobias, 1990).

2. Achievement and Participation in Science and Engineering

Research to date in the area of physical science and engineering (the "PSE") participation and achievement has examined a wide range of variables. Early work focussed on personality differences among males, most frequently college students, and less frequently people in the workforce. Increasingly over the 1970s and early 1980s, gender differences in verbal and quantitative skills became the focus as researchers attempted to explain women's lack of participation in the field. For several years, the physiology of the brain became the focus. There is now virtually no support for a thesis of physiological differences (Hyde & Linn, 1988; Kimball, 1989; Linn & Hyde, 1989) and the focus has moved to other variables.

These variables fall loosely into four categories of emphasis: academic aptitude and educational variables, socialization, including demographics, family and sex-role stereotyping within a culture; cognitive and affective variables; and cross-cultural differences.

Academic and Educational Variables

Studies of the math and science achievement of girls and boys in early elementary school consistently find girls equal to, or better than, boys (Bell, 1989; Benbow & Minor, 1986; Kelly, 1981; Matyas, 1985a). As well, at this age both sexes still perceive themselves to be better than the other at math (Sheridan & Short, 1984). However, as early as grade four, girls appear to lose interest in science (Bell, 1989), and by adolescence interest, participation, and achievement drops (Duncan & Haggerty, 1984; Finn, 1980; Kahle, 1985; Kelly, 1981; Matyas, 1985a). For girls, this reduced interest results in the selection of fewer math and science electives, and consequently, the beginning of a vicious cycle where for various reasons (discussed more fully under cognitive variables below) they do not take the very courses which could provide the exposure necessary to pique interest in a related career or, in a more practical sense, provide basic prerequisites for the 85% or more of future jobs which will require advanced math (Status of Women Canada & Manitoba Women's Directorate, 1989). Benbow and Minor (1986) found that general science attitude was directly related to science participation in high school students. On the other hand, although they may not have the exposure to, and therefore the knowledge of, detailed science courses and information, girls have been found to equal boys on test of science process skills (Erickson & Erickson, 1984; Jacobson & Doran, 1988).

The number of secondary math and science courses taken, as a predictor of university level participation, has received much attention. Betz & Hackett (1983) concluded that four characteristics predicted the likelihood of becoming a math college

major, math self-efficacy, being male, low anxiety, and number of high school math courses taken. Although the number of courses may be a predictor of participation (often in terms of prerequisites), it has not been found to be a factor in persistence in engineering studies for either gender. However, the amount of math taken and grade nine math scores together have been found to be the strongest predictors of grade twelve math achievement (Chipman, Brush & Wilson, 1985).

Jagacinski, Lebold, & Salvendy (1988) studied 2331 college majors in computer science and engineering and found that high school science grades, and number of courses taken, predicted persistence rates for men but not women, a finding that suggests although women may enter these fields in university with less preparation in certain areas, once in the program, this is not a factor for continuation. There may be separate predictors of success for the two sexes. Further support for this concept comes from another study (Wittig, Sasse & Giacomi, 1984) where it was found that success on visual spatial tasks was the best predictor of success for 24 women in engineering. This contrasts with findings that for men, mechanical reasoning ability is a better predictor.

Kimball (1989) discusses the phenomenon of classroom grades versus standardized tests. Girls typically have superior classroom grades in math, while boys outperform girls on standardized achievement tests. Several hypotheses are suggested including sex role conflict, attributions for success, and females' lack of comfort with novel material. Concerning the latter, it is argued that girls are more comfortable with the familiar material given in class. Girls are less likely to take risks or shortcuts in testing situations, or use intuition in relating problems to everyday situations (Linn & Hyde, 1989). Many argue that this is due to the use of sex-typed problems on the tests (Betz & Hackett, 1983; Linn & Hyde, 1989). Linn & Hyde's meta-analysis identified sex differences in achievement on items classified as typically "male" (sports, science) or "female" (aesthetics, interpersonal relationships).

The relationship between overall academic achievement and choice of college major was examined by Kerr and Colangelo (1988) using 76,951 high school juniors and seniors who had participated in the American College Testing Program and scored either in the 80th, 95th, or 99th percentile in general achievement. The strongest relationships between high academic achievement and proportion of students choosing a major were found in biology, engineering (the strongest), medicine, math and physical science. The weakest included agriculture and business. Certainty about choice of major decreased with each decreasing level of achievement, but significantly more females than males exhibited uncertainty at the top two levels.

The characteristics of school, teacher, and counsellor have all been identified as having differing effects on the physical sciences and engineering. Finn (1980) found that female science performance was higher in single sex schools than coed, while Matyas (1985a), controlling for socioeconomic status, reported a higher female preference for science and math in single sex schools, but equal performance in these subjects. It appears that single sex schools may foster more interest in, and preference for, science and math than coed schools, but once the girls are participating in science and math in the coed schools, achievement is equal to those in single sex schools (Kelly, 1981). Ormerod (1981) found the opposite effect with 14 year old males whose math and science preference was higher in coed schools than single sex schools.

Teachers and counsellors appear to have variable effects on science and engineering participation. Research shows that most science majors choose their major early in school. Approximately 40% do so prior to grade 9, 40-50% between grades 9 and 11, with only a few in grade 12 or first year university. Once in university there is virtually no migration into science, and significant numbers leave the field (Berryman, 1983). For engineering majors, the decision may come later in high school (Dench, 1990), and for girls in the last year of school (Newton, 1985). Fitzpatrick and Silverman (1989) found the role of high

school teachers' support to be more important for science majors than any other group. Houser and Garvey's (1985) study of 470 females choosing traditional versus non-traditional (i.e., female-dominated vs. male-dominated) occupations found significant differences between the two groups in terms of teachers' and counsellors' support for their decision. Nontraditional women had teachers and counsellors who encouraged them to pursue their areas. Further analysis of women who had considered and rejected nontraditional roles found that the support of school personnel represented the largest variation between the two groups.

Collins' (1986) longitudinal study of gifted students identified school variables as key in affording equal opportunities for males and females. She recommended early identification of math ability, and placement with equally capable peers in a challenging environment. She too, identified the importance of teachers and counsellors. Same sex teachers can provide important role models when they do not exist in a student's life beyond school. Kelly (1981) found that girls with female teachers scored higher in science achievement than those with male teachers.

Unfortunately, there are also many teachers and counsellors whose influence has a negative effect on girls' aspirations. Very few elementary school teachers have training in science education. Matyas (1985a) reports a survey finding that only 22% of elementary teachers feel qualified to teach science. Given the early age at which children become disinterested in the subject, the elementary teacher could be instrumental in maintaining enthusiasm. There are also many counsellors in the school system who actively discourage girls from nontraditional occupations (Fitzgerald & Crites, 1980; Luckins & Luckins, 1980; Matyas,1985a), and because girls meet more frequently with counsellors than do boys, they have even more opportunity to receive this advice (Kahle, 1985).

However, there are steps that can be taken with school personnel, intervention with these groups has been shown to be very effective. Activities targeting teachers, counsellors

and students from grades 1 through 9, have resulted in attitude change and sex role flexibility (Mason & Kahle, 1989; Rand & Gibb, 1989; Scott, 1984).

Socialization

Throughout the literature an underlying theme emerges of differences in basic knowledge concerning occupations in the fields of science and engineering. It appears that women do not receive information on these careers, or conversely, that a disproportionate number of women entering the field have a relative who has served as a role model or information source. Women in science and engineering are much more likely to have a father, mother, or sibling in a technical occupation than women in other fields (Carter & Kirkup, 1990; Dench, 1990; Fitzpatrick & Silverman, 1989; Jagacinski, 1987). Greenfield, Holloway, and Remus (1982) found a full 70% of their sample of male and female engineering students had siblings who were engineers. In the one identified exception to this finding, Newton (1985) surveyed male and female engineers in England and found the females more likely to have fathers in "demanding jobs", but not necessarily technical jobs.

Dench's (1990) sample also indicated different self-reported reasons for entering the field, 51% of men cited interest in engineering, (compared to 23% of women), while the largest number of women (39%) cited their enjoyment of math and science (13% for men). Did the women not know enough about engineering to cite their specific interest in the area? Or is it possible that they enrolled because engineering was presented to them as one of the options for a student skilled in science and math? More females view their first year of studies as a time to determine whether or not they have made the right choice (Greenfield et al., 1982), and Dench (1990) found 31% of her female sample to be undecided concerning their specialization within engineering, whereas none of the males were undecided.

Parents, like teachers and counsellors, also serve to encourage or discourage girls from entering nontraditional fields. Often this is related to their own sense of sex role appropriateness. Eccles, Adler, Futterman, Goff, Kaczala, Meece, and Midgely (1985) found that despite similar math achievement for sons and daughters, parents held differing attributions for success. They attributed their sons' success to aptitude, and their daughters' success to effort. The effect of this difference is suggested by a subsequent finding that the child's perception of the parents' beliefs was more closely related to self-concept than actual past performance. Dench (1990), in her engineering student sample, found significantly more discouragement from parents and friends for female students, and Berg and Ferber (1983) found that female graduate students in science reported less maternal support than their male counterparts.

Conversely, parental support for nontraditional career choices can be a strong factor in girls choosing that path (Fitzpatrick & Silverman, 1989). Greenfield et al. (1982) asked engineering students what was the most influential factor in their choice of engineering. The largest number of males (27%) cited the support of family and friends. The largest number of females (26%) cited direct recruitment, again suggesting that without very specific information on engineering as an option, the females may have decided on a different field.

Several studies have identified the use of masculine-typed toys in childhood by girls who eventually enter nontraditional fields (e.g., Newton, 1985), but Fitzpatrick & Silverman (1989) included high achieving women from the humanities and social science as well as engineering and natural science, and found that all had used the toys in childhood.

At the very time that children are deciding first, whether they actually like science and math, and second, whether they will continue to pursue it, the social pressures of early adolescence add significant weight to the decision making process. Bell (1989) worked

with grade 4 and 6 girls in a gifted program to identify the dilemmas they felt they were facing. These students felt very strongly that they could either be smart or social, silent about their work or be seen to be bragging, fail or be perfect, conform to the media's image of beauty or been seen as only marginal, be passive or judged as aggressive, and conform or be punished. Smithers and Collings (1981) asked male and female senior high school students in science, and other areas, to rate their own image and those of their classmates. All groups viewed the science students as more intelligent, hardworking, valuable, masculine, and less imaginative. All groups also viewed themselves as more exciting and attractive except for girls in science. These girls perceived themselves as less feminine, popular, attractive and sociable than the other groups.

Many students view math and science as a male domain (Betz & Hackett, 1983; Harding, 1986), and much of the most recent research on sex differences in participation has identified sex role stereotyping as a major factor (Dix, 1987; Eccles, 1987; Matyas, 1985b; Kimball, 1989). As early as grade 1, computer use is viewed as a masculine activity by both boys and girls (Collis & Ollila, 1990). Frieze and Harusa (1984) concluded that there were three major characteristics of women who became scientists: they had support and encouragement from significant others; a belief in their own ability; and, nontraditional sex role orientation. Both male and female college students perceive more difficulties for women in engineering than women in nursing (Bremer & Wittig, 1980), and female university students in psychology report that math is more important for males (Betz & Hackett, 1983).

The perceived conflict of family and career in science and engineering is also a deterrent for females. Glaze and Ellis (1980), in their Ontario survey, found that many high school girls believed women with university degrees do not marry. This phenomenon is not unique to teenagers. Right through graduate school, many female students in all fields express concern about balancing career and a family. However, this fear appears to

have some basis. Compared to men, women entering graduate school in science and engineering have more highly educated parents (as do female graduate students in more traditional fields), more science courses, higher work orientation, lower family orientation, and are more likely than their male counterparts to be divorced or separated (Fitzgerald & Silverman, 1989; Matyas, 1985b).

Helson (1980) reports that highly creative male mathematicians differ from their peers on their desire to accomplish, and achieve great fame. Highly creative females are distinguished by their desire to subordinate other goals in favour of their professional goals. Dench (1990) found that more males than females in her sample planned to marry and have children, and in Jagacinski's survey (1987) using four age groups of employed engineers, more females were single or without children. Cooper and Robinson (1987) found no sex differences on valuing home and family in their sample of male and female science and engineering majors, but higher female career-related values, and a significant negative correlation between home and career values for females, but not for males.

Interest in the relationship between sex role and participation in science and math has resulted in extensive use of the Bem Sex Role Inventory (BSRI) in research, with some conflicting results. Kavrell and Petersen (1984) conducted a longitudinal study of students in grades 6, 7, and 8, looking at scores on the BSRI, academic aptitude, and grades. As expected, self-described masculinity and femininity increased for both groups with age. However, the BSRI relationships showed some interesting sex differences. For boys in grade 7, math grades correlated equally with masculinity and femininity (r= .29), but only masculinity was correlated with science (r= .30). There were no significant correlations with androgyny, or for girls' math grades, but girls' science grades showed a significant negative correlation with masculinity and femininity (r= -.26, r= -.25). Hackett (1985) found the BSRI sex role measure to be a non-significant predictor for undergraduates of math test scores, or number of math courses taken, and Hackett and Betz (1989),

examining math performance, achievement, math self-efficacy, the BSRI, and choice of major found the only significant BSRI relationship to be between masculinity and math self-efficacy.

Within her sample of engineers, Newton (1986) found no significant differences between males and females on BSRI scores. The female engineers were, however, more androgynous than the norm. Jones and Lamke (1985) looked at the relationship between sex role (masculine, feminine, androgynous, undifferentiated) and self-esteem for undergraduate women majoring in home economics or engineering. Both groups contained more students classified as androgynous, although home economics had significantly more feminine-typed, and engineering more masculine-typed, students. The lowest self-esteem was found for masculine-typed engineering majors. Others have found high spatial relations scores to be associated with high masculinity in females, and low masculinity in males (Singleton, 1986), and likewise, nontraditional career choice to be associated with high masculinity, low femininity, in females (Houser & Garvey, 1985).

Cognitive and Affective Variables

Gender research on attributions for participation and achievement in science and engineering focuses on two areas of interest, locus of control, and performance attribution, or skill versus luck. Brewer and Blum (1979) investigated undergraduates in four areas: the humanities; biology; social science; and math and physical science. For both sexes, success was attributed to internal causes, and failure to external causes except for females in math and physical science where the opposite was true. Burlin (1976) compared grade 11 girls' ideal and real occupational aspirations and locus of control. Generally, she found that nontraditional occupations were more often chosen for ideal, rather than real, aspirations, but more often chosen for real occupations by girls classified as internal. Burlin feels that the use of ideal versus real for innovative occupations suggests that the

girls desire to pursue these occupations, but are constrained by social forces. She attributes the internals' more innovative occupational choice to freedom from environmental cues. These findings support other research which identified a "We can, but I can't" attitude toward the use of computers and achievement for high school girls (Collis, 1984). Collis found that girls agreed that women in general could enter these nontraditional fields but, when questioned, admitted that they personally could not see themselves doing it. It appears that girls are aware that in principle nontraditional careers are open to them as a group, but that they personally do not consider this an option.

Females also have a propensity to choose games of luck rather than skill (Nicholson, 1984), and attribute success to effort rather than ability (Deboer, 1986). This is contrary to the attributions of their mothers, at least for math achievement, who believe their daughter's success is due to ability, while their son's is due to effort (Holloway, 1986). High school girls exhibit a significant correlation between task easiness and preference in science and math, which is much weaker for boys of comparable achievement levels (Ormerod, 1981). Deboer's retrospective study (1986) of university students also found that perception of high school ability, not actual grades, was more closely related to the number of university science courses taken. Comparing successful and unsuccessful first year science students of both sexes, Deboer (1985) found that successful females held self-perceptions that were not replicated for males. They viewed themselves as more hard working, less reckless and rash, and more future oriented than the successful males.

While attributions to effort or ability may be related to initial participation at the university level, they do not appear to be related to persistence. Lyons-Lepke (1986) studied 25 "persisters" and 25 "defectors" from math or science at the end of their first year and found no significant differences on this variable. Ware, Steckler, and Lezerman (1985) followed a group of 300 first year students who expressed an interest in science.

They were matched on SAT scores and the number of science and math courses taken in high school. By the end of first year 69% of the males and 50% of the females intended to continue studies in science. Identified predictors for women were: highly educated parents, outstanding SAT math scores, desire for control, prestige and influence, and desire for affiliation. The two predictors for males were high grades in first year science, and the decision to major in science made prior to college entry.

Women who enter the fields of science and engineering, and persist, in fact exhibit many similarities to their male counterparts (Breakwell, 1986; Greenfield et al, 1982; Lunneborg & Lunneborg, 1985; Newton, 1986; Singer & Stake, 1986). The key difference for participation then, is in entry. Having explained or exhausted many of the other classes of variables in this area, current research is now increasingly concerned with cognitive variables such as self-efficacy, self-concept, self-confidence, interest and attitude. Across 17 countries, attitudes have been shown to correlate more positively with achievement in science than in any other subject (Simpson, 1977). While grade 9 grades and amount of high school math were overall predictors of grade 12 math achievement, Wise (1985) found that for boys technical expertise, and for girls, socioeconomic status, self-confidence and interest, were also predictors. Others have combined perceived usefulness and self-confidence (Chipman, 1985; Sherman, 1982), cognitive beliefs, affect, and ability (Lantz, 1985), confidence and academic preparation (Dix, 1987), self-confidence and career commitment (Lyons-Lepke, 1986), and ability, aspirations, and interest (Berryman, 1983).

The effect of scientific and same sex role models on participation in the PSE has received much attention. A recent group of studies (Hill, Pettus, & Hedin, 1990) looked at the relationship of sex, race (black and white), rural vs. urban school, and personal acquaintance with a scientist with 8 variables. The variables were teacher, and parent, encouragement, science activities, academic self-image, career interest, community and

peer support, perception of science relevance and actual math and science ability. The critical variable for females was lack of career interest, but for all students there were significant effects of personal acquaintance with a scientist on 6 of the 8 variables.

Confidence, and the more specific measure of self-efficacy (Bandura, 1977), are increasingly seen as contributing variables in multi-variable models of science and math participation and achievement. Betz and Hackett (1983) initially examined math self-efficacy in university students in the social sciences and found higher male self-efficacy scores, a positive correlation with BSRI masculinity and, for students with higher efficacy, lower math anxiety, higher confidence, and a more positive view of math as useful. A regression analysis indicated that a college major in math was best predicted by math self-efficacy, being male, more high school math, and low math anxiety. Actual math scores were not predictive.

More recent research (Hackett & Betz, 1989) using measures of math self-efficacy, BSRI, career plans, math achievement, and attitudes toward math, found math self-efficacy a more significant predictor of college major than past performance or current math achievement. Sex differences in math self-efficacy were correlated with sex differences in math performance. Similarly, Siegal, Galassi, and Ware (1985) found self-efficacy and SAT math score to be more predictive of achievement than math anxiety and sex role. However, Hackett and Betz (1989) identified a continuing need for examination of the interrelationship of cognitive, affective, attitudinal, behavioural, familial, and socialization variables.

Many students view science as rigid or impersonal. The largest percentage of students (43%) who left science and engineering for other college majors in 1973, 1981, and 1983 in the United States, did so because they found other fields more interesting (Tobias, 1990). Tobias (1990) initiated a study to investigate why very bright students either drop out of science or, after a distinguished high school record of science

achievement, do not enter the field in university. Students in other faculties were paid to attend, and "seriously audit" (which included completing assignments and exams) physics or chemistry courses. These students complained of the highly competitive nature of the classes, their classmates who were either "bored or scared", and the lack of community and interchange with professors who were viewed as keepers of information unwilling to discuss alternate theories.

Female students were the most conscious of the unfriendly nature of the classes and the intense competition. One girl said " Science seems to hurry off before I get too close. It avoids my attempts to touch or shape it" (Tobias, 1990, p. 24). Greenfield et al. (1982) report an unexpected sex difference in their sample of engineering students in this regard. Their survey identified male discomfort with the impersonal nature of the program but no corresponding findings for females. While not discussed as such, the extensive support groups reported for the female minority within the program may have overcompensated.

The impersonal nature of science is a frequent theme in girls' reports. They view it as abstract, academic, and divorced from social context (Brighton Women in Science Group, 1980). Harding (1986) refers to the "maleness" of science. Finn's (1980) sample of girls scored lower in science achievement than the boys, and were less positive toward the subject, but rated the importance of science higher. Finn's suggested explanation of this finding was that the girls place higher value on a subject which to them appears complex. Others have found that boys, but not girls, in high school are able to relate academic science to life outside of school (Duncan and Haggerty, 1984).

While those outside the field view science as divorced from social context, those in the field do not agree. Fitzpatrick and Silverman (1989) compared female university majors in the humanities, social sciences, engineering and science and found all four groups believed their work would contribute to society, again supporting the underlying theme of consistency within occupational subgroups. Another study (Lunneborg &

Lunneborg, 1985) examined high school scores on ability, academic achievement, and vocational interest for college graduates in traditional and nontraditional fields. Within each field, male and females were very similar with the most sex differences in business administration, the fewest differences in psychology and sociology. However, regardless of the field, men expressed greater interest in business and technical activities, women in art and service.

Frieze and Harusa (1984) asked Grade 7 and 8 boys and girls "What makes people become a scientist?". Their responses reflect much of what older students believe in terms of social benefit, risk taking, effort versus ability, and interest. More boys than girls cited helping others (10.7% vs. 5.7%), more girls cited being adventurous and curious (15.2% vs. 10.7%), more boys cited being smart (37.3% vs. 21.9%), and more girls cited interest in the subject (51.4% vs. 40%).

Career interests in the ninth grade have been found to be a significant predictor of grade 12 math participation (Wise, 1985), but the female interest in social and helping, rather than theoretical values, and their accompanying perception of science as impersonal and divorced from society, would seem to stack the odds against a career in science. The majority of men view occupational choices in terms of status and economic benefits, while women have a more intrinsic interest in human service aspects (Eccles, 1987). Even at the eighth grade, girls report they use personal values when making decisions while boys say they use logic (Baker, 1985). At the same age, subjective task value has been found to mediate sex differences in achievement behaviours and plans (Parsons, Adler, & Meece, 1984). Smithers and Collings (1981) found that interest in science was more important in course choice for senior high school girls, than for boys. This effect was also stronger for physics than for biology.

Culture

The most recent extensive study of actual science achievement across cultures is the Second International Association for the Evaluation of Educational Achievement Science Study (Jacobson & Doran, 1988). This study examined: achievement in general science for grades 5 and 9; biology, chemistry, and physics achievement at the senior level; science process skills; teachers and teaching; and student attitudes. The first two stages of the study covered 16 countries (including Canada, the United States, Japan, Korea, Singapore, and Hong Kong), the last stage was completed only in selected countries (Lapointe, Mead, & Philips, 1989).

In science achievement at the grade 5 and 7 levels, Canada and the United States placed in the middle or lower range of the 16 countries, and Hong Kong near the bottom (Japan, Korea and Hungary scored highest). Overall, comparisons to a previous study completed in 1970 show no change for grade 5 students, but a decline in the scores of grade 9, as well as a decline in the growth of achievement scores from grades 5 to 9. Sex differences in grade 5 for Hong Kong and Canada were in the middle range (Japan had the smallest differences), increasing in grade 9 for both countries.

At the senior level, in grade 12, scores in the United States and Canada remained low in biology, but Hong Kong moved up to fifth place, and for chemistry and physics, first place. Biology was the only subject showing higher female scores. Looking at the difference between the percentage of girls and boys scoring correctly, girls scored higher than boys in Hong Kong, Sweden and Australia, and sex differences for Canada dropped to 4.0%. Canada and Hong Kong both scored in the middle range of the 17 countries for sex differences in chemistry and physics. In Japan however, girls' actual physics' scores exceeded those of boys in several other countries. There were no significant sex differences in science process laboratory skills.

In the United States fewer girls than boys took physics and chemistry, more girls than boys took biology. Students in physics expected the most years of post secondary education, students in biology the least. Students in physics also spent the least time watching television, the most doing homework, and had more highly educated parents.

It has been found that across cultures, girls' attitudes to science vary more than do those of boys, and overall, attitudes vary more than achievement between countries. However, there is also no relationship between the proportion of girls studying science in a country, and that country's female science achievement (Kelly, 1981), a finding similar to the principle cited earlier for equal achievement in single sex vs. coed schools.

The relationship between culture and academic achievement is complex, confounded by geography, citizenship, and the many variations within a cultural group. Attempting cross-cultural research between countries is equally complex, which has resulted in the majority of work being conducted within one country using indigent and immigrant peoples. Most cross-cultural researchers seek to illustrate that the majority of differences found across cultures in achievement are a result of the interplay of various socialization factors within the cultural situation, and not physiological differences between races.

Williams and Leonard (1988) found the greatest predictors of academic success for black American undergraduates to be high school GPA and aptitude tests, not self-efficacy, vocational interests or racial identity. Durojaiye (1975) found no differences in verbal and quantitative achievement between black and white children of comparable background in Nigeria, and Beard (1968) found a similar quantitative deficit in female performance for a sample of English and Ghanian teenagers, but an age effect, the deficit appeared earlier for Ghanian girls.

Frieze and Harusa (1984) argue that, for example, members of the Jewish race are predisposed to become scientists because of their cultural values of individual study and

academic excellence. Eastern Bloc countries that promote equality of the sexes such as the Soviet Union, Hungary, and Poland do in fact have more women in the sciences and engineering, but still exhibit sex differences. In the Soviet Union there is a wage discrepancy between male and female physicians and engineers (Haley-Oliphant, 1985), and in the earlier mentioned 17 country science achievement study, Hungary and Poland exhibited some of the largest sex differences in chemistry and physics achievement at the high school level (Jacobson & Doran, 1988).

There has been a limited amount of research on Chinese culture and academic achievement. The most focussed is a recent study by Chen and Uttal (1988), which looked at the relationship between math and reading achievement, cultural values, and parents' beliefs. Using 720 Chicago, and 396 Beijing, first, third, and fifth graders, the authors measured the children's achievement and conducted interviews with their mothers (questionnaires were sent to the fathers but, due to the very low American response rate, were excluded from the analysis). In terms of actual achievement, there were no differences in reading scores, but the Beijing students scored higher in math. The major differences were between the perceptions, and roles, of the American and Chinese mothers. Despite equal or better performance, significantly fewer Chinese mothers were satisfied with their child's performance (36% vs. 76% American), and unlike the American mothers, Chinese mothers' satisfaction did not correlate with their perception of their child's satisfaction.

Mothers were asked to estimate what score their child would receive on a hypothetical test, and then what score they would be satisfied with. American mothers indicated satisfaction with a score 7 points lower than the estimated actual, Chinese mothers indicated 10 points higher than actual. Chinese mothers reported significantly more time spent helping with homework, and mothers in both countries rated their children's liking of school equally. Despite the seemingly greater role that Chinese mothers play in educating

their children, they reported that the teacher was the most important figure in a child's education. American mothers cited themselves.

The authors described a system of Chinese beliefs which they felt supported their findings. These include: the Confucian belief that all the Chinese population should be educated; the importance of malleability- change is possible and should start with the self; the role of the environment in shaping the expression of human potential; the belief that societal improvement starts with self improvement; the belief that ability only determines the rate of acquisition of knowledge, ultimate achievement comes from effort; and the importance of group identity and collectivism, the child's achievement reflects the effort of the whole family and often the whole community. This results in a society where an emphasis on achievement is not perceived as stressful, and a "belief system that focuses on internal goals" (Chen & Uttal, 1988, p. 357).

Other work supports this thesis of increased emphasis on academic achievement and time devoted to its pursuit in the Chinese culture. A study of Japanese, Taiwanese, and American grade 1 and 5 students (Stevenson, Lee & Stigler, 1986), found the Taiwanese spent significantly more time in class, and at home, on academic studies. When asked to rate their feelings about homework by choosing a smiling, frowning, or neutral face, 60% of the Americans chose a frown, 60% of the Japanese chose a smiling or neutral face, and 60% of the Chinese chose a smiling face.

The role of parents' education is also quite different for Asians and whites. For all other ethnic groups in the United States, parents' university education doubles the rate of children's university participation. For Asian Americans, the children's participation rate does not vary. At the elementary level, parental variables have been found to account for 22% of the variation in achievement. Campbell and Mandel's (1990) study of Asian and white American parents found Asian parents pressured and monitored their children more

but gave very little actual help. White parents used less pressure and monitoring, more psychological support.

Sparrow (1987) found Asian race to be a significant predictor for female science majors and across cultures differences have consistently been found in favour of Chinese quantitative achievement with: seventh and eighth grade Chinese, Hispanic and Anglo-Americans (Shieh, 1985); fifth and sixth grade Asian and white Americans (Campbell & Mandel, 1990); and, first and fifth grade Japanese, Taiwanese, and American students (Stevenson, Lee & Stigler). Within the Chinese culture, sex differences in math and science have been identified in favour of males (Hsiung, 1988; Shieh, 1985).
Koo's study (1987) of Chinese university and college students in California examined the differences between students born in China, Taiwan, Hong Kong, and the United States. Differences included a lower grade point average for Taiwan born, heavier course loads carried by students from Hong Kong and China, and a higher overall grade point average for females. Despite these findings however, overall Koo found academic variables to be more predictive than birthplace.

Berryman (1983) offers a sociocultural explanation for disproportionate Asian representation in American science and engineering with three thrusts: the effect of a high achieving culture; a quantitative skills advantage due to the handicap of Western language requirements; and, the relative lack of racial discrimination in scientific and technical occupations. Language requirements may in fact be an issue for immigrants, but they do not explain Chinese superiority in studies using mainland China and Hong Kong (Shieh, 1985). Using six measures of self-perception, and one cognitive measure (reading level), Lehn (1980), found that reading was the best predictor of grade point average for black, white, and latino Los Angeles high school students, while level of aspiration was more effective for Asians.

In terms of attitudes and attributions for success, the limited research conducted with Chinese students indicates culture differences. Tzeng's study (1987) of high, low, and average grade 6 students in Taiwan identified no sex differences in attitude at each achievement level, but more positive attitudes, and attributions to ability and effort at the higher level. The opposite was true for low achievers. A comparison of locus of control for success and failure using Taiwanese and American children found opposite attributions (Chiu, 1986). Americans were more internal in success situations, with boys more internal than girls. The Chinese were more internal for failure, with no sex differences. Mizokawa and Ryckman (1990) examined attributions to ability and effort in language arts/social studies, and math/science, in a sample of Chinese American students in grades 4 to 11. They found that the students made more attributions to effort overall, and more to language/socials than to math/science. Attributions to ability were equal for the two subject areas. In terms of sex role, Asian American women have similar scores to whites, but when correlated with occupational attainment, masculine and androgynous-typed Asian women have the highest attainment (Chow, 1987).

Collis and Williams (1987) compared attitude toward computers, science, and writing, in samples of grade 8-12 students in Shanghai, China, and Canada. Overall, the Chinese students had a more positive attitude toward computers and science, but lower self-confidence about their computer ability. There were no significant sex differences within the Chinese sample, but in the Canadian sample boys were more positive about computers. In both samples the attitudes of girls became less positive with age. Girls in both samples believed that females possessed computer aptitude equal to males, but boys in both samples were skeptical.

The correlation between academic achievement and choice of university major identified for the United States (Kerr & Colangelo, 1988) has not been investigated for the Asian cultures, but a three year study of 424 gifted and 468 average students in Taipei

identified the largest difference between the two groups as preference for the Chinese language, and science, in the gifted sample.

3. Values

Values Defined

Values are "relationships among abstract categories with strong affective components, implying a preference for a certain kind of action or state of affairs" (Triandis, 1979, p. 209). They are for the most part cultural products which are linked to motivation, but are only one element in determining motivation (Kluckhohn, 1952). Values provide for selectivity in perception, modes of self-presentation, conflict resolution and decision making. They influence an individual's interpretation of events, and they provide "non-specific" guidelines for the selection of goals and subsequent motivation (Rokeach, 1973; Triandis, 1979). Rokeach believed that values are organized hierarchically, serving as standards or criteria that the socialized self uses to judge the competent and moral selves. He viewed values as enduring systems, but systems that could undergo change when faced with self-dissatisfaction, or discrepancy (Rokeach, 1979a). Beliefs are value related expectancies, their importance defined by the number of interconnections with other beliefs. The more central the belief, the more connected to other beliefs, and, therefore, the more resistant to change. Attitudes, then, become relatively enduring organizations of beliefs that predispose one to behaviours.

Values have been shown to be relatively stable over time (McMahon, Pulvino & Sanborn, 1982), with the most central or important values remaining most stable. It appears that at age 11 or 12, value systems are not yet crystallized, but by senior high school, are fairly stable (Borzym, 1981; McMahon et al., 1982).

The present study emphasizes the role of the self in values, and its connection to behaviour:

> "all attitudes, as well as beliefs and values, are predispositions that serve the function of maintaining and enhancing self-conceptions, which derive in large part from societal demands and focus upon issues of competence and morality"
>
> (Rokeach, 1979a p. 266).

Values have received relatively little attention in social psychology, in large part because of the assumed complexity of measurement. On the one hand, values can be viewed as buried at the base of many interrelated perceptions and behaviours, all themselves varying on any number of factors. On the other, as Feather (1970) believes, a value is a determinant of attitude as well as behaviour, and because people possess fewer values than attitudes, values are the more economical tool in the study of people. Despite this, the major issue in values investigation appears to be the description and classification of values. To date, most research has used structures imposed by the researchers themselves. That is, through their own familiarity with the communities under study, they have derived categories or themes to fit the situation. For this reason, Triandis points out that our "measurement of values has generally corresponded to the concepts that people have used to define and describe them" (Triandis, 1979, p. 209).

Allport, Vernon and Lindzey (1960) identified six major value areas or motives: theoretical, economic, aesthetic, social, political, and religious. Kluckhohn and Stodtbeck (1961) instead identified what they viewed to be five major themes, or "value orientations", for their work with southwest American communities: human/nature, man/nature, time, activity, and relational. Williams' comprehensive review of the research (1979) identified 15 themes, present in varying weights in studies showing the association of value systems to a wide range of behaviours including career choice, political attitudes, racism, and cheating. Hofstede (1980), on the other hand, has argued that cross-cultural work

demands only three main thrusts, or relationships: those with other people; those with things; and those with our inner selves and God. Others have developed their own categories for individual testing situations (e.g., Homer & Kahle, 1988; McMahon et al., 1982) or used combinations or modifications of existing instruments (e.g., Bond & Yang, 1982; Braithwaite & Law, 1985).

Values Measurement

The Rokeach Value Survey

The Rokeach Value Survey (RVS) is one of the most frequently used values measurement instruments. Developed in the late 1960s, it investigates value hierarchies through a ranking of "terminal" and "instrumental" values. Rokeach (1973) viewed values as conceptions of the socially or personally preferable, using terminal values to represent end states, and instrumental values as a means to achieve desirable end states (see Appendix A for a complete list of the values).

The terminal values were developed in two stages, gathering and refinement. Gathering involved combining lists of values from a literature review of values in American and other Western societies, Rokeach's own values, and those of 30 graduate students, and 100 adults in Michigan. The list was cut to 12 by eliminating synonymous words, overlapping or narrow concepts, and those which did not represent end states. Six values deemed essential were then added to the 12 to reach 18.

Instrumental values were taken from existing lists of over 18,000 personality traits, reduced to 200 positive concepts, and then culled to 18 by removing synonymous words and concepts which would represent "vanity", and choosing items that would result in maximum discrimination across race and sex. The author admits that the process was somewhat "intuitive".

The 36 values are presented in two groups of 18 with instructions to rank in order of "importance to you,...your life". Reliability for terminal values ranges from .69-.76, and for instrumental from .61-.65 (Rokeach, 1973). Inter-item reliability ranges from .45-.88, with items ranked highest and lowest showing the least change, those in the middle the most. Lau (1988) correlated RVS scores with a personal values instrument in a Hong Kong population and found strong support for RVS validity.

The RVS has been criticized in several areas, most frequently on the actual values used, and their ipsative nature (Braithwaite & Law, 1985; Hofstede & Bond, 1984; Zavalloni, 1980). Braithwaite and Law (1985) asked a sample of adults to criticize the RVS, and to add any values they felt were missing. Suggested changes included rating, not ranking the values (found to be non-significant by Ng, 1982), splitting terminal into social and personal values, inserting the word "being" before each value, and allowing for equal ranking or tied scores. Additional items more than doubled the RVS which was ultimately split into three inventories. A factor analysis revealed that these three inventories contained two factors not incorporated in the RVS, physical development and well-being, and basic rights and necessities.

Others have expressed concern about the broad nature of the RVS and its usefulness in predicting specific behaviours with very narrowly defined groups (Homer & Kahle, 1988), and very heterogeneous groups (Coyne, 1988).

The Echo Technique

First developed by Alex Bavelas for the "Moral Ideology Test" (Bavelas, 1942), one of the main purposes of the Echo technique is to avoid the problem of researcher imposed value categories, and to instead "generate reliable, culturally unbiased information about the prevalent value hierarchy and related influence structure in any selected population" (Barthol & Bridge, 1968, p. 1346). Echo provides a means of investigating

and describing group values in a way that utilizes spontaneous group responses rather than preconceived categories. That is, Echo allows the experimenter to "reflect back to the population, the population's own words" (Schaefer, Bavelas, and Bavelas, 1980, p. 83). General questions are asked, and repeated several times, resulting in a pattern of answers over time. Using the Echo technique, it is possible to generate information concerning a population's values, influences and beliefs. By gathering salient individual values it is possible to compile group values and belief systems. This information can then be used to construct an instrument of measurement for future application to similar groups (George, 1980). The resulting instrument has the advantage of using only items which have previously been identified as important to the population under study, and it presents these items in the vernacular of that population. Depending on the heterogeneity of the group under study, however, the instrument may have a very narrow range of applications. This, coupled with laborious data collection and scoring, may be the basis of infrequent use of the technique.

The technique typically involves asking two questions about behaviours- "What is a good thing to do?", and "What is a bad thing to do?, with companion queries on the "approvers" and "disapprovers" (called "surrogates" by Bavelas) of these behaviours- "Who would approve of this?", or "Who would disapprove of this?". Depending on the group under study, the actual questions are preceded by instructions which place the questions in context and narrow the possible range of responses. For example, Barthol & Bridge (1968), in investigating employee and company values in a large insurance company, asked employees to reply reflecting their position in the company. They also asked that other employees be used as surrogates or approvers for the behaviours, thereby narrowing the range of responses to the worksite.

In terms of responding as an individual vs. a member of the group as a whole, it is assumed that the subject gives their own point of view (Bavelas, 1942). The responses are

then sorted into naturally occurring categories based on frequency. For example, in a school, responses may fall into categories of sports, academic, or social behaviours, or may be even more specific creating sub-groups within one of the major groupings. The sorting procedure is validated by re-sorting, preferably by several external experts or indigenous judges.

Reliability for the technique is good. Havighurst and Neugarten (1954) found .91 six month test-retest reliability for girls, .86 for boys. Sampling variations indicate that within a homogeneous sub-group, a sample of 15-20 will reflect the values of 100-200. However, given the paucity of Echo research, Barthol and Bridge (1968) identify several issues concerning Echo that require further investigation including: the number of times a question is asked (anywhere from 5 to 10 repetitions appears to be effective); reliability of category sorts; sensitivity- the relationship of the question wording to the specificity of responses; the characteristics of the individuals sorting the responses, advantages of indigenous vs. external sorters; validity, relationship to other measured behaviours; and variations of design, for example, ideal vs. real, diversified surrogates, valuation (good/bad, right/wrong), and reinforcement (variations on approve/disapprove).

Values Research

Cross-Cultural

Much of the cross-cultural values research to date has been conducted with the Rokeach Value Survey (e.g., Bond 1982; Feather, 1986; Furnham, 1984; Ng, Hossain, Ball, Bond, Hayashi, Lim, O'Driscoll, Sinha, & Yang, 1982). The exceptions have used the Echo technique, Allport, Vernon and Lindzey's instrument (1960), or a combination of it, and the RVS.

Triandis, Bontempo, Leung and Hui (1990) used the latter method to compose two lists of 35 values for use with American and Hong Kong undergraduates. In a departure

from usual procedures, they formed triads of students to reach consensus on value priorities assuming this would measure individual values in a cultural context. Of the four top rated values, the two samples had two in common- harmony with the environment, and the need for close, intimate friendship. Differences were the American choice of contentment, and being able to take advantage of opportunities, and the Hong Kong emphasis on persistence (ranked first) and courtesy.

Using the RVS, Bond (1982) examined the effect of language on a bilingual (Chinese/English) sample of Chinese undergraduates in Hong Kong. He found some movement toward Western values on the English RVS ("cross-cultural accommodation"), and increased ethnic affirmation on the Chinese RVS. However, this varied with value importance. The more important the value, the less likely cross-cultural accommodation. Lau's (1988) previously mentioned validation of the RVS used 927 Hong Kong undergraduates. Male students ranked sense of accomplishment highest (ranked number 8 for women), female students chose happiness (ranked number 5 for males). There were no significant differences by year or field of study. Overall the top values were true friendship, wisdom, self-respect, happiness, responsible, courageous, intellectual, and capable. Lau interpreted the results as indicating an emphasis on competency and accomplishment, devaluing ambition and imagination, and with little support for the "caring" personality.

These results vary from Triandis et al. (1990), but given the slight variation in instruments, are not surprising. The RVS does not incorporate "persistence" or "courtesy". The findings are very similar to Feather's comparison (1986) of students from Australia and mainland China. Four of the top eight values are common for both Chinese samples, while the major differences between the Australians and Chinese were an emphasis on self-related values by the former, and competence and scholarship by the latter. Within the Chinese sample, men rated mature love more positively. In the

Australian sample, women rated inner harmony and independence more positively. Feather's Australian students were also very similar in their ratings to the Americans studied by Triandis, et al. (1990).

Ng et al. (1982) used a modified version of the RVS (four extra values were added) with university students in nine Pacific Rim countries. They found New Zealand and Tasmania to have a similar orientation to "self-related" values; Bangladesh, India, and New Guinea to stress the "societal and materialistic"; Japan "self-oriented and materialistic"; and the Chinese samples to be a unique combination of "societal and self". Overall sex differences indicated a male preference for power, an exciting life and independence, and a female preference for family, loving, and a world at peace.

Bond (1988) completed a factor analysis on this same data, and compared it with a factor analysis of a 21 culture study using the Chinese Value Survey, a 40 item semantic differential instrument. Two factors emerged for the Chinese Value Survey, social integration vs. cultural inwardness, and reputation (social standing) vs. social morality Four factors emerged for the RVS: competence (intellectual, independent) vs. security (world at peace, family); personal morality vs. success; social reliability (e.g., polite) vs. beauty; and political harmony vs. sociability. Significant sex differences were found on two factors, males were higher on competence, females were higher on personal morality.

A separate analysis of the Chinese Value Survey, based on the 21 country study (The Chinese Culture Connection, 1987), resulted in four factors: "integration", a grouping of social stability, tolerance and harmony; "human-heartedness", including patience and courtesy; "moral discipline", including prudence and adaptability; and "Confucian work dynamism", including persistence and protecting face. The values for the Survey itself were developed from lists of 10 "fundamental and basic values" prepared by Chinese social scientists. The four factors varied significantly across culture with the largest difference on "Confucian work dynamism". This factor had strong positive

loadings for Hong Kong, Japan, Taiwan, and South Korea, and negative loadings for all the Western countries including Canada, England and the United States.

Yang's (1986) review of 20 value studies with Chinese students in mainland China, Hong Kong, Taiwan and the United States identified a shift away from traditional values to more "Americanized" values of individualism and a future orientation, but a continued emphasis on social concern.

Conformity with parental values appears to vary with achievement for some cultures. Studies of Polish and Mexican-American students (Borzym, 1981; Buenning & Tollefson, 1987) found that the values of gifted children showed a discrepancy with parental values, while those of average performance did not. Hanson and Ginsberg (1988) found an opposite trend looking at only educational values with white adolescents who were high achievers in math. These students uniformly exhibited a strong sense of self control over their lives, held high self-expectations, and held educational values similar to those of their parents. However, as well as the difference in scope of values investigated, both the former studies used a younger sample, students whose values would not yet be crystallized. The effect may disappear with age.

Overall, between the Asian and North American (and Australian) cultures, strong value differences emerge. However, within the two cultures, the sex differences are quite similar. Cross-cultural differences can be summarized as an Asian emphasis on the combined concept of society and self, accomplishment and competence, persistence, courtesy and a sense of maintaining face, and a white emphasis on the individual self, self-actualization, ambition, contentment and a comfortable life. Similarities between the two cultures include the importance of close friendship, and harmony with the environment. As well, in both cultures males rate power and accomplishment more positively, while females emphasize happiness, a world at peace and family values.

Science and Engineering

Research on the relationship between values and occupational choice for the most part concentrates on choice of university major, with very little work done using actual workforce participants. Exceptions to this include a study by Rokeach (1979b) focusing on science as a social institution. Rokeach theorized that it would be possible to define the social institution called science by using expert witnesses. He used five sources: a content analysis of editorials in Science magazine; personal values of scientists, and graduate students in science; and the perceived values of science by scientists and non-scientists. Overall, the top rated values were wisdom, freedom, self-respect, sense of accomplishment, intellectual, capable, honest and responsible. The least favoured values were salvation, national security, mature love, comfortable life, obedient, clean, polite, and loving. There was higher agreement among the five methods for instrumental (means to an end) rather than terminal (desirable end state) values.

The most deviant group were the graduate students. Their responses tended to include some quality of life characteristics that were not evident in the older samples. Their preferences included happiness and loving, while their least favoured values included social recognition. The most conforming values were those perceived of science by scientists, closely followed by scientists' own personal values. Perhaps one of the most interesting findings of the study, and one not fully discussed by Rokeach, is the similarity between scientists' personal, and perceived values. This value congruence is particularly interesting for Echo research where empirical work has yet to be done on the true nature of the values elicited based on the questions asked. Rokeach's work supports the assumption that responses will be congruent regardless of the wording used. What is still unknown is the direction of the congruency, whether personal values conform to institutional values or vice versa.

The RVS has also been used to discriminate among university majors. A comparison of 463 first year students in the humanities, social science, and natural science (Feather, 1970) indicated differences among the three groups. Students in the humanities gave high rankings to world of beauty, forgiving, imaginative and intellectual, and low rankings to ambitious, capable and self-controlled. Social science and natural science students both gave high rankings to a comfortable life, while natural science students alone also preferred capable and self-controlled, and rated forgiving very low. The similarity of social science and natural science students is interesting, but the study has one major drawback, the data was gathered prior to participation in the faculties. Given the very high migration out of the sciences in first year, these findings must be interpreted carefully.

Overall, identified sex differences included higher ratings by males for a comfortable life, pleasure, ambitious, broadminded, capable and logical. In addition, males gave lower rankings to a world at peace, salvation, honest and loving. Feather (1984) investigated his theory about a values/self link by administering the BSRI, the RVS, and a personality questionnaire to undergraduates in Australia. Significant sex role/value correlations included a positive correlation of masculinity with freedom, and femininity with loving, and negative correlations between masculinity and loving, and femininity and logical, and a comfortable life. Significant sex differences in actual rankings were male choices of comfortable life and logical, and female preferences for loving, inner harmony, honesty, and self-respect. Self-described personality characteristics correlated with value preferences, leading Feather to suggest a relationship between the two.

Al-Asadi (1989) used the Work Value Inventory to test third and fourth year students in natural science, social science, the humanities, education and law. He found no significant differences among males in separate faculties, but a high variability among females, with females in education showing the greatest difference from all other areas. There were no significant sex differences within university majors, but females in the

natural sciences showed a tendency to value prestige, while those in the humanities valued aesthetics. The author concluded that the Work Values Inventory did not have the sensitivity to discriminate among areas, but his sample was very small, including only four women outside of the field of biology in science.

Using questionnaires on work interest and opinions about children, and the BSRI, Galejs & King (1983) compared women majoring in engineering to those in the social sciences. Women in engineering reported a stronger need to parent, but wanted fewer children, viewed themselves as more independent, valuing status and promotion more, were more likely first born and came from larger communities than women in the social sciences. Women in social science viewed themselves as more feminine, less incisive and diplomatic, and more interested in careers that allowed for their family than women in engineering.

Early work by Allport et al. (1960) indicated that engineers (male) viewed themselves as more theoretical and interested in power than other occupations. Greenfield et al.'s (1982) work with first year engineering students found significant sex differences in reasons for choosing the field. Both males and females cited employment certainty, challenging work, and problem solving opportunities, but for men the other primary reason was co-worker respect, for women, to help others. Taylor and Whetstone (1983) compared male and female undergraduates in engineering, arts and science, and in an Air Force Academy, and found that overall the engineers rated themselves as more precise, logical, and intellectual than the other two groups. Female engineers rated themselves as less willing to counsel and teach others than females in the other two groups, while male engineers rated themselves as less "philosophical and theoretical".

Women who leave the field of engineering and return later in their careers question the values they previously accepted, and look to different jobs incorporating social welfare aspects (Swarbrick, 1984). Carter and Kirkup (1990) found the most enthusiastic

practicing female engineers in their sample were those whose jobs were linked to the environment, and female enrollments at the University of British Columbia graduate school of engineering have increased dramatically since the introduction of an environmental engineering program (Young, 1990).

Studies with high school students support a sex difference in values and participation in science. Girls have higher scores in science responsibility than boys (Linn & Petersen, 1986). For girls, an understanding of the social implications of science correlates with their choice of the subject, a finding not replicated for boys (Harding, 1986), and as already mentioned, eighth grade girls say they use personal values for decision making while boys say they prefer logic (Baker, 1985). Ormerod (1981) reported that boys' attitudes concerning payoff and practicality lead them into science. Girls' participation is based on aesthetic and humanitarian beliefs, but this does not hold true for biology, only chemistry and physics. As well, the converse is true, lack of these beliefs will divert girls from chemistry and physics but not biology.

Walberg's (1969) study of over 2000 high school physics students examined 56 variables and found values to be the biggest discriminator between males and females. Using a combination of the RVS and The Study of Values (Allport et al., 1960), the author identified higher religious, social and aesthetic values for girls, and higher economic, political, and theoretical values for boys. He also found that the traits of a scientist developed by Taylor and Barron (1975, see Appendix B for a complete list), distinguished high and low achievers in the field.

Throughout the values research, the female emphasis on social values and helping behaviour emerges. Sutherland and Veroff (1985) feel that satisfaction of women's affiliative needs is in fact crucial for the satisfaction of achievement aspirations. Women scoring high on the need for achievement measure also score high on affiliation and power.

Gilligan (1982) argues that women and men view adult social reality differently, men focussing on separation, women on interdependence.

4. A Model for Values and Behaviour

Rokeach (1979a) criticized predictive models incorporating social constraint, social influence, social pressure and norms as contributory variables, for their narrow scope. He felt a more relevant application of these variables was not their direct influence per se, but the individual's perception of them. Eccles (1984) takes an identical path arguing that reality is not tantamount, but instead one's interpretation of reality. Her model of achievement (see Figure 1, overleaf, Eccles, 1984, p. 103), links achievement choices to expectancies for success and subjective task value, but also accommodates a wide range of cultural, affective, attributional, and self-related variables. Values provide options, experiences, objects, and behaviours with a negative or positive affect dependent on the individual. The strength of the affect is dependent on the many other variables identified in the Eccles model, and the individual's own value hierarchy. Acceptance of the model does not discount other variables such as self-efficacy, demographics, and self-esteem, rather it acknowledges their existence and potential for differential weighting.

Support for this model is found in research such as Canter's (1979) study identifying a strong positive correlation (r= .70) between expectancy of success and aspiration. Chipman (1987) also supports the Eccles model, specifically for science and engineering participation. She argues that the "achievement-related choices" influenced by expectancy of success, and outcome value, are in the case of science and engineering, participation. However, she questions the present focus on equal participation of every population in every occupation. If the current choices "reflect individual and cultural differences in values...rather than arbitrary discriminatory barriers or discouraging

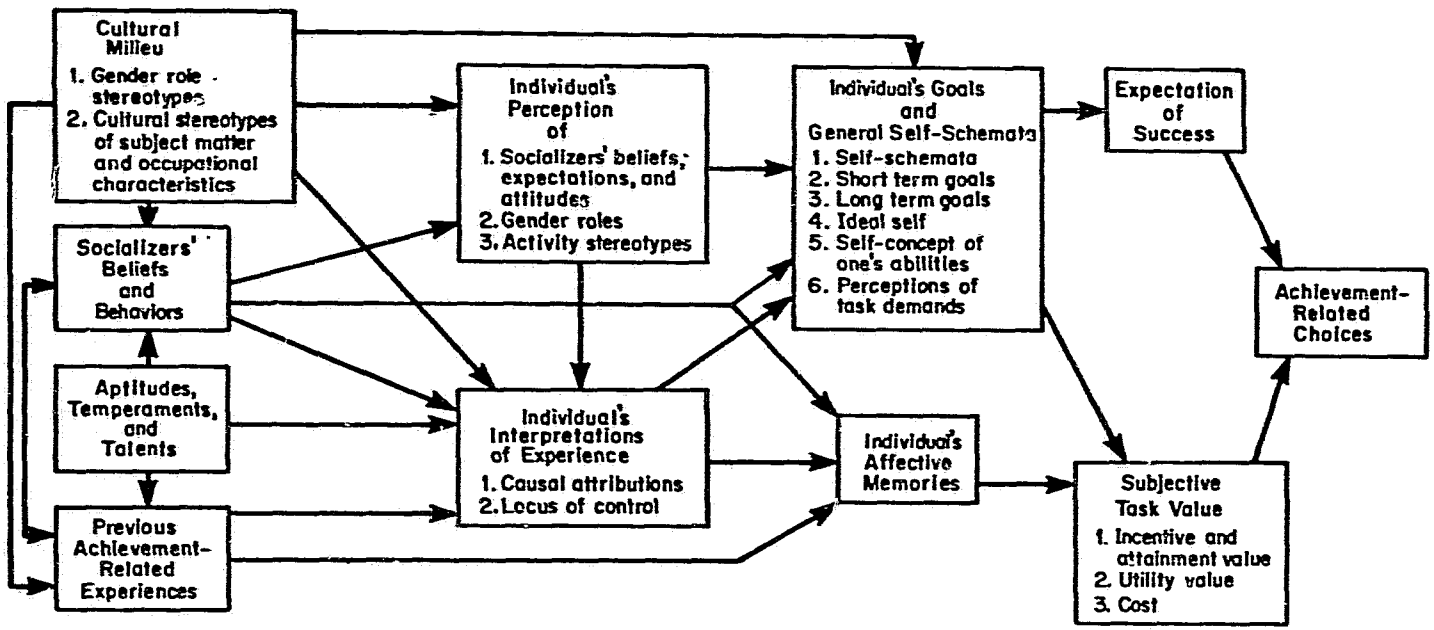


FIGURE 1. General model of achievement choices.

treatment...should we regard that as a problem? Is it in any way appropriate to modify those values?" (Chipman, 1987, p. 47).

The present study seeks to illustrate that it is the very women who keep many of their separate, and cultural values intact, and recognize that the fields of science and engineering can incorporate them, that will move into these areas. It is not value modification, but a recognition that the fields of science and engineering can incorporate these different values.

Chapter Two: The Hypotheses

Based on the results of previous research which indicate that values may play a key role in occupational interest, choice, and participation, the present study was undertaken in two stages to examine both value differences by race, sex, and area of study, and the overall process of values measurement.

The Echo Study

The intent of the first study, the Echo Study, was twofold. First, to use the Echo technique to gather information about the values held by students in the PSE and the humanities, and to examine these values for differences by sex, race and area of study. Second, to create a new values measurement instrument using the Echo generated values.

The following hypotheses were made:

1. There will be significant overall differences in the nature of the responses generated between the PSE, and the humanities.
2. There will be significant sex differences on the responses generated within the PSE and the humanities, and overall between the two areas of study.
3. There will be significant race differences between white and Chinese students overall, and within the science and engineering major for females.
4. There will be differences between the values elicited through the Echo technique and those included in the Rokeach Value Survey.
5. Within the PSE, there will be differences between sex, and race, on the identified surrogates for behaviours.

The Value Study

The second study, the Value Study, was also structured to identify differences and similarities in the values held by students in the PSE and the humanities. In addition, by using an existing instrument, the Rokeach Value Survey, and the newly created Echo instrument, comparisons with previous research and between the two instruments were made possible.

The following hypotheses were made:

1. There will be significant differences in the ranking of values on the Rokeach Value Survey by students in the PSE and those in the humanities.
2. There will be significant race and sex differences in the ranking of values on the Rokeach Value Survey.
3. There will be significant differences in value rankings on the Echo instrument between students in the PSE, and those in the humanities.
4. There will be significant differences in the sensitivity of the Echo instrument and the Rokeach Value Survey to discriminate between students in the PSE and those in the humanities.

Chapter Three: The Echo Study

A. Method

1. Pilot Testing

Eight Echo questions were developed for the study. The eight covered personal values, and more general views concerning the role of science and the humanities in society. In order to verify the wording of the questions, determine the order of their presentation, and gauge the time required for completion, the questions were pilot tested. Six students, 3 from the PSE and 3 from the humanities, were given four repetitions of each of the eight questions to complete (a total of 36 questions with 28 companion surrogate questions). Presentation order was varied, one half of the students had the personal questions first, the other half had the general questions first. After completion, the students were also interviewed regarding concerns with the wording of the questions, and the order of the questions.

Several changes resulted. First, the personal questions were moved to lead the questions. Second, given time constraints for administration of the questions, the number of repetitions of the questions was altered. The personal questions, which are more pertinent to the overall focus of the value study, remained at four repetitions. The others were dropped to three and two repetitions. The last change was in the wording of one of the surrogate questions which confused the students. "Who would disapprove of this?" was replaced with "Who would disapprove if you did this?" where appropriate.

2. The Main Study

Sample

A total of 127 students in third and fourth year at the university were used in the study. Of the total, 78 were majoring in engineering, chemistry, computer science or

mathematics (60 males, 18 females), and 49 were majoring in English or history (27 males, 22 females).

Procedure

The Echo questions were administered during regularly scheduled class time, in the classroom, by the experimenter. Participation was voluntary and each student received an introductory sheet which explained the task, and its voluntary and confidential nature (see Appendix C).

The following eight questions, with companion surrogate questions where indicated, were used for the Echo study. Based on the results of the pilot testing, each question, and its companion surrogate question, was repeated two, three, or four times. The number of repetitions for each question, or pair of questions, is noted following the individual questions:

1. What is an important personality characteristic for you to have? Who would approve of this? (4 repetitions)
2. What is a poor, or bad, personality characteristic for you to have? Who would disapprove of this? (4 repetitions)
3. What is an important thing that you could do with your life? Who would approve of this? (4 repetitions)
4. What is a poor, or bad, thing that you could do with your life? Who would disapprove if you did this? (4 repetitions)
5. What will be a positive impact of workers in your field on society? (3 repetitions)
6. What will be a positive impact of workers in the field of the humanities (or science and engineering) on society? (3 repetitions)

7. What is an important thing that you, as part of the fields of science and engineering (or the humanities) in the future, could do? Who would approve of this? (2 repetitions)
8. What is a bad thing that you, as a part of the fields of science and engineering (or the humanities) in the future, could do? Who would disapprove if you did this? (2 repetitions)

The questions were administered in the typical Echo manner with each question printed on one slip of paper. All eight questions were printed on a different colour of paper. Students also completed a one page demographic questionnaire after the Echo questions (see Appendix D). All responses, and the demographic questionnaire, were coded with a student identification number. Due to the timing of the Echo study, less than one month after the outbreak of the Persian Gulf crisis, the questionnaire included one question concerning attitudes toward Canada's participation in the war. The intent of gathering this information was to control for possible effects of attitudes toward the war on Echo responses.

B. Results

1. The Questionnaire

Demographic Profile

A summary of the demographic data is presented in Table 1. Due to the very low representation of Chinese students in the humanities, analysis by race will only include the Chinese students in the PSE. Due to the small number of Chinese females , formal analysis is not feasible. Only anecdotal comparisons between white and Chinese females in the PSE will be made.

Table 1

Demographic Characteristics, the Echo Study

	Area			
Variable	Humanities		PSE	
Age	M= 24.1 years		M=24 years	
Racial Origin:	Male	Female	Male	Female
White	26	21	47	13
Chinese	0	1	8	4
Other non-Caucasian	1	0	5	1
Place of Birth:				
Canada	85.7%		74.4%	
Other	14.3%		25.6%	
Parents' Educational Level:				
No Post Secondary	36.7%		53.2%	
One Parent Has	32.7%		28.6%	
Both Parents Have	30.6%		18.2%	
Own Expected Level of Education:				
Undergraduate	42.5%		48.0%	
Graduate Degree	26.8%		38.7%	
Doctorate	10.6%		13.3%	

The War Question

No relationship was found between support for the war and responses concerning the war, international relations, or weapons. Average support ratings for the groups were as follows (1= strongly agree with Canada's participation; 5= strongly disagree): engineering males= 2.4; engineering females=2.5; chemistry/math females=2.6; humanities males=2.7; chemistry/math males=2.9; humanities females=3.2.

2. Echo Question Responses

Number of Questions Completed

The responses to each question were first sorted by area of study, sex, and race. Overall, 3006 or 91% of the Echo questions were completed. Female and male completion rates for Echo questions were 95% and 84% respectively. Students in the PSE completed 90.7% of the Echo questions, while students in the humanities completed 91.6%. Chinese students completed 90.2%.

Question Responses

The Echo responses were sorted into categories of response separately within each question for males, and females, in the PSE and the humanities. In addition, PSE responses were further sorted into white and Chinese males and females.

The nature of the Echo method is to allow "free-falling" responses that naturally group together. By sorting first on the basis of the four major interest groups, maximum flexibility is allowed. The resulting categories contain groupings of similar words and phrases. For example, "kind, loving, considerate" would be grouped with responses such as caring and thoughtful. The sorting of responses into these categories was completed by the experimenter and validated by two external judges. Agreement was close to 100%.

The number and nature of categories varied by sex, area of study, and nature of question. Answers to personal questions exhibited the widest variation, questions concerning field of study resulted in a narrower range of responses.

The categories were then rank ordered, on the basis of number of responses within each category, for each sex, within each question, separately for students in the PSE and students in the humanities. The top categories were compared in each case and overall summaries by sex and area of study were compiled (see Appendix E). The number of top category comparisons varies across groups and questions due to equal, or very low frequencies in some categories. The low frequency counts for categories in the last four questions produced a narrow range of categories which did not allow for meaningful comparisons beyond four.

Due to unequal sample sizes, simple rank comparisons were made across groups, and chi-squares calculated where differences by sex, race, and area of study were indicated. All chi-squares used a 2-tailed test of significance unless otherwise noted (see Table 2 overleaf for a summary of individual frequencies).

In addition, simple effect comparisons were made by sex, race, and area of study on category order. For example, "honesty" may have been in the top five categories for all groups, and statistical comparisons of actual frequency counts would not result in a significant difference. However, if "honesty" was the largest category for one group and the fifth largest for another, this relative difference in frequency counts is worthy of note. For all Echo questions, significant statistical differences and simple effects of category size and ranking are reported.

Question 1: What is an important personality characteristic for you to have?

Overall, the top five responses were as follows:

1. Kind, caring, loving.
2. Diligent, hard working, determined.

Table 2

Echo Study. Frequencies of Mention Within Category by Sex, Race, and Area of Study

Category	Sex		Area of Study		Race (PSE)	
	Males (N=87)	Females (N=40)	PSE (N=78)	Humanities (N=49)	Chinese (N=12)	White (N=60)
Diligent/determined			42	15		
Easygoing/sociable	PSE males= 20 (N=60)		Humanities males=2 (N=27)			
Tolerant/open-minded	PSE males= 11 (N=60)		Humanities males=12 (N=27)			
Confident	Chinese PSE males=2 (N=8)		White PSE males=0 (N=47)			
Lack of Confidence	9	10				
Self-Critical	PSE females=8 (n=18)		Humanities females=10 (N=40)			
Shy/introverted			13	1		
Unkind/inconsiderate					10	22
Career Success			35	9		
Financial Success					9	16
Self-Development	PSE males=13 (N=60)		Humanities males=19 (N=27)			
Teach	14	16				
Complete School	6	12				
Waste Potential	46	39				
Family Mistakes	PSE males= 8 (N=60)		PSE females=11 (N=18)			

Table 2 continued

Echo Study, Frequencies of Mention Within Category by Sex, Race, and Area of Study

Category	Sex		Area of Study		Race (PSE)	
	Males (N=87)	Females (N=40)	PSE (N=78)	Humanities (N=49)	Chinese (N=12)	White (N=60)
Humanities Questions:						
Help Environment	5	6				
Teach			7	22		
Foster free thought			12	18		
Art/literature	11	13				
PSE Questions:						
Medical Advances	29	23				
Help Environment	28	28	31	25		
Economic Wealth			20	1		
Research, Teach	PSE males= 5 (N=60)			PSE females=7 (N=18)		

3. Honesty.
4. Tolerant, open-minded
5. Sense of humour.

Students in the PSE were more likely to mention "diligent and determined" than students in the humanities, $x^2(1, N=127) = 6.57, p<.01$. Males in the PSE were more likely than males in the humanities to mention "easy-going, sociable", $x^2 (1, N=87) = 6.63, p<.01$. While males in the humanities were more likely than males in the PSE to mention "tolerant, open-minded", $x^2 (1, N=87) = 6.53, p<.01$, Chinese males in the PSE mentioned "confident", while white males did not, $x^2 (1, N=55)= 12.19, p<.001$.

In terms of category rankings, overall, "honesty" was the most frequently mentioned female response but ranked number three for males.

Question 2: What is a poor or bad personality characteristic for you to have?

Overall:
1. Lazy, procrastination.
2. Moody, short-tempered.
3. Arrogance, conceit.
4. Inconsiderate, unkind.
5. Dishonest.

Overall, females were more likely to mention low confidence than males, $x^2 (1, N=127) = 4.63, p<.03$. Females in the PSE were more likely to mention low confidence than those in the humanities, but this difference was not significant ($p>.05$).

Females in the PSE were also more likely to mention "self-critical and perfectionist", x^2 (1, N=40)= 9.04, p<.003, as poor personality characteristics. Both male and female students in the PSE also more frequently mentioned "shy, introverted"than students in the humanities, x^2 (1, N=127)= 6.56, p<.01. Chinese students in the PSE were more likely to mention "inconsiderate, unkind, cruel", x^2 (1, N=72) = 8.82, p<.002.

In terms of category rankings, the most frequently mentioned category by males in the humanities was "egocentric, snob, arrogant". This category ranked fifth for males in the PSE, and fourth for both groups of females. Unlike the other three groups, females in the humanities did not mention the second-ranked "moody. short-tempered" at all.

Question 3: What is an important or valuable thing that you could do with your life?

Overall:

1. Help others, help the disadvantaged.
2. Family related (e.g., get married, raise good children, care for parents).
3. Career success.
4. Self-development, self-exploration, self-fulfillment.

Students in the PSE students more frequently mentioned "career success", x^2 (1, N=127) = 9.34, p<.002, than those in the humanities. Within the PSE, Chinese students more frequently mentioned "financial success" than did white students, x^2 (1, N=72)= 10.31, p<.001. Males in the humanities were more likely than those in the PSE to mention "self development", x^2 (1, N=87) = 18.1, p<.001. Overall females were more likely than males to mention "teach", x^2 (1, N=127) =8.68, p<.003, and "complete a degree, stay in school", x^2 (1, N=127) =12.02, p<.001. Several males, but no females, mentioned "become a politician". There were no significant differences by area of study in the frequency of mention of "help others".

Question 4: What is a poor or bad thing that you could do with your life?

Overall:

1. Waste it, do nothing, abuse potential.
2. Hurt others, cause pain to others.
3. Commit a crime, be dishonest.
4. Abuse personal health, become a drug addict or alcoholic.
5. Quit school.

Overall, females were more likely than males to mention "waste it, abuse potential, do nothing", x^2 (1, N=127) = 24.66, p<.001. Within the PSE, females were more likely than males to mention "Family mistakes, lose touch with family and friends", x^2 (1, N=78) = 17.15, p< .001.

In terms of category rankings, for both females in the PSE and males in the humanities, family references were one of the top four categories. Overall, family references for females more frequently included "choosing the wrong husband", for males, infidelity.

Question 5 : What will be a positive impact of workers in the humanities on society?[2]

Overall PSE Responses:

1. Help others (social, emotional, health problems).
2. Understand human behaviour/nature.
3. Enhance culture, develop art and literature.
4. Expand our horizons and social conscience, increase wisdom and knowledge.

[2]Questions 5 and 6 asked students to identify positive impacts of workers in their own field, and the other field (PSE or the humanities) respectively. The reporting of responses to these questions varies from the other questions to reflect the content of responses by area of study.

Overall Humanities Responses:

1. Understand society/human nature.
2. "Educate others", and "Increase awareness, wisdom, free and creative thought" (rated equally).
3. Through the study of history, learn from past mistakes.
4. Improve social services.

Overall, females were more likely than males to mention "help the environment" but this difference was only marginally significant at the 1-tailed level, x^2 (1, N=127) = 2.1, p< .04. Students in the humanities were more likely than students in the PSE to mention "teach, educate others", x^2 (1, N=127) = 22.04, p< .001, and "increase wisdom, encourage free thought", x^2 (1, N=127) = 7.6, p< .005. Within the PSE, several males but no females mentioned man/machine interface. Overall, females more frequently mentioned art and literature than did males, x^2 (1, N= 127) =7.05, p<.008.

White males in the PSE had the lowest completion rate (70.2%) on this question concerning the impact of the humanities on society of any group on any question (female completion rate= 91%, Chinese males= 83.3%). Males in the humanities, on the corresponding question concerning a positive impact of workers in the PSE, had a completion rate of 86%.

Question 5: What will be a positive impact of workers in the fields of science and engineering?

Overall PSE Responses:

1. Improved goods and services, both health and general.
2. Improved standard of living.
3. Help for the environment.

4. Increased economic wealth and productivity; job creation.

Overall Humanities Responses:

1. Help for the environment.
2. Improve the standard of living, help less fortunate.
3. Health and medical advances.
4. Technical advance, innovation and understanding.

Overall, females were more likely than males to mention "health and medical improvements", x^2 (1, N=127) = 6.62, p<.01, and to mention "help the environment", x^2 (1, N=127) = 15.1, p<.001. This difference was significant within the PSE as well, with females more likely than males to mention "help the environment", x^2 (1, N=78) = 5.94 p<.01. Students in the PSE more frequently mentioned "economic wealth and productivity" than did students in the humanities, x^2 (1, N=127) = 12.15, p<.001.

Question 7 (PSE): What is an important thing that you, as part of the workforce in science and engineering in the future, could do?

Overall PSE Responses:

1. Improve the standard of living (40% general responses, 37% environment, 23% health).
2. Create better products and processes.
3. Research, teach, increase knowledge in the field.

Unlike males, females in the PSE made specific mention of helping third world countries. Females were also more likely to mention "research, teach, increase the

knowledge base" than males, x^2 (1, N=78) = 9.93, p<.002. Males instead made reference to more specific technological developments, or fields of endeavor.

Question 8 (PSE): What is a bad thing that you, as part of the workforce in science and engineering in the future, could do?

Overall PSE Responses:

1. Exploit or hurt the environment through science and technology.
2. Develop weapons.
3. Hurt people.
4. Be irresponsible, ignore social needs and interests.

There were no significant sex or race differences.

Question 7 (Humanities): What is an important thing that you, as part of the workforce in the humanities in the future, could do?

Overall Humanities Responses:

1. Educate others.
2. Help others, improve the human condition.
3. Increase awareness, freedom of thought, critical thinking.

There were no significant sex differences.

Question 8 (Humanities): What is a bad thing that you, as part of the workforce in the humanities in the future, could do?

Overall Humanities Responses:

1. Mislead others, pursue personal gain at the detriment of others, abuse position of trust.

2. Perpetuate narrow, rigid thinking, bias and prejudice.
3. Waste education, do nothing.
4. Be uncaring, ignore world problems and social needs.

Females in the humanities were more likely than males to mention "ignore social problems, be uncaring", x^2 (1, N=49) = 7.01, p<.008.

3. Surrogate Question Responses

Responses to the questions "Who would approve of this?" and "Who would disapprove of this?" were first sorted by area of study, sex, and race. Overall, 2204 or 86% of the surrogate questions, were completed. Female and male completion rates were 90.3% and 84.2% respectively. Chinese males and females completed 90.3% and 91.2% respectively.

The surrogate questions allowed for more than one approver or disapprover per answer. The total 2204 completed surrogate responses resulted in 2554 actual mentions. Males in the PSE mentioned the fewest surrogates (17.7 per student), females in the humanities mentioned the most (24.5 per student).

A summary of overall "approvers and disapprovers", in descending order of percent of frequency of mention is presented overleaf in Table 3. Table 4 presents a breakdown by area of study, sex, and race.

Across the four groups of male and female PSE and humanities students, female PSE and male humanities students were the most similar in their choice of approvers and disapprovers, male PSE and female humanities students were the most different. Male PSE students were more likely than female humanities students to use "everyone" (38.2% and 19.4% of responses respectively). Female humanities students were the only group to

Table 3

Overall Frequency of Surrogate Mentions.

Surrogate	Percentage of Responses
"Everyone" or "society"	33%
"Myself" or "me"	26%
Family (includes parents, individual family members or "family")	19%
Friends (includes boyfriend or girlfriend)	16%
Employer	3%
God	1%
Professor	1%
Other	1%

Table 4

Percentage of Echo Surrogate Responses by Sex, Race and Area of Study

	Sex			
Area	Males		Females	
	Surrogate	%	Surrogate	%
PSE	Everyone	38.2	Everyone	33.4
	Myself	28.2	Myself	24.0
	Friends	13.8	Family	24.0
	Family	11.6	Friends	15.4
	Employer	4.6	Employer	2.4
	God	2.2	Professor	0.5
	Professor	1.4	God	0.3
Chinese	Everyone	29.1		
	Myself	25.7		
	Family	20.9		
	Friends	15.2		
	Employer	5.7		
	Professor	3.4		
Humanities	Everyone	34.2	Family	28.1
	Myself	25.9	Myself	25.2
	Family	22.1	Friends	20.0
	Friends	14.7	Everyone	19.4
	Employer	1.5	Employer	3.1
	God	1.2	Professor	1.8
	Professor	0.4	God	1.1
			Other	1.3

use "family" most frequently, and overall, females used "family" more frequently than males (26.5% and 15.3% of responses respectively). Chinese students also used "family" more frequently than white students in the PSE (20.9% and 14.8% of responses respectively). Within the humanities, females were more likely to mention "friends" than males (20% and 14.7% of responses respectively).

There were also differences in the approvers and disapprovers mentioned for the personal and general questions. Students in the humanities were more likely than students in the PSE to use "family" for approval and disapproval of important things to do with their lives (29.6% and 18.8% of responses respectively). PSE students were more likely to use "myself" for these questions (37.3% of responses). All groups except females in the humanities were more likely to use "everyone" for the workforce questions. Humanities females used "myself".

C. The Echo Value Survey

One of the intents of the present study was to create a value survey instrument which approximated the Rokeach Value Survey (RVS) as closely as possible in structure and format. That is, one that contained 18 positive "terminal" values (end states) and 18 positive "instrumental" values (means to an end).

The Echo Value Survey (EVS) was developed in several steps. First, the largest categories of responses overall (i.e., those containing the greatest number of responses for each question), and within each of the five groups (Humanities males and females, PSE males, females, and Chinese) were listed for all eight questions. In those questions where the answers were negative or disvalued items, (questions 2, 4, and 8), potential opposites were listed. For example, the negative values of "selfish" and "impatient" were listed as "generous" and "patient", and "ignoring social needs" and "being socially irresponsible"

were transformed to "social responsibility". Because the Echo technique relies on the population's "echo", no transformations were made that did not involve language already used by the population.

Potential items were then categorized as terminal (end states) or instrumental (means to an end) values, resulting in 21 terminal values and 28 instrumental values. These items were reduced to two lists of 18 by combining similar, or excluding redundant, items. For example, "loving, caring, sensitive, thoughtful" was reduced to "loving, caring", the most frequently cited words. Parenthetical statements were used to further describe values where necessary (e.g., Social Responsibilty, caring for the needs of others) but all statements used the students' own wording. The EVS (see Appendix F) was constructed using the two lists of 18 items, in alphabetical order, with the instrumental values presented first. This presentation order varies from the RVS which presents terminal values first. Pilot testing revealed that students found personal characteristics the easiest to describe, and that placing them first facilitated further responses.

Of the resulting 36 Echo values, 6 are identical to RVS values, and another 9 are similar in meaning to values on the RVS (see Table 5, overleaf). As with the RVS, the EVS requests a forced choice ranking of each of the items on the two lists of 18 values from 1 as the most important to 18 as the least important. On the present Form G of the RVS this forced choice is facilitated by the use of gummed labels. Each of the 18 values is printed on a separate gummed label which the subjects are asked to move into designated spaces numbered 1 to 18. The necessary resources were not available to create a similar gummed label instrument for the Echo Value Survey. Instead, subjects are requested to write the appropriate ranks next to the individual values.

Table 5

Comparable Values: the Echo Value Survey and the Rokeach Value Survey

Echo	Rokeach
Instrumental Values	
Ambition	Ambitious
Honest	Honest
Creative	Imaginative
Loving, Caring	Loving
Loyal	Loyal
Responsible	Responsible
Tolerant	Broadminded
Terminal Values	
Art and Beauty	A World of Beauty
Career Success	A Sense of Accomplishment
Equality	Equality
Fame, Distinction	Social Recognition
Family Health and Happiness	Family Security
Fun and Excitement	An Exciting Life
Personal Health	Health
Self-fulfillment	Inner Harmony

Chapter Four: The Value Study

A. Method

Sample

A total of 242 students in British Columbia's two mainland universities were used in the study. Of the total, 145 were majoring in chemistry, computer science, engineering, mathematics, or physics, and 97 were majoring in English, history, education or social science. All students were in third or fourth year except for two classes of second year students, one in the humanities, and one in the PSE.

Test Materials

Each student received a package which included an introductory cover sheet (see Appendix G), the Echo Value Survey ("EVS"), the Rokeach Value Survey ("RVS") Form G, and a demographic questionnaire (see Appendix H). Presentation order was not varied due to the relatively unsophisicated format of the EVS compared to the RVS.

Procedure

The test materials were administered during regularly scheduled class time in the early spring. All students present on the day of testing were asked to participate, and participation was voluntary. The points on the introductory sheet were read to the students by the experimenter, and one-half hour was allowed for completion of the materials. Analysis of the first data collected indicated that some students had misunderstood the EVS instructions and had assigned several values equal rankings. Subsequent classes received additional instructions from the experimenter concerning the forced choice nature of the EVS rankings.

B. Results

1. The Questionnaire

A summary of the demographic data is presented overleaf in Table 6. A total of 14 students were unable to complete the questionnaire due to the half hour time limitation. Except for racial origin which is reported for the entire sample, the demographic statistics reported represent 94% (136) of the PSE students, and 95% (92) of the humanities students. The question concerning anticipated occupation was answered by 85% (208) of the students. A summary of responses is appended (see Appendix I).

2. The Value Surveys

Scoring

A total of 17 students (11 in the humanities, 4 in the PSE) did not complete the EVS correctly, and 2 (both in the humanities) were unable to complete the instrumental values on the RVS due to the half hour time constraint. A summary of the number of completed surveys in each group is presented overleaf in Table 7.

Mean and median rankings for each of the total 72 values from the two surveys were calculated for all subjects and plotted for comparison. The intent of the comparison was to determine the extent of the difference between mean and median scores, and the feasibility of using the mean, rather than median scores for further statistical analysis. As indicated in Figures 2, 3, 4, and 5 overleaf, all means and medians were close except for 7 of the 72 values where there was a difference of 1.5-3 points.

However, these 7 values, (Competitive, Religious, Fame/Distinction on the EVS, and Salvation, Clean, Obedient, Polite on the RVS) did not differ on their mean and median composite ranks. Composite ranks were calculated by listing the mean and median scores

Table 6
Demographic Characteristics, the Value Study

	Area			
Variable	Humanities		PSE	
Age	M= 24.2 years		M=22.6 years	
	Male	Female	Male	Female
Racial Origin:				
White	24	67	76	24
Chinese	0	1	17	9
Other non-Caucasian	1	4	16	4
Place of Birth:				
Canada	82.1%		61.4%	
Other	17.9%		38.6%	
Parents' Educational Level				
No Post Secondary	49.5%		42.6%	
One Parent Has	20.4%		26.5%	
Both Parents Have	30.1%		30.9%	
Own Expected Level of Education:				
Undergraduate	45.0%		46.2%	
Graduate Degree	47.3%		31.5%	
Doctorate	7.7%		22.3%	

Table 7

Number of Completed Echo and Rokeach Value Surveys by Area of Study, Sex and Race

	PSE		Humanities	
	Echo	RVS	Echo	RVS
Males				
Chinese	16(n=17)	17	N/A	N/A
White	73(n=76)	76	21(n=24)	24
Other	16(n=16)	16	1(n=1)	1
Females				
Chinese	9(n=9)	9	1(n=1)	0
White	23(n=24)	23	60(n=67)	66
Other	3(n=4)	4	3(n=4)	4

Figure 2
Echo Instrumental Values
All Subjects
Means and Medians

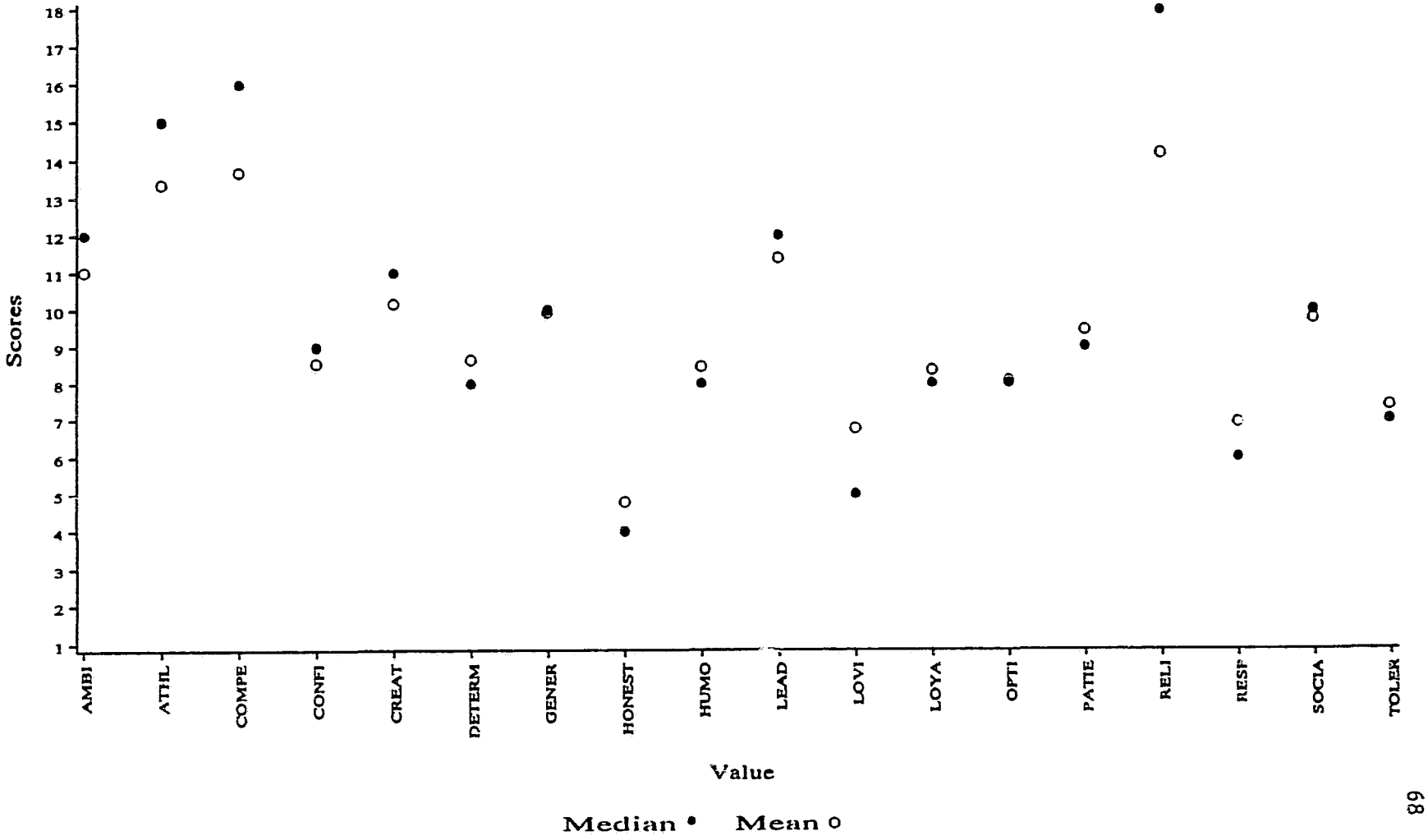


Figure 3
Echo Terminal Values
All Subjects
Means and Medians

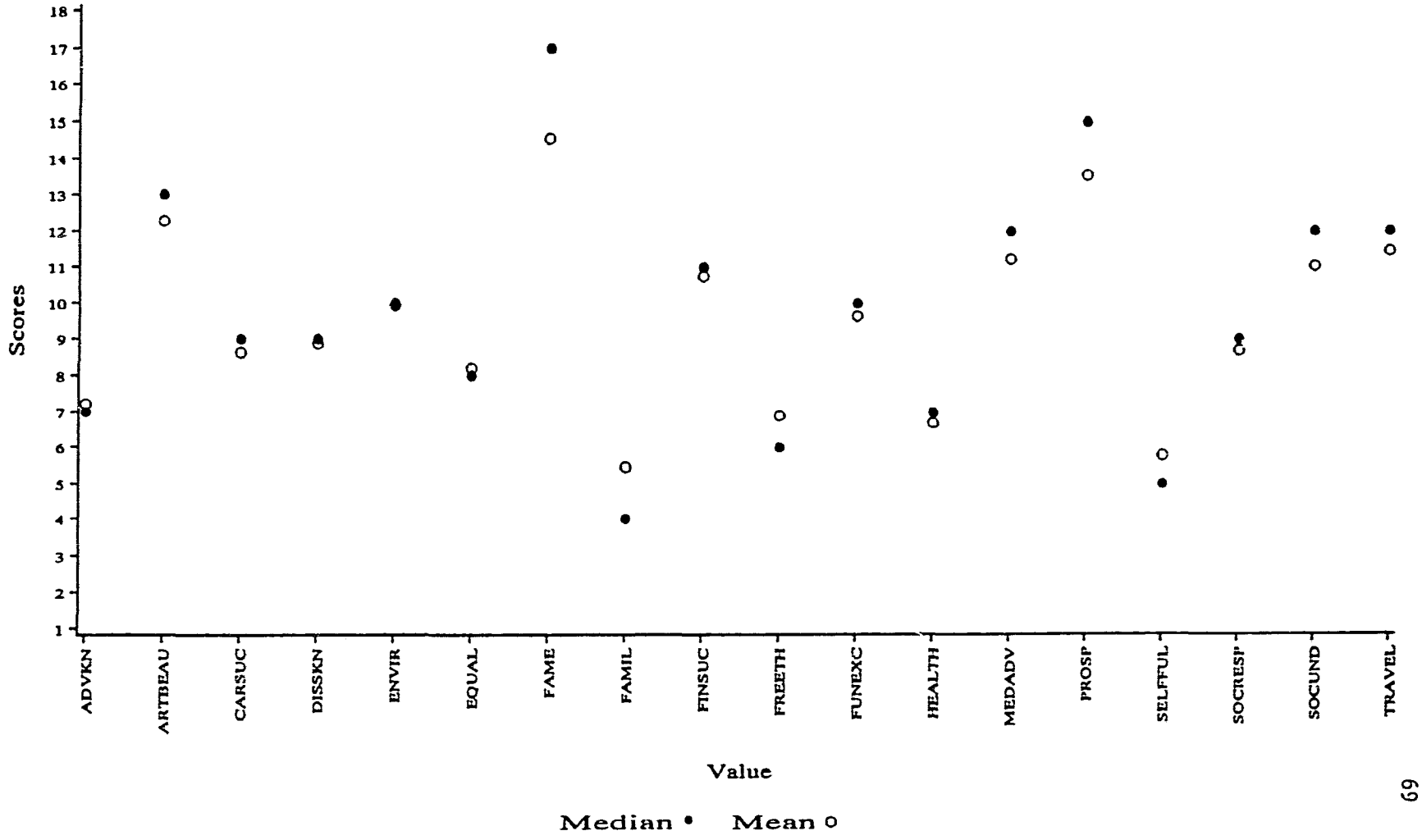


Figure 4
Rokeach Instrumental Values
All Subjects
Means and Medians

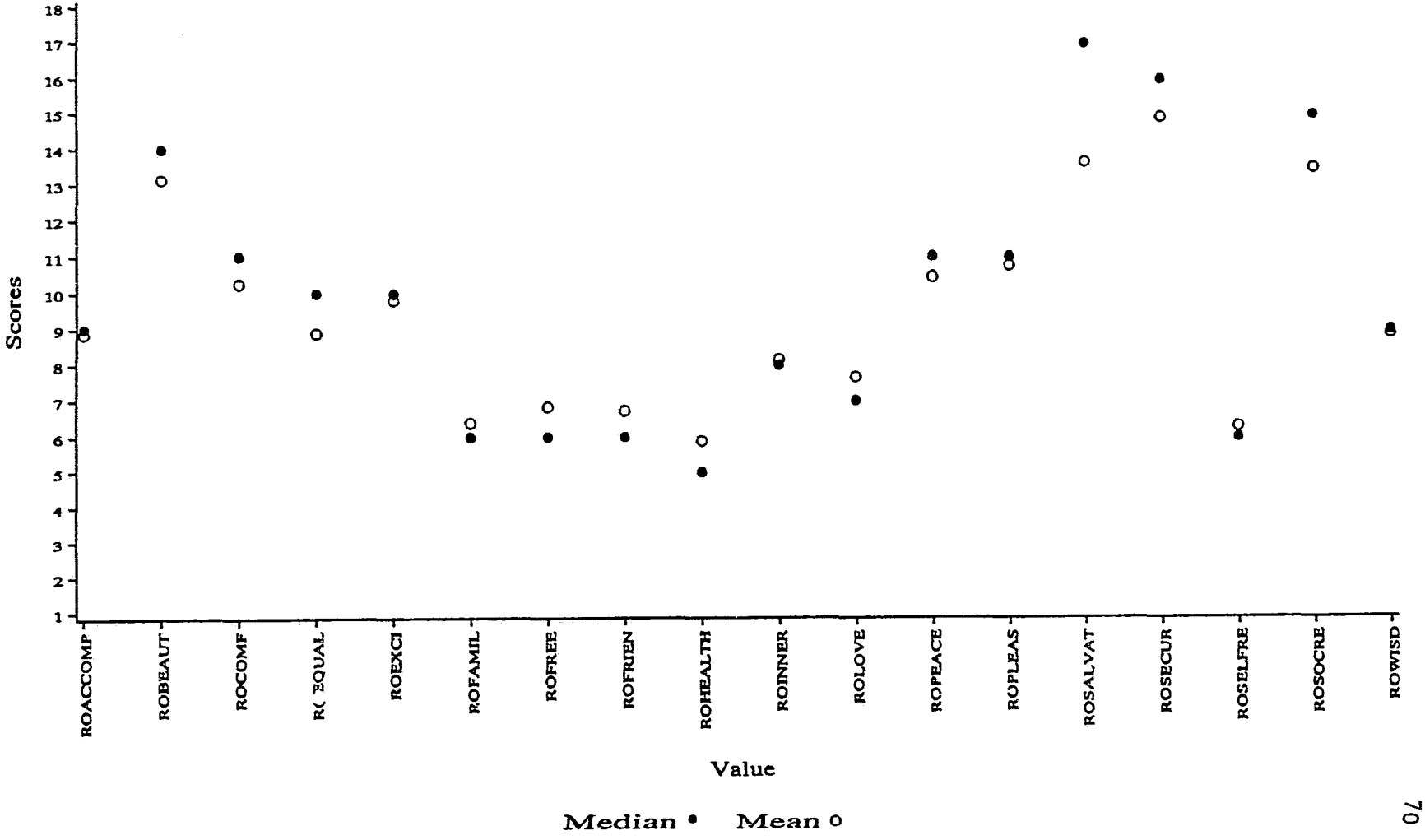
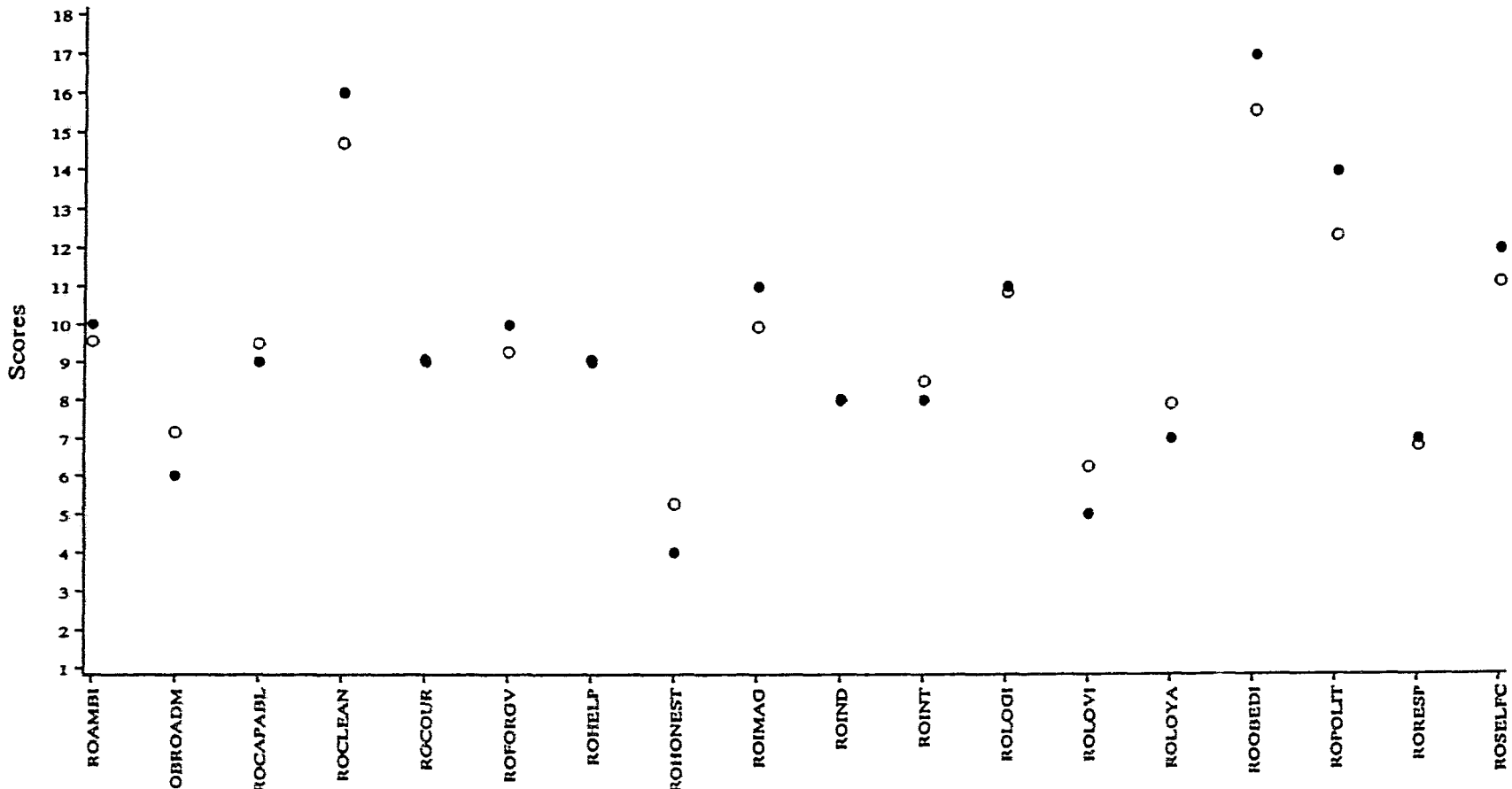


Figure 5
Rokeach Terminal Values
All Subjects
Means and Medians



for each of the 4 sets of 18 values in descending order. The value with the smallest mean or median score was then assigned rank number 1, and so on up to the largest score which was assigned rank 18. These 7 values were also all ranked very low, receiving the rank of 16, 17 or 18. The 7 differed from other low ranking scores in their raw score distribution. Unlike other low ranking values which had raw scores clustered at the bottom of the scale, each of the 7 were skewed with a small cluster of scores at the top of the scale.

Given the close relationship between mean and median scores, subsequent analysis used mean composite rank scores for rank comparisons among groups, and group means for univariate and multivariate analysis (see Appendix J for listings).

Value Ranking Differences

Prior to gathering the Value Study data, results from previous use of the RVS reported in the literature suggested that there would be a narrow range of most and least preferred values among the groups of students. The data from the present study instead indicate a wide variation in preferred values, with much of the variation beyond the top 2 or 3 ranks and into ranks 4-7. The complexity of the data led to two avenues of analysis, confirmatory analysis conducted to complete the planned comparisons and investigate overall differences, and exploratory analysis to pursue and further document specific interests between groups.

Confirmatory Analysis

The first three hypotheses for the Value Study concerned differences in the RVS ratings by area of study, race, and sex, and differences in the EVS ratings by area of study. In order to determine if there were overall differences, a MANOVA was conducted for each of the four ranking groups: EVS terminal and instrumental values, and RVS terminal and

instrumental values. Students classified as other non-Caucasian race (N=25) were excluded from the analysis.

There were significant effects of sex on the EVS instrumental values, $F(18, 172)= 1.68$, $p< .05$. On the RVS instrumental values there were significant effects of race, $F(18, 188) = 1.82$, $p< .03$, and area of study, $F(18, 188) = 3.39$, $p< .001$, and on the RVS terminal values, a significant effect of sex, $F(13, 196) = 1.91$, $p< .03$. There were no significant effects on the EVS terminal values. These results must be interpreted with caution given the large number of variables in each analysis (18), and the incomplete factorial design.

The fourth hypothesis stated that there would be differences in the sensitivity of the EVS and the RVS to discriminate between students in the humanities and students in the PSE. A stepwise discriminant analysis using the Wilks' lambda minimization method was run on both the EVS and RVS data for all students. For the EVS, a total of 13 out of the 36 values were identified (see Table 6, overleaf). These 13 values combined to account for 62.2% of PSE group membership, and 76.7% of humanities group membership. The overall correct classification was 67.9%.

For the RVS, 10 values were identified (see Table 8). These 10 values combined to account for 70.4% of PSE group membership and 78.7% of humanities group membership. The overall correct classification was 73.7%.

In order to further explore these moderate classification rates, identical discriminant analyses were run for two subgroups, white males and females. For females, once again 13 values were identified on the EVS, but 7 of these values differed from the original 13 (see Table 9). The classification rate rose sharply with the females-only analysis. The 13 values combined to predict 95.5% of PSE group membership and 88.1% of humanities

Table 8

Identified EVS and RVS Values, Discriminant Analysis by Area of Study, All Students

EVS Values	RVS Values
Loving, Caring	Logical
World Travel	Self-Controlled
Competitive	Capable
Medical Advancement	Mature Love
Loyal	True Friendship
Advancement of Knowledge	A Comfortable Life
Financial Success	Equality
Harmony with the Environment	Loyal
Fun and Excitement	Obedient
Sociable	Honest
A Prosperous Economy	
Religious	
Personal Health	

Table 9

Identified EVS and RVS Values, Discriminant Analysis by Area of Study, and Sex, White Students

	Values	
	EVS Values	RVS Values
Females		
	Loving, Caring	Loving Loyal
	Ambition	Wisdom Forgiving
	Personal Health	Health Logical
	Fame, Distinction	Social Recognition
	Honest	Honest
	Advancement of Knowledge	True Friendship
	Harmony with the Environment	Freedom
	Sociable	Logical
	Career Success	Independent
	Optimism	Broadminded
	Medical Advancement	Helpful
	Art and Beauty	National Security
	Patience	Obedient
Males		
	World Travel	Logical
	Social Responsibility	Capable
	Fame/Distinction	Self-Controlled
	Art and Beauty	Clean
	Career Success	A Comfortable Life
	Fun and Excitement	True Friendship
	Advancement of Knowledge	Honest
	Financial Success	
	Ambition Patience	
	Tolerant Creative	
	Self-fulfillment	

group membership, an overall classification of 90.1%. On the RVS 15 values were identified (see Table 7), only 5 of which were included in the original 10 identified for all students. These 15 values combined to predict 82.6% of PSE group membership, and 90.6% of humanities group membership, an overall rate of 88.5%.

For males, like females, 13 values were again identified on the EVS but 9 differed from the original 13 (see Table 7). The classification rate rose only slightly with the males-only analysis. The 13 values combined to predict 77% of PSE group membership, and 79.2% of humanities group membership, an overall rate of 77.6%. On the RVS , only 7 values were identified (see Table 7), all but 1 of which (Clean) were contained in the original 10 values identified for all students. Accuracy of classification rose to 85.7% of PSE group membership, and 90.5% of humanities group membership, an overall classification rate of 86.8%.

Exploratory Analysis

Based on the overall results of the discriminant analysis by area of study, ANOVAs were run on the 13 identified EVS values and the 10 identified RVS values, by area of study, sex, and race. In each case, the ANOVAs were run twice, once including students of "other" race and once using only Chinese and white students. This procedure was followed due to the focus on Chinese/white racial differences and the confound that the varied "other" races represented. Ten additional values were identified for ANOVA by their composite rank score differences among groups. Each of the 10 was either uniquely ranked in the top 7 ranks by a group, or ranked 1 or 2 for one group and 6 or 7 for another.

As well, simple effects were investigated through two methods: t-tests for all values by area of study, sex, and race (see Tables 10-13 overleaf, for a complete summary of the results); and the comparison of the top 7 and bottom 4 ranked values in each of the

Table 10

Results, T-Tests, Echo Value Survey Terminal Values, PSE and the Humanities, Males and Females

Value	Comparison Group		
	All PSE vs. Humanities	Females PSE/ humanities	Males PSE/ Humanities
Advancement of Knowledge	t (222) =3.23***	t(80) =2.6**	x
A Prosperous Economy	t(221) =3.01**	x	x
Art and Beauty	x	x	x
Career Success	t(222) =2.36*	x	x
Dissemination of Knowledge	x	x	x
Equality	t(221) =2.42*	x	x
Fame, Distinction	t(220) =2.19*	x	x
Family Health and Happiness	x	t(79) =2.49*	x
Financial Success	t(221) =3.99***	x	t(90) =2.31*
Freedom of Thought	x	x	x
Fun and Excitement	x	x	x
Harmony with the Environment	x	x	x
Medical Advancement	x		x
Personal Health	x	x	x
Self-Fulfillment	x	x	x
Social Responsibility	t(222) =3.43***	x	t(91) =2.9**
Social Understanding	t(222) =2.47**	x	x
World Travel	t(224) =2.78**	x	t(91) =2.79**

* $p < .05$, ** $p < .01$, *** $p < .001$, x = not significant

Table 10 continued

Results, T-Tests, Echo Value Survey Instrumental Values, PSE and the Humanities, Males and Females

Value	Comparison Group		
	All PSE vs. Humanities	Females PSE/ humanities	Males PSE/ Humanities
Ambition	t(210) =2.29*	t(82) =2.92**	x
Athletic, Agile	t(212) =3.25***	x	t(91) =1.95*
Competitive	t(222) =5.39***	x	x
Confident	t(221) =2.57**	x	x
Creative	x	x	x
Determined	t(222) =3.12**	t(80) =2.7**	x
Generous	t(223) =2.4	x	x
Honest	x	t(80) =2.17*	x
Leadership	t(205) =3.32***	x	x
Loving, Caring	t(210) =5.45***	t(81) =3.46***	x
Loyal	t(222) =3.12**	t(80) =3.04**	x x
Optimism	x	x	x
Patience	x	x	x
Religious	t(224) =2.27*	t(78) =5.03***	x
Responsible	x	x	x
Sense of Humour	x	x	x
Sociable	x	x	x
Tolerant	t(222) =2.5**	x	t(49) =3.18**

* $p < .05$, ** $p < .01$, *** $p < .001$, x = not significant

Table 10 continued

Results, T-Tests, Rokeach Value Survey Terminal Values, PSE and the Humanities, Males and Females.

Value	Comparison Group		
	All PSE vs. Humanities	Females PSE/ humanities	Males PSF/ Humanities
A Comfortable Life	t(238) =4.23***	x	t(97) =2.09*
An Exciting Life	t(239) =2.24*	x	x
A Sense of Accomplishment	t(239) =2.53**	t(89) =2.13*	x
A World at Peace	t(240) =2.7**	x	x
World of Beauty	x	x	x
Equality	x	x	x
Family Security	x	x	x
ɔm	x	t(89) =2.63**	x
	x	x	x
ɔony	t(240) =2.12*	x	x
	t(240) =2.8**	x	x
rity	x	x	x
-	x	x	x
Salvation	t(237) =2.71**	t(66) =3.75***	x
Self-respect	x	x	x
Social Recognition	t(240) =3.11**	x	x
True Friendship	x	x	x
Wisdom	x	x	x

* p < .05, ** p <.01, *** p < .001, x = not significant

Table 10 continued

Results, T-Tests, Rokeach Value Survey Instrumental Values, PSE and the Humanities, Males and Females.

Value	Comparison Group		
	All PSE vs. Humanities	Females PSE/ humanities	Males PSE/ Humanities
Ambitious	t(236) =2.72**	t(88) =2.06*	x
Broadminded	x	t(88) =2.04*	x
Capable	t(236) =4.64***	t(88) =2.95**	t(96) =2.99**
Clean	x	t(62) =2.0*	t(96) =2.06*
Courageous	t(236) =2.27**	x	x
Forgiving	t(235) =4.49***	t(87) =2.98**	t(96) =2.29*
Helpful	x	x	x
Honest	x	x	x
Imaginative	x	x	x
Independent	x	t(88) =2.57**	x
Intellectual	t(237) =2.12*	t(88) =2.21*	x
Logical	t(236) =7.89***	t(87) =4.67***	t(96) =3.46***
Loving	t(235) =5.41***	t(86) =4.56***	x
Loyal	t(237) =4.37***	t(31) =3.73***	x
Obedient	x	x	x
Polite	t(236) =2.07*	x	x
Responsible	x	x	x
Self-Controlled	t(235) =3.65***	x	t(96) =2.64**

* $p < .05$, ** $p < .01$, *** $p < .001$, x = not significant

Table 11

Results, T-Tests, Echo Value Survey Terminal Values, PSE, Males and Females, Chinese and White

Value	Comparison Group		
	PSE: All Male/Female	PSE: White Male/Female	PSE: Chinese Male/Female
Advancement of Knowledge	x	x	x
A Prosperous Economy	x	t(93) =2.27*	x
Art and Beauty	x	x	x
Career Success	x	x	x
Dissemination of Knowledge	x	x	x
Equality	x	t(92) =2.01*	x
Fame, Distinction	t(134) =2.0*	t(56) =2.31*	x
Family Health and Happiness	x	x	x
Financial Success	t(135) =3.59***	t(92) =3.52***	x
Freedom of Thought	x	t(91) =2.12*	x
Fun and Excitement	t(135) =2.16*	x	x
Harmony with the Environment	x	x	x
Medical Advancement	x	x	x
Personal Health	t(136) =2.18*	t(93) =2.09*	x
Self-Fulfillment	x	x	x
Social Responsibility	x	x	x
Social Understanding	x	x	x
World Travel	x	x	x

* $p < .05$, ** $p < .01$, *** $p < .001$, x = not significant

Table 11 continued

Results, T-Tests, Echo Value Survey Instrumental Values, PSE, Males and Females, Chinese and White

Value	Comparison Group		
	PSE: All Male/Female	PSE: White Male/Female	PSE: Chinese Male/Female
Ambition	t(137) =2.15*	x	x
Athletic, Agile	x	x	x
Competitive	t(136) =2.05*	x	x
Confident	x	x	x
Creative	x	x	x
Determined	x	x	x
Generous	x	x	x
Honest	x	x	x
Leadership	x	x	x
Loving, Caring	x	x	x
Loyal	x	x	x
Optimism	t(137) =2.38*	t(93) =2.13*	t(23) =2.29*
Patience	x	x	x
Religious	x	t(94) =2.18*	x
Responsible	x	x	x
Sense of Humour	t(44) =1.98*	x	x
Sociable	x	x	x
Tolerant	x	x	x

* $p < .05$, ** $p < .01$, *** $p < .001$, x = not significant

Table 11 continued

Results, T-Tests, Rokeach Value Survey Terminal Values, PSE, Males and Females, Chinese and White

Value	Comparison Group		
	PSE: All Male/Female	PSE: White Male/Female	PSE: Chinese Male/Female
A Comfortable Life	x	x	x
An Exciting Life	x	x	x
A Sense of Accomplishment	x	x	x
A World at Peace	t(143) =3.12**	x	t(10) =2.29*
World of Beauty	t(143) =2.22*	x	x
Equality	x	x	x
Family Security	x	x	x
Freedom	t(143) =2.25*	t(97) =2.3*	x
Health	t(143) =3.38***	t(97) =2.77**	x
Inner Harmony	x	x	x
Mature Love	x	x	x
National Security	x	x	x
Pleasure	t(142) =2.02*	x	x
Salvation	x	x	x
Self-Respect	x	x	x
Social Recognition	x	x	x
True Friendship	x	x	x
Wisdom	x	x	x

* $p < .05$, ** $p < .01$, *** $p < .001$, x = not significant

Table 11 continued

Results, T-Tests, Rokeach Value Survey Instrumental Values, PSE, Males and Females, Chinese and White

Value	Comparison Group		
	PSE: All Male/Female	PSE: White Male/Female	PSE: Chinese Male/Female
Ambitious	x	x	x
Broadminded	x	t(96) =2.51**	x
Capable	x	x	x
Clean	t(105) =2.20*	x	x
Courageous	x	x	x
Forgiving	x	x	x
Helpful	x	x	x
Honest	x	x	x
Imaginative	x	x	x
Independent	x	t(96) =2.79**	x
Intellectual	x	x	x
Logical	x	x	x
Loving	x	x	x
Loyal	x	x	x
Obedient	x	t(93) =2.99**	x
Polite	x	x	x
Responsible	x	x	x
Self-Controlled	t(140) =2.77**	t(95) =3.19**	x

* $p < .05$, ** $p < .01$, *** $p < .001$, x = not significant

Table 12

Results, T-Tests, Echo Value Survey Terminal Values, PSE, Chinese and White

Value	Comparison Group Within PSE		
	All White/ Chinese	Chinese/ White Male	Chinese/ Wh. Female
Advancement of Knowledge	t(117) =2.03*	t(86) =2.3*	x
A Prosperous Economy	t(118) =2.72**	x	t(30) =2.97*
Art and Beauty	x	x	x
Career Success	t(117) =3.09**	t(86) =2.18*	t(29) =2.34*
Dissemination of Knowledge	x	x	x
Equality	x	x	t(29) =2.45*
Fame, Distinction	x	x	x
Family Health and Happiness	x	x	x
Financial Success	t(117) =3.49***	t(85) =2.85**	t(30) =3.31**
Freedom of Thought	t(116) =2.06*	x	t(29) =2.54*
Fun and Excitement	x	x	x
Harmony with the Environment	x	x	x
Medical Advancement	x	x	x
Personal Health	x	x	x
Self-fulfillment	x	x	x
Social Responsibility	x	x	x
Social Understanding	x	x	x
World Travel	x	x	x

* $p < .05$, ** $p < .01$, *** $p < .001$, x = not significant

Table 12 continued

Results, T-Tests, Echo Value Survey Instrumental Values, PSE, Chinese and White

Value	Comparison Group Within PSE		
	All White/ Chinese	Chinese/ White Male	Chinese/ Wh. Female
Ambition	x	x	x
Athletic, Agile	x	x	x
Competitive	x	t(86) =2.28*	x
Confident	x	x	x
Creative	x	x	x
Determined	x	x	x
Generous	x	x	x
Honest	x	x	x
Leadership	x	x	x
Loving, Caring	x	x	x
Loyal	x	x	x
Optimism	x	x	x
Patience	x	x	x
Religious	x	x	t(31) =2.3*
Responsible	x	x	x
Sense of Humour	t(117) =1.99*	x	x
Sociable	x	x	x
Tolerant	x	x	t(30) =2.27*

* $p < .05$, ** $p < .01$, *** $p < .001$, x = not significant

Table 12 continued

Results, T-Tests, Rokeach Value Survey Terminal Values, PSE, Chinese and White

Value	Comparison Group Within PSE		
	All White/ Chinese	Chinese/ White Male	Chinese/ Wh. Female
A Comfortable Life	x	x	x
An Exciting Life	x	x	x
A Sense of Accomplishment	x	x	x
A World at Peace	x	*t*(39) =2.69**	x
World of Beauty	x	x	x
Equality	x	x	x
Family Security	t(55) =2.10*	x	x
Freedom	t(123) =1.99*	x	x
Health	x	x	x
Inner Harmony	x	x	x
Mature Love	t(123) =2.0*	x	x
National Security	x	x	x
Pleasure	x	t(89) =2.35*	x
Salvation	x	x	x
Self-Respect	x	x	x
Social Recognition	x	x	x
True Friendship	x	x	x
Wisdom	x	t(90) =2.04*	x

* $p < .05$, ** $p < .01$, *** $p < .001$, x = not significant

Table 12 continued

Results, T-Tests, Rokeach Value Survey Instrumental Values, PSE, Chinese and White

Value	Comparison Group Within PSE		
	All White/ Chinese	Chinese/ White Male	Chinese/ Wh. Female
Ambitious	x	x	x
Broadminded	x	x	t(31) =3.0**
Capable	x	x	x
Clean	x	x	x
Courageous	t(122) =4.0***	t(89) =3.77***	x
Forgiving	x	x	t(31) =2.34*
Helpful	x	x	t(31) =2.52*
Honest	x	x	x
Imaginative	t(122) =2.47*	x	t(31) =3.66***
Independent	x	x	x
Intellectual	x	x	x
Logical	x	x	x
Loving	x	x	x
Loyal	x	x	x
Obedient	x	x	x
Polite	t(32) =2.05*	x	x
Responsible	x	x	x
Self-Controlled	x	x	x

* $p < .05$, ** $p < .01$, *** $p < .001$, x = not significant

Table 13

Results, T-Tests, Echo Value Survey Terminal Values, Humanities, White Males and Females

Value	Comparison Group Humanities: White Males and Females
Advancement of Knowledge	x
A Prosperous Economy	x
Art and Beauty	x
Career Success	x
Dissemination of Knowledge	x
Equality	x
Fame, Distinction	x
Family Health and Happiness	x
Financial Success	x
Freedom of Thought	x
Fun and Excitement	x
Harmony with the Environment	x
Medical Advancement	x
Personal Health	x
Self-fulfillment	t(27)= 2.11*
Social Responsibility	x
Social Understanding	x
World Travel	x

* $p < .05$, ** $p < .01$, *** $p < .001$, x = not significant

Table 13 continued

Results, T-Tests, Echo Value Survey Instrumental Values, Humanities, White Males and Females

Value	Comparison Group Humanities: White Males/Females
Ambition	x
Athletic, Agile	x
Competitive	x
Confident	x
Creative	x
Determined	x
Generous	x
Honest	x
Leadership	v
Loving, Caring	x
Loyal	x
Optimism	x
Patience	x
Religious	x
Responsible	x
Sense of Humour	x
Sociable	x
Tolerant	x

* $p < .05$, ** $p < .01$, *** $p < .001$, x = not significant

Table 13 continued

Results, T-Tests, Rokeach Value Survey Terminal Values, Humanities, White Males and Females

Value	Comparison Group Humanities: White Males/Females
A Comfortable Life	x
An Exciting Life	x
A Sense of Accomplishment	x
A World at Peace	x
World of Beauty	x
Equality	x
Family Security	x
Freedom	x
Health	x
Inner Harmony	t(89)= 2.18*
Mature Love	x
National Security	x
Pleasure	x
Salvation	x
Self-Respect	x
Social Recognition	x
True Friendship	x
Wisdom	x

* $p < .05$, ** $p < .01$, *** $p < .001$, x = not significant

Table 13 continued

Results, T-Tests, Rokeach Value Survey Instrumental Values, Humanities, White Males and Females

Value	Comparison Group Humanities: White Males/Females
Ambitious	x
Broadminded	x
Capable	x
Clean	x
Courageous	x
Forgiving	x
Helpful	x
Honest	x
Imaginative	x
Independent	x
Intellectual	x
Logical	x
Loving	x
Loyal	t(32)= 2.25*
Obedient	x
Polite	x
Responsible	x
Self-controlled	x

* $p < .05$, ** $p < .01$, *** $p < .001$, x = not significant

EVS and RVS instrumental and terminal results for each group. Only two-tailed tests are reported, and all tests are adjusted for homogeneity of variance.

Certain of the values were consistently ranked across almost all groups showing very few differences. These were the top-ranked Honest and Responsible (both EVS and RVS), Family Security, Self-Respect, and True Friendship; the middle-ranked Dissemination of Knowledge, Patience, Creative, Sociable, Harmony with the Environment, and Fun and Excitement; and the bottom-ranked World of Beauty, and Art and Beauty.

Analysis of Variance

Area of Study

The ANOVAs conducted on the 13 EVS and 10 RVS values identified by the discriminant analysis resulted in 9 significant main or interaction effects of area of study. Except where noted, comparisons by area of study include all students. On the EVS the following values were significant: Competitive, main effect , PSE higher, $F(1, 213)= 4.42$, $p< .04$; Loving, Caring, main effect, humanities higher, $F(1, 214)= 10.51$, $p< .001$; Loyal, main effect, humanities higher, $F(1, 213)= 6.28$, $p< .01$; Advancement of Knowledge, main effect, PSE higher, $F(1, 213)= 14.59$, $p< .001$; and Medical Advancement, main effect , PSE higher, $F(1, 214)= 3.99$, $p< .05$.

On the RVS, the following values were significant: a Comfortable Life, main effect, PSE higher comparing Chinese and whites only, $F(1, 229)= 5.15$, $p< .02$; Capable, main effect, PSE higher, $F(1, 233)= 12.88$, $p< .001$; Logical, main effect, PSE higher, $F(1, 233)= 41.43$, $p< .001$; and Loyal, main effect, humanities higher, $F(1, 234)=10.18$, $P< .002$.

Significant area effects were also found on the 5 additional values identified through composite rank score comparisons. On the EVS they were as follows: Tolerant, main effect, using white and Chinese students only, humanities higher, $F(1, 195)= 4.63$, $p< .03$, and an area by sex interaction, PSE females and humanities males higher, $F(1, 195)= 4.3$, $p< .04$; Confident, main effect using Chinese and white student comparisons only, PSE higher, $F(1, 193)= 4.14$, $p< .04$; and Determined, main effect, PSE higher, $F(1, 213)= 6.25$, $p< .01$.

On the RVS, significant effects of area were as follows: a Sense of Accomplishment, main effect, comparison using only Chinese and white students, PSE higher, $F(1, 210)= 6.52$, $p< .01$; and Forgiving, main effect using white and Chinese only, humanities higher, $F(1, 209)= 11.7$, $p< .001$.

Sex

The ANOVA results identified 8 values with main effects or interactions by sex. On the EVS these were: Optimism, main effect, females higher, $F(1, 214)= 8.22$, $p< .005$; Self-fulfillment, main effect, females higher comparing only Chinese and whites, $F(1, 194)= 8.36$, $p< .004$; a Sense of Humor, main effect, males higher $F(1, 213)= 4.79$, $p< .03$; Competitive, main effect, males higher, $F(1, 213)= 8.15$, $p< .005$; Financial Success, main effect, males higher, $F(1, 212)= 12.19$, $p< .001$; Equality (EVS), main effect, females higher, $F(1, 212)= 3.79$, $p< .05$, and a race by sex interaction, white females and Chinese males higher, $F(2, 212)= 5.45$, $p< .005$.

On the RVS, there was a main effect for Self-Controlled, males higher $F(1, 232)= 5.83$, $p< .02$.

Race

The ANOVAs identified 7 values with main effects of race. On the EVS they were as follows: Career Success, main effect, Chinese higher, $F(2, 213)= 5.06$, $p< .003$; a

Sense of Humor, main effect, whites higher, $F(2, 213)= 3.87$, $p< .02$; Competitive, main effect, Chinese higher, $F(2, 213)= 4.02$, $p< .02$; Advancement of Knowledge, main effect, whites higher, $F(2, 213)= 3.21$, $p< .04$; Financial Success, main effect, Chinese higher, $F(2, 212)= 9.1$, $p< .001$; and World Travel, main effect, whites higher, $F(2, 215)= 3.39$, $p< .04$.

On the RVS significant main effects for race were found only on Mature Love, whites higher, $F(2, 231)= 7.6$, $p< .001$.

Simple Effects

Students in the Physical Sciences and Engineering and the Humanities

Of all comparisons by area of study, sex, and race, the largest number of statistically significant differences between mean value ratings was found between overall areas of study. Of the total 72 values, 38 of the comparisons between PSE students and humanities students were significant (see Table 10), with the proportion of variance accounted for ranging from 1.8% (Inner Harmony and Polite) to 12.3% (Loving Caring).

Students in the PSE gave higher rankings to: on the EVS, Ambition, Athletic/Agile, Competitive, Determined, Leadership, Advancement of Knowledge, a Prosperous Economy, Career Success, Fame/Distinction, and Financial Success; and on the RVS, a Comfortable Life, an Exciting Life, a Sense of Accomplishment, Social Recognition, Ambitious, Capable, Intellectual, Logical, and Self-Controlled.

Students in the humanities gave higher rankings to: on the EVS, Generous, Loving/Caring, Loyal, Religious, Tolerant, Equality, Social Responsibility, Social Understanding, and World Travel; and on the RVS a World at Peace, a World of Beauty,

Inner Harmony, Mature Love, Salvation, Courageous, Forgiving, Loving, Loyal, and Polite.

Within the Physical Sciences and Engineering

Males and Females in the Physical Sciences and Engineering

Within the PSE, there were 15 values identified with statistically different mean ratings overall for males and females with the proportion of variance accounted for ranging from 2.7% (Pleasure) to 8.7% (Financial Success). Males in the PSE gave higher ratings to: on the EVS, Competitive, a Sense of Humour, Fame/Distinction, Financial Success, Fun and Excitement, Health, and Pleasure; and on the RVS, Health, Clean, and Self-Controlled. Females in the PSE gave higher ratings to: on the EVS, Ambition, and Optimism; and on the RVS, a World at Peace, a World of Beauty, and Freedom.

White Males and Females in the Physical Sciences and Engineering

A total of 14 significantly different mean rankings were identified for white males and females in the PSE (see Table 11), with proportion of variance accounted for ranging from 4.2% (Equality) to 11.5% (Financial Success). White males gave higher rankings to: on the EVS, Religious, a Prosperous Economy, Fame/Distinction, Financial Success, and Health; and on the RVS, Health, Obedient, and Self-Controlled. White females gave higher rankings to: on the EVS, Optimism, Equality, and Freedom of Thought; and on the RVS, Freedom, Broadminded and Independent.

In terms of composite rank scores (see Appendix K), males ranked Honest, Responsible, and Loving as their top three on both the EVS and RVS instrumental values. Females also ranked Honest in their top three, but chose Tolerant, Optimism, Independent and Broadminded as their other top values.

Chinese Males and Females in the Physical Sciences and Engineering

There were only 2 significantly different mean rankings for Chinese males and females in the PSE (see Table 9). Females ranked the EVS Optimism (accounting for 18.6% of the variance) and the RVS a World at Peace (accounting for 34.2% of the variance), higher than did males. In terms of composite rank scores (see Appendix K), unlike males, females ranked Loving in their top two instrumental values on both the EVS and the RVS, and Helpful and Loyal in their top five. Males placed Responsible, Broadminded, and Tolerant higher. On terminal values, females ranked family values as number 1. Financial and Career Success, and Health, were ranked higher for males.

Chinese and White Females in the Physical Sciences and Engineering

There were significantly different means for Chinese and white females in the PSE on 11 of the 72 values (see Table 12), with proportion of variance accounted for ranging from 14.3% (Tolerant) to 49.4% (Prosperous Economy). Chinese women gave higher rankings to: on the EVS, Religious, a Prosperous Economy, Career Success, and Financial Success; and on the RVS, Forgiving, and Helpful. White women gave higher rankings to: on the EVS, Tolerant, Equality, and Freedom of Thought; and on the RVS, Broadminded, and Imaginative.

In terms of composite rank scores (see Appendix J), Chinese women ranked Loving and Loyal within their top three instrumental values. White women placed these values at numbers 6 and 10 respectively. Family (EVS and RVS) received the top terminal value rank from Chinese females, white females ranked family values on the EVS and RVS at numbers 5 and 7 respectively.

Many of the two groups' least preferred values were similar but white females included Financial Success in their bottom four ranks (compared to the Chinese rank of 6),

and Chinese women included Sociable, Imaginative, and an Exciting Life in their bottom four ranks.

Chinese and White Males in the Physical Sciences and Engineering

Within the PSE there were significantly different means for Chinese and white males on 8 of the 72 values (see Table 12), with proportion of variance accounted for ranging from 4.3% (Wisdom) to 14.7% (a World at Peace). Chinese males gave higher rankings to: on the EVS, Competitive, Career Success, and Financial Success; and on the RVS, Pleasure. White males gave higher rankings to: on the EVS, Advancement of Knowledge; and on the RVS, a World at Peace, Wisdom, and Courageous.

Chinese and White Students in the Physical Sciences and Engineering

As well as the differences reported separately by sex, there were 3 other values with significantly different mean rankings overall by race within the PSE (see Table 10). Chinese students gave higher rankings to Polite (RVS, accounting for 11.7% of the variance). White students gave higher rankings to a Sense of Humour (EVS), and Mature Love (RVS), accounting for 3.3% and 3.2% of the variance respectively.

Between the Physical Sciences and Engineering and the Humanities

Given the small number of Chinese or other non-Caucasian students in the humanities, comparisons for simple effects used only white students.

White Females in the Physical Sciences and Engineering and the Humanities

The t-tests identified significantly different mean rankings by white females in the PSE vs. those in the humanities for 22 of the total 72 values (see Table 10), with

proportion of variance accounted for ranging from 4.6% (Broadminded) to 25.4% (Loyal). Females in the PSE gave higher rankings to: on the EVS, Ambition, Determined, Advancement of Knowledge, and a Sense of Accomplishment; and on the RVS, Freedom, Ambitious, Capable, Broadminded, Independent, Intellectual, and Logical. Females in the humanities gave higher rankings to: on the EVS, Loving/Caring, Honest, Loyal, and Religious; and on the RVS, Salvation, Loving, Clean, Obedient, Loyal, Family Security, and Forgiving.

In terms of composite rank scores, females in the humanities also assigned higher ranks to personal Health. Females in the PSE assigned higher rankings to Optimism (EVS) and Independent (RVS). Both groups ranked EVS values such as Fame/Distinction, Financial Success, and Athletic/Agile at the bottom of their lists, but PSE females also included Art and Beauty, while humanities females included RVS values Logical and a Comfortable Life.

White Males in the Physical Sciences and Engineering and the Humanities

There were 12 values with significantly different mean rankings for white males in the PSE and the humanities (see Table 10), with proportion of variance accounted for ranging from 4% (Athletic/Agile) to 17% (Tolerant). Males in the PSE gave higher rankings to: on the EVS, Athletic/Agile and Financial Success; and on the RVS, a Comfortable Life, Capable, Logical, and Self-Controlled. Males in the humanities gave higher rankings to: on the EVS, Tolerant, Social Responsibility, Social Understanding, and World Travel; and on the RVS, Clean, and Forgiving.

White Males and Females in the Humanities

Within the humanities, there were 3 values with significantly different mean rankings for white males and females (see Table 13). Females ranked Self-Fulfillment

(EVS, 13.9% of the variance), and Inner Harmony and Loyal (RVS, 5.1% and 13.8% of the variance respectively) higher.

Least Preferred Values, Instrumental and Terminal

Comparisons of composite rank orders for EVS and RVS instrumental and terminal values indicated a pattern of similarity in the values ranked 15 through 18. While the actual rank may have varied from group to group (e.g., Religious ranked 17 by one group and 18 by another), the four lowest values were identical in 11 of 24 comparisons. The only group comparisons which indicated no identical instrumental or terminal EVS or RVS lowest ranked values were the three racial group comparisons within the PSE: Chinese and white students overall, Chinese and white females, and Chinese and white males. The most similar two groups were white males and females in the humanities. Only the lowest ranked RVS terminal values were not identical for these two groups.

Of the 11 identical cases, 5 were instrumental values and 6 were terminal with no disproportionate representation by either value survey.

Relative Rankings, Comparable EVS and RVS Values

Rankings of comparable or identical values on the EVS and RVS (see Table 5, page 63, for a listing) were compared for both instrumental and terminal values. Across the groups, EVS and RVS comparable instrumental value rankings showed a strong positive correlation, $r = .92$, $p < .001$. Rankings for the identical items, Honest, Loyal, and Responsible were the most similar. Rankings for Ambition and Ambitious were the most different with the largest differences in the PSE males' ranks. Ambitious (RVS) was ranked 5 points higher than Ambition (EVS) for both Chinese and white PSE males. The low rank on the EVS reflects higher ranks given to values not included on the RVS: Patience, Optimism, Competitive, Sociable, Creative, Leadership and Generous.

Chinese males were the only group to rank Loving/Caring (EVS, ranked 10) and Loving (RVS ranked 4) more than two ranks apart. Their low rank on the EVS again reflects higher ranks assigned to values not included on the RVS: Confident, Determined, Generous, Patient, A Sense of Humour, and Tolerant.

Comparable terminal value rankings also showed a strong positive correlation, $r = .89$, $p < .001$. The most similar rankings were for the lowest ranked values, Art and Beauty and World of Beauty, Fame/Distinction and Social Recognition. The most different overall were Self-fulfillment and Inner Harmony. Chinese students showed the largest discrepancy in Career Success and Sense of Accomplishment, ranking the EVS value Career Success higher. This pattern was also true for Fun and Excitement and an Exciting Life. Chinese students ranked the EVS value Fun and Excitement higher.

Chapter Five: Discussion

The results of the present study support the hypotheses that value differences exist among the six groups examined -- Chinese and white males and females in the PSE, and white males and females in the humanities. Values for these students vary in their nature, number and scope, and in their priority.

Overall, the values expressed by the students in both the Echo and Value Studies indicate an emphasis on three general areas: the self; family and friends; and the concept of freedom and clarity of thought, an open-minded approach to life. Emphasis on the self included priorities of personal health, self-respect, development and fulfillment. This self concern was unexpected overall given the large number of responses in the Echo Study concerned with helping others. When faced with the forced choice situation in the two value surveys, the students chose self over social responsibility. However, it should be noted that the self-emphasis in the present study is not one of hedonism. Values such as Fun, Excitement, Pleasure and a Comfortable Life received relatively low rankings. The students are concerned with achieving full potential and living life to its fullest.

Family and friends were emphasized through such values as Family Health and Happiness, Responsible, True Friendship, Loyal, and Loving. Once again though, family-related responses came second to helping others in the Echo study. A possible explanation for these differences is the context, and wording, of the instructions for the two studies. The Echo question may have tapped socially relevant behaviours by using the words "important" and "valuable". The value surveys may have tapped more personal behaviours by requesting that the students rank the values in order of importance to their own lives.

The third group of values included Broadminded, Freedom, Freedom of Thought, and Honest. In the Echo Study, responses included positive characteristics of tolerance,

and being open-minded, as well as negative characteristics such as being narrow-minded, rigid, or prejudiced.

The students assigned the lowest ranks to values representing order and organization such as Obedient, Self-Controlled, and Clean, also religious values, and Competitive. As well, students overwhelmingly devalued status values such as Leadership, Social Recognition, and Fame/Distinction. The exceptions to this were Financial and Career Success. Despite frequent references to the environment in the more general Echo questions, students also ranked Harmony with the Environment relatively low. Even lower however, were the aesthetic values of Art and Beauty.

The low ranking of aesthetic values is not consistent with previous RVS research using students in the humanities in Australia (Feather, 1970). The findings overall also vary from the Australian study on terminal, but not instrumental, values due to the Canadian emphasis on personal health and family. Feather's sample of students in the humanities, social sciences, and sciences all rated True Friendship, Wisdom, Freedom and a Sense of Accomplishment as their top four values. A comparable Michigan State University sample also varied from the present study choosing Freedom, Happiness (from the previous RVS Form E, now replaced by Health), Wisdom, and Self Respect.

Differences by Area of Study

The data from both the Echo and Value Studies strongly support the hypothesized value differences by area of study, but closer examination reveals that the underlying themes are quite similar. Students in the PSE and the humanities are both very concerned with not wasting their lives, or not living up to their potential. Both groups also reflect concern with the concept of pure thought and knowledge, and with helping others. However, their respective interpretations of these priorities are quite different. Students in the PSE appear to view success more in economic and theoretical/empirical terms. Their interpretation of knowledge and thought is one of logic, technical expertise and innovation.

Helping others involves technological improvements to the quality of life, or maintaining the environmental balance.

Students in the humanities also emphasize clarity of thought, but more in terms of social understanding, critical thinking, and freedom of expression. To them, wasting their potential involves not broadening the awareness of others or themselves, or allowing themselves to become narrow and rigid.

In terms of comparisons to previous work, for students in the PSE the findings of the present study with regard to instrumental values are similar to Rokeach's (1979b) own work with graduate students in science in the United States. Although in different ranking order, each group chose the same top 7 instrumental values. Both groups ranked Honest as number 1, but the present sample ranked Responsible and Broadminded higher than Rokeach's sample.

There are differences in the terminal value rankings. This sample ranked Family Security and a Sense of Accomplishment higher, Rokeach's students assigned higher ranks to Wisdom and Inner Harmony. Health was ranked number 1 by these PSE students, Happiness was number 2 for the Rokeach students. There are no differences in lowest ranked values.

Both the Echo and the Value Studies identified differences between females in the PSE and the humanities. An overall pattern emerges for white females in the PSE of independence, diligence, determination, and a relative devaluing of family-related values, results which are consistent with the earlier research associating women in science with lower family orientation and higher desire for prestige (Fitzpatrick & Silverman, 1989; Frieze & Harusa, 1984; Matyas, 1985b). They are also more concerned with self-fulfillment and self-respect.

White females in the humanities instead emphasized social and helping values such as loving and caring. Helping others comprised the largest category of Echo responses for

females in the humanities on the "important to do with your life" question. Career success was the largest category for PSE females. Despite the PSE females' emphasis on ambition and career success, as with other students, both groups of females rated Competitive low in the Value Study and it emerged as a "bad" personality characteristic for PSE females in the Echo Study. Consistent with previous work (Betz & Hackett, 1983; Lyons-Lepke, 1986; Wise, 1985), females in the PSE were also more concerned with confidence and self-esteem. In the Echo Study this emerged in the "bad personality characteristics" responses of low confidence, and self-criticism.

A pattern emerges of PSE females showing greater concern for career success and self-sufficiency, and an accompanying greater concern with their own confidence to achieve these goals. For females in the humanities, there appears to be less concern with success overall, or perhaps they are more confident of success in their chosen field, and therefore less likely to raise it as an issue.

In the Echo Study, both PSE and humanities females emphasized self-development, the importance of completing their degree, and teaching others. Both also emphasized family-related activities as valuable life activities. However, PSE females also more frequently cited family related mistakes as "bad" things to do. Perhaps they are more conscious of the potential of making these mistakes in their field. If as previous research suggests (Galejs & King, 1983), females in science are less concerned with family and having a career which easily accommodates family responsibilities, they may also be more sensitive to the pressures of potential errors in this area.

Sex and Race Differences

Overall, sex differences bear some similarity to early work with Allport's Study of Values (Allport, Vernon, & Lindzey, 1960), but there are also marked departures. Allport et al.'s males scored higher on theoretical, economic, and political (power, prestige)

values. Females scored higher on aesthetic, social, and religious values. In the present study, males did rate theoretical and economic values higher, and females rated social values marginally higher. But both sexes rated aesthetic (e.g., World of Beauty), religious (e.g., Religious, Salvation) and political (e.g., Fame/Distinction, Social Recognition) values equally low.

Sex differences within the two races show an oppposite pattern by area of study. That is, there were very few differences between Chinese males and females in the PSE, and between white males and females in the humanities. Without a comparable sample of Chinese students in the humanities, race and sex differences for both areas of study cannot be compared. But for white students within the PSE, males and females appear to hold quite different value systems.

Although white males in the PSE ranked values such as financial success higher than did females, they also assigned higher ranks to loving and family values on both the RVS and EVS. White females in the PSE, compared to males, exhibited a pattern similar to their comparisons to Chinese females, higher rankings to values of equality, freedom, and independence.

The profile of Chinese females in the PSE resembles that of white females in the humanities, giving higher rankings to loving and family values. It appears that the Chinese women have maintained their nurturing and family values. White women have embraced other values to enter (or to exist in) the PSE, different from women in the humanities and from Chinese in the PSE, but also different from their male colleagues in the PSE. This pattern of Chinese homogeneity within the PSE, and white homogeneity within the humanities, suggests an overriding sociocultural value system that encourages Chinese women to enter the PSE but not white women. It appears that white women must move away from the traditional female values such as family to participate in the PSE, a career area that is not supported by the broader white social system.

Within the PSE, there were a greater number of race differences for females than for males. The small sample of Chinese females in the Echo study made formal analysis difficult, but trends that emerged for the Chinese were higher values of kindness and caring, intelligence and wisdom, confidence, helping others, and financial/career success. These findings were supported by the Value Study results where Chinese females in the PSE also gave higher rankings to success values, Forgiving, Helpful, Loving, and Loyal. White women in the PSE gave higher rankings to values such as Equality, Broadminded, and Freedom of Thought, including Financial Success with their lowest ranks.

There are several possibilities for this emphasis on equality by white females. They may face greater discrimination from their white male peers in the PSE and therefore equality is a key concern. Or, they may have been sensitized to the issue of equality prior to their entry to the PSE, and recognized that their participation would represent a move toward equal representation in the field. Or, their inclusion of the values of Tolerant and Broadminded may reflect Tobias's (1990) findings that science is viewed by females as narrow and rigid. Whether the high ratings reflect frustration with their current field or, on a more positive note, optimism for the contributions they may bring to it, is unknown. But the greater PSE female emphasis on the EVS value of Optimism suggests that these females either need optimism to persist, or are optimistic about their field.

The Chinese Students

The values of the present sample of Chinese students represent a juxtaposition of traditional Confucian, and western beliefs. Consistent with Confucian values of the importance of effort over ability, the students identified diligence and determination as priorities. As well, the importance of family was evident both in the ranking of family values, and the more frequent choice of family as approvers and disapprovers of behaviour in the Echo Study. In terms of a collectivist philosophy, and submission to authority, the Chinese students also assigned higher ranks to Self-Controlled and Polite, and lower

rankings to Courageous and Freedom of Thought. However, they also assigned high rankings to Self-Respect and Self-Fulfillment, supporting Yang's (1986) theory of an increasing emphasis on the individual self.

The high rankings of Financial Success and a Prosperous Economy are not consistent with previous work using university students in Hong Kong and Taiwan, In the Hong Kong sample used by Triandis et al. (1990), high income placed last in a list of 24 values. Yang's (1986) review of value studies using the Allport, Vernon and Lindzey (1960) instrument identifies consistently high ratings of theoretical and aesthetic values, and low ratings of economic and religious values.

The RVS rankings for Chinese students in the present study are only somewhat consistent with previous studies using this instrument in Hong Kong and Taiwan as reviewed by Yang (1986). Like others, this sample assigned high ranks to family and friendship values, but were not as concerned with Inner Harmony, and were more concerned with Health and Self-Respect. The RVS rankings in the present study differ markedly from previous work (Feather, 1986) with a similar age group in mainland China. Feather's sample gave high ratings to Wisdom, Mature Love, Ambitious and Courageous, all rated below 10 for the present sample. Likewise the low ranked Family Security, a Comfortable Life, and Helpful were all rated 5 or above for the present sample.

Lau's (1988) Hong Kong sample of university students also varied from the present sample on several value rankings. Lau's sample ranked Wisdom, Courageous, Capable and Intellectual in their top four instrumental and terminal values. These all fell from ranks 7 to 16 for the Chinese students in Canada. Lau's sample also included a Comfortable Life and Pleasure in ranks 15 to 18. These were ranked 5 and 8 by the Canadian sample.

In terms of sex differences, for the Chinese students, Lau found significant differences on 10 of the 36 RVS values. However, Lau's sample covered several areas of

study and, having found no sex differences between areas, any differences within areas are not reported. His findings may be confounded by area of study. The present study, using only PSE students, found just 2 of the total 72 RVS and EVS values to show significant sex differences for the Chinese students, and a reversal of Lau's finding that males ranked a Sense of Accomplishment higher. Similar findings in the Hong Kong and Canadian samples were low rankings for ambition and imagination.

Lau concluded that his results indicate little support for a "caring" personality. This conclusion was not supported by the present study where Chinese students identified being inconsiderate and unkind as "bad" personality characteristics in the Echo Study significantly more often than whites, and assigned higher rankings to the RVS Helpful and Loving.

Overall, the present study found many differences among the highest ranked instrumental and terminal values across groups, and many similarities among the lowest ranked. However, with regard to the lowest ranked values, for the two areas of study, and for males and females, there is a high degree of consensus. This consensus does not exist for the two races regardless of sex. Chinese students consistently ranked values of creativity lower, also Courageous (standing up for your beliefs).

Impacts in Society

The Echo Study supported previous research on students' views of the impact of their own field of study in society (Fitzpatrick & Silverman, 1989). Students in the humanities and the PSE both felt their work would be beneficial to society. However, unlike males, females in both areas of study were able to describe positive social impacts of their own, and each other's field of endeavour. White males in the PSE found it very difficult to identify positive impacts of workers in the humanities.

Females in the humanities overwhelmingly viewed the impact of science and engineering as helping the environment, people, and health care. There were very few Echo responses by this group concerning any other specific technologies. Males in the humanities were more varied in their responses and more likely to emphasize improvements in the comfort of life, or specific technical understanding. Within the PSE, as enrollment trends are suggesting, females were significantly more concerned with science and engineering as they relate to the environment.

Surrogates

The "surrogate" questions in the Echo Study provided some interesting indications of the reference groups used by students for the various aspects of their lives. As hypothesized, there were race and sex differences within the PSE. The pattern of surrogates choice by the Chinese students, looking to "family" more frequently than other PSE students, is consistent with previous research (Chen & Uttal, 1988). The frequent use of "family" by females overall, however, may present either an obstacle or an opportunity for PSE participation. If, as others have noted (Berg & Ferber, 1983; Dench,1990; Greenfield et al., 1982), lack of maternal or parental support is a deterrent for young girls entering the PSE, then this most important reference group "family" may play a strong role in a negative occupational choice. Conversely, if a girl's family support a non-traditional choice then female students in the PSE are receiving additional assistance to help them enter the field or persist. It is not clear if the present sample of females in the PSE are receiving support or disapproval from their families. But, a closer examination of the Echo responses does indicate family support for behaviours leading to self-sufficiency and financial success.

In terms of the specific questions concerning important or poor life activities, it is interesting to note that students in the PSE look to themselves for approval and

disapproval, while students in the humanities look to their families. For females, this is consistent with higher ratings of Independent.

The Two Instruments

It was hypothesized that there would be differences in the relative ability of the two value surveys to discriminate between students in the PSE and students in the humanities. Overall, the RVS classification was only slightly higher than the EVS (73.7% vs. 67.7% for the EVS), in both cases classification for humanities group membership being more accurate. However, applying the instruments to more homogeneous groups raised classification rates sharply. It appears that although there are many significant ranking differences found overall between the two areas of study using the RVS and EVS, both instruments have limited group classification powers on such heterogeneous groups. If the groups are further defined by race or sex, classification accuracy rises.

It was also hypothesized that different values would be elicited through the Echo technique than those already included in the RVS. This hypothesis was supported, the Echo technique elicited a wide range of values and 21 of those used for the EVS were different from the existing 36 RVS values. However, also noteworthy are the number of similar items given Rokeach's "intuitive" methodology and the Echo technique's more rigorous data gathering.

Despite Rokeach's (1973) defense of the intent of the RVS, to examine the relative ordering of values, not their absolute presence or absence, the RVS has received frequent criticism on this point. The inclusion of similar or identical values on the EVS and RVS provided an opportunity to examine the issue further. The results indicated that some almost identical values (e.g., Ambition/Ambitious, Loving, Caring/Loving) received different rankings on the two surveys. In each case, the lower ranking on the EVS reflected higher rankings assigned to values not included on the RVS. This was

particularly true for Chinese students, suggesting a greater culture bias in the content of the RVS values for this group. However, the original intent of the RVS must be noted, whether the values reflect priorities for a given population is not the issue. Instead, it is how that population ranks the values compared to another population.

Echo goes one step beyond, ensuring appropriate content as well as measuring relative relative ranking differences. In the Value Study, the relative advantages of the Echo technique were not evident in overall comparisons by area of study. Responses were similar. However, when more specific comparisons were made, within and between areas, the unique Echo values illustrated some interesting differences not evident on the RVS. For example, the high values assigned to: Financial/Career Success by Chinese students; and Optimism by females in the PSE; and the relatively low values assigned to Competitive, Social Responsibility and Harmony with the Environment by all students.

Summary

Perhaps some of the most interesting findings of the present study are the trends evident from the overall patterns by sex, race, and area of study. The largest number of differences appear to exist overall between students in the PSE and the humanities. Consistent with this, for both white males and females, this pattern also holds but there are a greater number of differences between females in the two areas than for males. Both white males and females also differ from their Chinese counterparts within the PSE, again with a greater number of differences between females in the two races than males. But, comparisons of Chinese males and females within the PSE show few differences. White males and females within the humanities are likewise very similar. The pattern then is one of Chinese homogeneity within the PSE, and white homogeneity within the humanities.

What contributes to these patterns? A potential explanation may be in the interrelationship of socialization, values, expectations, and goals found in the Eccles (1984)

model. Al-Asadi's (1989) research using a work values survey with students in different areas of study found few differences. He concluded that the survey used lacked the necessary sensitivity to discriminate among areas. Perhaps an alternate explanation may be that personal values, not work values, are more closely related to occupational choice. Rokeach (1973) cited criticism of the Study of Values (Allport et al., 1960) on this point, asserting that the survey was simply a test of occupational interest. He argued that interest was just one of the many manifestations of a value.

There are two major findings in the present research that support the role of other values. First, unlike Al-Asadi's research using work values, both the EVS and RVS, using personal values, successfully discriminated between students in the different areas of study. Second, values held by the two sexes, and the two races, also discriminated differentially between areas of study. For white students in the humanities, sex-related value differences were infrequent. The opposite effect was found in the PSE, white females and males differed significantly in their values, and white females moved away from "traditional" female values. For Chinese students, sex-related value differences in the PSE were infrequent but Chinese females maintained their traditional female values. Even without a comparison group of Chinese students in the humanities, these results suggest an interaction of at least three categories of values: personal; cultural as in sex-role; and cultural as in social or racial origin.

If this is so, then for the Chinese students, personal and sex-role values interact with overriding social values of the importance of science and engineering. For Chinese females, this allows them to enter the PSE, maintaining their "traditional" female values of family and caring while experiencing little sex-role conflict. Their social values, peers and family support a career choice which for whites is considered nontraditional.

Despite previous research suggesting that one of the deterrents for female participation in the PSE is their lack of knowledge concerning the fields, the level of

understanding of the humanities females in the present study was surprisingly high. This supports the socialization and sex-role research indicating a perceived incompatibility between traditional female values and a career in the PSE. White females for the most part have been raised in a culture that views their traditional sex-role as conflicting with participation in the PSE. Therefore, those that do participate shun traditional personal values and embrace values of equality, independence, and optimism. It is beyond the scope of the present paper to conjecture about the actual receptivity of the PSE to individuals holding traditional female values, but the findings concerning the present sample of PSE females indicate a disproportionate emphasis on self-confidence and esteem, consistent with previous research in this area (Jones and Lamke, 1985).

What are the implications of the values held by white PSE females in the present sample for their success in the field? In terms of limitations, there are several issues. The females are focussed on environmental and health issues to a greater degree than the males, limiting their career choices. As well, their emphasis on freedom of thought may come into conflict with the necessary rigidity that some fields demand. Related to this is their emphasis on optimism and achievement, possibly unrealistic given discrimination in the workplace, while suppressing family values may contribute to sex-role conflict.

However, these same values could facilitate their participation. Suppressing family values may be a realistic coping mechanism in a competitive workplace, and optimism coupled with ambitious goals will provide strength and motivation in the face of adversity. Independence will assist with dedication to singular research, and tolerance provides a means to face discrimination.

For the Chinese women, limitations are few, focussing on potentially unrealistic expectations for equality and advancement in their careers. Conversely, their values would seem to facilitate a career in the PSE where for them, sex role conflict is minimal, optimism is high, and they have the support of family and friends.

While the focus of the present research has been on females, the implications for intervention and change apply to both sexes. White males and females in the humanities in the present study held very similar values and, given declining enrollments in the PSE overall, would both benefit from intervention at an early age. Teachers, counsellors, and the curriculum must give a clear message concerning the social benefits and scope of the PSE.

As stated earlier, the present study sought to illustrate that it is the very women who keep many of their separate, and cultural values intact, and recognize that the fields of science and engineering can incorporate them, that will move into these areas. For the Chinese women this has been illustrated, but they appear to have a special advantage of accompanying social support for their choice. For white women, this is not yet the case.

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Appendix A

Appendix A. Values, The Rokeach Value Survey

Terminal Values	Instrumental Values
A World at Peace	Honest
Family Security (taking care of loved ones)	Ambitious
Freedom (independence and free choice)	Responsible (dependable, reliable)
Health	Forgiving
Self-Respect	Broadminded
Wisdom	Courageous (standing up for your beliefs)
Equality	Helpful
Salvation	Clean
A Comfortable Life	Capable
A Sense of Accomplishment	Self-Controlled
True Friendship	Loving
National Security	Loyal
Inner Harmony	Independent
Mature Love (sexual and spiritual intimacy)	Polite
A World of Beauty	Intellectual (intelligent and reflective)
Social Recognition	Obedient
Pleasure	Logical
An Exciting Life	Imaginative

Appendix B

Appendix B. Taylor and Barron: Traits of a Scientist

1. High degree of autonomy, self-sufficiency, self-direction.
2. Preference for mental manipulations involving things rather than people, detached attitude in interpersonal relations, preference for intellectual vs. social challenge.
3 High ego strength, emotional stability.
4. Liking for method, precision, exactness.
5. Preference for defense mechanisms like repression and isolation.
6. High degree of personal dominance but dislike of personally bred.controversy.
7. High degree of impulse control.
8. Liking for abstract thinking, tolerance of cognitive ambiguity.
9. Independence of judgment, rejection of group conformity pressures.
10. Superior general intelligence.
11. Early, broad interest in intellectual activities.
12. Drive to comprehensiveness with elegance in explanation.
13. Special interest in "wagering"- pitting against uncertain circumstances where own effort is deciding factor.

Appendix C

Introductory Sheet. A Study of Values

I am asking for your voluntary participation in this study of values as part of a larger study involving students in science, engineering, and the humanities at the province's three universities.

You will be completing a set of questions, as well as a one page questionnaire concerning various demographic characteristics (name, age, university major).

All responses and information will be kept absolutely confidential. The data will be stored in locked filing cabinets. I will be the only person analyzing the data which will be analyzed as composite scores so that at no time will any results be attributable to an individual.

Guidelines

The pile of slips of paper you have been given contains 8 questions, some repeated 4 times, some only 2 or 3 times each. These questions concern you personally, and your thoughts about your field of study. Please try to provide different answers to each of the questions.

All but 2 of the questions have related questions on the reverse side. These questions concern "approvers and disapprovers", and, unlike the other questions, will not always have different answers. In certain areas of your life you may look to the same people for approval or disapproval of your behaviour. You may list more than one approver or disapprover in each case if appropriate.

For all questions, answers may be a sentence, a phrase or just a word.

Please answer the questions from your point of view, reflecting your own feelings about the subject.

The various paper colours have no significance, they simply assist in sorting the data.

Please complete the one page questionnaire last.

Appendix D

Questionnaire

Name:_____

Age:_____ Sex: M F

Place of Birth:_____

Cultural/Racial Origin (e.g., Italian, British, Chinese):_____

Number of Years of Education Completed in Canada (please circle all that apply):

Elementary High school Some High School Only

Post Secondary Some Post Secondary Only All

Other (please specify):_____

University Major:_____

Grade Point Average (present year to date, letter grade or number):_____

Anticipated Highest Level of Education:_____

Anticipated Occupation:_____

Father's Place of Birth:_____

Father's Education and Field of Study:_____

Mother's Place of Birth:_____

Mother's Education and Field of Study:_____

Please check the appropriate interval:

|_____|_____|_____|_____|_____|_____|

Strongly Agree Strongly Disagree

I support Canada's participation in the war in the Persian Gulf

Appendix E

Appendix E

Echo Response Summary by Question, Area of Study and Sex

Note: Categories of equal size are ranked equally.

Question 1: What is an important personality characteristic for you to have?

Humanities

Males	Females
1. Kind, caring, loving.	1. Kind, caring, loving.
2. Tolerant.	2. Honest.
3. Honest.	3. Diligent, determined.
4. Diligent, determined.	4. Tolerant.

PSE

Males	Females
1. Kind, caring, loving.	1. Honest.
2. Diligent, determined.	2. Diligent, determined.
3. Easy-going, sociable.	3. Caring, kind.
Honest.	4. Tolerant, open-minded.
4. Sense of humour.	

Chinese

1. Kind, caring, loving.
2. Diligent, determined.
3. Tolerant.
   Easy-going.
4. Intelligent.

Question 2: What is a poor or bad personality characteristic for you to have?

Humanities

Males

1. Arrogant, egotistical.
2. Moody, short temper.
3. Lazy, procrastinate.
   Selfish, greedy.
   Uncaring, inconsiderate.
4. Intolerant, narrow.

Females

1. Lazy, procrastinate.
2. Lack of confidence.
3. Dishonest.
4. Uncaring, inconsiderate.
   Intolerant, narrow.
   Arrogant, egotistical.

PSE

Males

1. Lazy, procrastinate.
2. Short temper.
3. Intolerant, narrow.
4. Cruel, vindictive.
   Uncaring, inconsiderate.

Females

1. Dishonest.
   Lazy, procrastinate.
   Competitive.
2. Moody, short temper.
3. Uncaring, inconsiderate.
4. Arrogant, egotistical.

Chinese

1. Uncaring, inconsiderate.
2. Intolerant, narrow.
   Lazy, procrastinate.
3. Dishonest.
   Shy, introverted.

Question 3: What is an important or valuable thing that you could do with your life?

Humanities

Males

1. Help others.
   Self development.
2. Family related.
3. Teach.
4. Make others happy.
5. Help the environment.
   Continue learning.
   Career success.

Females

1. Help others.
2. Family related.
3. Teach.
4. Complete university.
   Make others happy.
5. Self development.
   Career success.
   Write, publish.

PSE

Males

1. Career success.
2. Help others.
3. Financial success.
4. Family related.
5. Have fun.

Females

1. Career success.
2. Help others.
3. Family related.
4. Teach.
   Complete degree.
5. Self development.

Chinese

1. Financial success.
2. Career success.
3. Family-related.
4. Help others.
5. Self-development, fun.

Question 4: What is a poor or bad thing that you could do with your life?

Humanities

Males

1. Waste it, abuse potential.
2. Not help, hurt others.
3. Be dishonest, criminal.
4. Family-related mistakes.
   Abuse personal health.

Females

1. Waste it, abuse potential.
2. Abuse personal health.
3. Be uncaring, inconsiderate.
   Become materialistic.
4. Be dishonest.
   Hurt the environment.
   Become dependent.

PSE

Males

1. Hurt others.
2. Waste it, abuse potential.
3. Be dishonest, criminal.
4. Abuse personal health.
5. Quit school.
6. Become dependent.

Females

1. Waste it, abuse potential.
2. Quit school.
   Family related mistakes.
3. Lose touch with friends,family
   Be dishonest, criminal.
4. Hurt others.
5. Abuse personal health.
   Become dependent.

Chinese

1. Hurt others.
2. Abuse personal health.
3. Quit school.
4. Family related mistakes.

Question 5: What will be a positive impact of workers in the humanities on society?

Humanities

Males	Females
1. Understand society and human behaviour, improve human relations.	
2. Learn from past mistakes.	2. Teach, educate.
3. Teach, educate. Wisdom, knowledge, free thought.	3. Literature, art, culture.
4. Improve social services.	4. Help the environment.

PSE

Males	Females
1. Help others.	1. Help others.
2. Understand human nature.	2. Understand human nature.
3. Literature, art, culture.	3. Literature, art, culture.
4. Wisdom, expanded horizons. Man-machine interface. Improve international relations.	4. History. Teach, educate. Help the environment.

Chinese

1. Help others.
2. Help the environment.
3. Wisdom, expanded horizons.
4. Social/technological balance.

Question 5: What will be a positive impact of workers in the fields of science and engineering?

Humanities

Males	Females
1. Improved standard of living.	1. Help the environment.
2. Help the environment.	2. Medical advances.
Medical advances.	3. Help others.
3. Technological innovation.	4. Technological innovation.
4. Transport improvements.	Social/technological balance.
Social/technological balance.	

PSE

Males	Females
1. Improved products and processes, both health and general.	
2. Improved standard of living.	2. Help environment.
3. Help environment.	3. Improved standard of living.
4. Improved productivity, general improved economic wealth.	

Chinese

1. Improved standard of living.
2. Personal development.
3. Improved products and processes.
4. Help the environment.

Question 7 (PSE): What is an important thing that you, as part of the workforce in science and engineering in the future, could do?

Males	Females
1. Help others, improve the standard of living, including environmental and health products.	
2. Improved products and processes .	2. Research and teach.
3. Social/technological balance.	3. Improved products and processes.
4. Increase knowledge.	4. Help third world countries.

Question 8 (PSE): What is a bad thing that you, as part of the workforce in science and engineering in the future, could do?

Males	Females
1. Use science and technology to hurt the environment.	
2. Develop weapons.	2. Develop weapons.
3. Hurt people.	3. Hurt people.
4. Ignore social needs.	Exploit others financially.
5. Exploit others financially.	4. Ignore social needs.
	Create poor products.
	Waste life.
	Work by rote, like a robot.

Chinese

1. Develop weapons.
   Use science and technology to hurt the environment.
2. Hurt others.
3. Exploit others financially.

Question 7 (Humanities): What is an important thing that you, as part of the workforce in the humanities in the future, could do?

Males	Females
1. Educate others.	1. Educate others.
2. Increase awareness, thought.	2. Help others.
3. Help others.	3. Increase awareness, thought.
4. Appreciation of the arts.	4. Personal improvement.

Question 8 (Humanities): What is a bad thing that you, as part of the workforce in the humanities in the future, could do?

Males	Females
1. Mislead and exploit others.	1. Become rigid and narrow.
2. Become rigid and narrow.	2. Mislead and exploit others.
3. Waste education.	Ignore social concerns.
4. Discontinue learning.	3. Waste education.

Appendix F

Echo Value Survey

Please rank these values from 1 (most important to you) to 18 (least important to you):

AMBITION ____

ATHLETIC, AGILE ____

COMPETITIVE ____

CONFIDENT ____

CREATIVE ____

DETERMINED ____
(persistent, persevering, diligent, disciplined)

GENEROUS ____

HONEST ____

LEADERSHIP ____
(able to lead others, take charge)

LOVING, CARING ____

LOYAL ____

OPTIMISM ____
(positive attitude, outlook on life)

PATIENCE ____

RELIGIOUS ____

RESPONSIBLE ____

SENSE OF HUMOR ____

SOCIABLE ____
(outgoing and friendly)

TOLERANT ____
(open-minded, without prejudice or bias)

When you have finished, please proceed to the next page.

Please rank these values from 1 (most important to you) to 18 (least important to you):

ADVANCEMENT OF KNOWLEDGE ____
(a growing knowledge base achieved through research and writing)

A PROSPEROUS ECONOMY ____
(economic growth and national wealth)

ART AND BEAUTY ____
(development of art, music and literature)

CAREER SUCCESS ____
(personal career achievement)

DISSEMINATION OF KNOWLEDGE ____
(teaching others, developing youth)

EQUALITY ____

FAME, DISTINCTION ____
(recognition and status for accomplishments)

FAMILY HEALTH AND HAPPINESS ____
(raising children well, marital and home stability)

FINANCIAL SUCCESS (PERSONAL) ____

FREEDOM OF THOUGHT ____

FUN AND EXCITEMENT ____

HARMONY WITH THE ENVIRONMENT ____
(reduction of pollution, respect for nature)

MEDICAL ADVANCEMENT ____
(innovation in health care to cure disease)

PERSONAL HEALTH ____

SELF-FULFILLMENT ____
(achieving potential, inner harmony)

SOCIAL RESPONSIBILITY ____
(caring for the needs of others)

SOCIAL UNDERSTANDING ____
(the pursuit of the meaning of life)

WORLD TRAVEL ____
(seeing other places, cultures)

Appendix G

I am asking for your voluntary participation in this study of values as part of a larger study involving students in science, engineering, and the humanities at the province's three universities.

You will be completing two ranking instruments, as well as a one page questionnaire concerning various demographic characteristics (e.g., name, age, university major).

All responses and information will be kept absolutely confidential. The data will be stored in locked filing cabinets. I will be the only person analyzing the data which will be analyzed as composite scores so that at no time will any results be attributable to an individual.

Guidelines

Attached are two separate instruments, the Echo Value Survey and the Rokeach Value Survey, containing statements or words which reflect values held in our society. On both instruments you are asked to rank the values in order of importance to you, and to your life.

Each instrument contains 2 lists of 18 values, listed in alphabetical order. Please rank the values from 1 as the most important to you, to 18, as the least important to you.

You will find some of the values are included on both instruments, others appear on only one. Please complete each instrument separately, considering each of the stated values only in relation to the surrounding 17 values on that page. It is the relative ranks, not the actual ranks, that are important.

Please complete the Echo Value Survey first, the Rokeach Value Survey second, and the one page questionnaire last.

Thank you for your cooperation.

Appendix H

Questionnaire

Name (optional):_____

Age:_____ Sex: M F

Place of Birth:_____

Cultural/Racial Origin (e.g., Italian, British, Chinese):_____

Number of Years of Education Completed in Canada (please circle all that apply):

Elementary High School Some High School Only

Post Secondary Some Post Secondary Only All

Other (please specify):_____

University Major:_____

Grade Point Average (present year to date, letter grade or number):_____

Anticipated Highest Level of Education:_____

Anticipated Occupation:_____

Father's Place of Birth:_____

Father's Education and Field of Study:_____

Mother's Place of Birth:_____

Mother's Education and Field of Study:_____

Appendix I

Appendix I

Summary, Anticipated Occupation, Students in Physical Science and Engineering and the Humanities

Occupation	Percentage Choosing	N
PSE		
Engineer		
Undergraduate	28.3%	36.0
Graduate	16.5	21.0
Professor	15.0	19.0
Business	12.6	16.0
Research		
Undergraduate	11.8	15.0
Graduate	10.2	13.0
Teacher	3.1	4.0
Other	2.5	3.0
Humanities		
School Teacher	38.3	31
College Teacher	25.9	21
Professor	11.1	9
Writer	8.7	7
Lawyer	6.2	5
Research	3.7	3
Business	2.5	2
Other	3.6	3

Appendix J

Appendix J, Composite Rank Orders of Values, Echo and Rokeach Value Surveys, All Students.

Echo Terminal Value	Mean	Rank	Rokeach Terminal Value	Mean	Rank
Family Health and Happiness	(5.45)	1	Health	(5.88)	1
Self-Fulfillment	(5.76)	2	Self-Respect	(6.29)	2
Personal Health	(6.69)	3	Family Security	(6.37)	3
Freedom of Thought	(6.90)	4	True Friendship	(6.71)	4
Advancement of Knowledge	(7.21)	5	Freedom	(6.82)	5
Equality	(8.19)	6	Mature Love	(7.66)	6
Career Success	(8.62)	7	Inner Harmony	(8.15)	7
Social Responsibility	(8.68)	8	A Sense of Accomplishment	(8.86)	8
Dissemination of Knowledge	(8.86)	9	Equality	(8.87)	9
Fun and Excitement	(9.64)	10	Wisdom	(8.90)	10
Harmony /Environment	(9.93)	11	An Exciting Life	(9.79)	11
Financial Success	(10.74)	12	A Comfortable Life	(10.25)	12
Social Understanding	(11.01)	13	A World at Peace	(10.43)	13
Medical Advancement	(11.21)	14	Pleasure	(10.75)	14
World Travel	(11.43)	15	World of Beauty	(13.15)	15
Art and Beauty	(12.27)	16	Social Recognition	(13.50)	16
A Prosperous Economy	(13.53)	17	Salvation	(13.64)	17
Fame, Distinction	(14.55)	18	National Security	(14.90)	18

Echo Instrumental Values	Mean	Rank	Rokeach Instrumental Values	Mean	Rank
Honest	(4.78)	1	Honest	(5.26)	1
Loving, Caring	(6.75)	2	Loving	(6.25)	2
Responsible	(6.92)	3	Responsible	(6.81)	3
Tolerant	(7.38)	4	Broadminded	(7.16)	4
Optimism	(8.07)	5	Loyal	(7.89)	5
Loyal	(8.35)	6	Independent	(8.00)	6
Sense of Humour	(8.45)	7	Intellectual	(8.49)	7
Confident	(8.55)	8	Courageous	(9.05)	8
Determined	(8.65)	9	Helpful	(9.06)	9
Patience	(9.43)	10	Forgiving	(9.27)	10
Sociable	(9.75)	11	Capable	(9.49)	11
Generous	(9.92)	12	Ambitious	(9.56)	12
Creative	(10.15)	13	Imaginative	(9.95)	13
Ambition	(11.01)	14	Logical	(10.45)	14
Leadership	(11.39)	15	Self-Controlled	(11.12)	15
Athletic, Agile	(13.35)	16	Polite	(12.35)	16
Competitive	(13.68)	17	Clean	(14.71)	17
Religious	(14.20)	18	Obedient	(15.56)	18

Appendix J,Composite Rank Orders of Values, Echo and Rokeach Value Surveys, All PSE Students.

Echo Terminal Values	Mean	Rank	Rokeach Terminal Values	Mean	Rank
Family Health and Happiness	(5.83)	1	Health	(5.76)	1
Self-Fulfillment	(6.07)	2	Self-Respect	(6.35)	2
Advancement of Knowledge	(6.46)	3	Family Security	(6.63)	3
Personal Health	(6.77)	4	True Friendship	(6.64)	4
Freedom of Thought	(7.13)	5	Freedom	(6.70)	5
Career Success	(8.03)	6	A Sense of Accomplishment	(8.26)	6
Equality	(8.77)	7	Mature Love	(8.28)	7
Dissemination of Knowledge	(9.09)	8	Wisdom	(8.66)	8
Fun and Excitement	(9.49)	9	Inner Harmony	(8.68)	9
Social Responsibility	(9.70)*	10	Equality	(9.17)	10
Financial Success	(9.70)*	11	A Comfortable Life	(9.18)	11
Harmony /Environment	(9.87)	12	An Exciting Life	(9.26)	12
Medical Advancement	(10.81)	13	Pleasure	(10.41)	13
Social Understanding	(11.71)	14	A World at Peace	(11.15)	14
World Travel	(12.15)	15	Social Recognition	(12.89)	15
Art and Beauty	(12.68)	16	World of Beauty	(13.55)	16
A Prosperous Economy	(12.78)	17	Salvation	(14.49)	17
Fame, Distinction	(14.04)	18	National Security	(14.70)	18

Echo Instrumental Values	Mean	Rank	Rokeach Instrumental Values	Mean	Rank
Honest	(5.09)	1	Honest	(5.57)	1
Responsible	(6.79)	2	Responsible	(6.44)	2
Confident	(7.98)*	3	Broadminded	(7.32)	3
Determined	(7.92)*	4	Loving	(7.58)	4
Tolerant	(8.02)	5	Independent	(7.72)	5
Loving, Caring	(8.10)	6	Intellectual	(8.01)	6
Optimism	(8.21)	7	Capable	(8.51)	7
Sense of Humour	(8.43)	8	Ambitious	(8.79)	8
Loyal	(9.11)	9	Loyal	(8.94)	9
Patience	(9.78)	10	Logical	(9.11)	10
Creative	(9.84)	11	Helpful	(9.36)	11
Sociable	(9.85)	12	Courageous	(9.59)	12
Ambition	(10.43)	13	Imaginative	(9.81)	13
Generous	(10.45)	14	Self-Controlled	(10.26)	14
Leadership	(10.62)	15	Forgiving	(10.32)	15
Competitive	(12.54)	16	Polite	(12.78)	16
Athletic, Agile	(12.63)	17	Clean	(15.05)	17
Religious	(14.86)	18	Obedient	(15.57)	18

* tied and close scores were split using the median ranks.

Appendix J, Composite Rank Orders of Values, Echo and Rokeach Value Surveys, All Humanities Students.

Echo Terminal Values	Mean	Rank	Rokeach Terminal Values	Mean	Rank
Self-Fulfillment	(5.27)	1	Family Security	(5.98)	1
Family Health and Happiness	(4.86)	2	Health	(6.06)	2
Freedom of Thought	(6.54)	3	Self-Respect	(6.20)	3
Personal Hea'th	(6.56)	4	Mature Love	(6.72)	4
Equality	(7.26)	5	True Friendship	(6.81)	5
Social Responsibility	(7.37)	6	Freedom	(6.99)	6
Advancement of Knowledge	(8.42)	7	Inner Harmony	(7.35)	7
Dissemination of Knowledge	(8.48)	8	Equality	(8.43)	8
Career Success	(9.55)	9	Wisdom	(9.26)	9
Social Understanding	(9.90)	10	A World at Peace	(9.34)	10
Harmony /Environment	(10.03)	11	A Sense of Accomplishment	(9.74)	11
Fun and Excitement	(10.31)	12	An Exciting Life	(10.60)	12
World Travel	(10.32)	13	Pleasure	(11.26)	13
Art and Beauty	(11.61)	14	A Comfortable Life	(11.85)	14
Medical Advancement	(11.85)	15	Salvation	(12.37)	15
Financial Success	(12.41)	16	World of Beauty	(12.55)	16
A Prosperous Economy	(14.74)	17	Social Recognition	(14.41)	17
Fame, Distinction	(15.34)	18	National Security	(15.20)	18

Echo Instrumental Values	Mean	Rank	Rokeach Instrumental Values	Mean	Rank
Honest	(4.28)	1	Loving	(4.17)	1
Loving, Caring	(4.57)	2	Honest	(4.80)	2
Tolerant	(6.35)	3	Loyal	(6.30)	3
Loyal	(7.13)	4	Broadminded	(6.92)	4
Responsible	(7.14)	5	Responsible	(7.37)	5
Optimism	(7.84)	6	Forgiving	(7.68)	6
Sense of Humour	(8.48)	7	Courageous	(8.23)	7
Patience	(8.86)	8	Independent	(8.42)	8
Generous	(9.06)	9	Helpful	(8.60)	9
Confident	(9.45)	10	Intellectual	(9.22)	10
Sociable	(9.58)	11	Imaginative	(10.17)	11
Determined	(9.81)	12	Ambitious	(10.71)	12
Creative	(10.65)	13	Capable	(10.96)	13
Ambition	(11.94)	14	Polite	(11.70)	14
Leadership	(12.59)	15	Self-Controlled	(12.41)	15
Religious	(13.12)	16	Logical	(13.52)	16
Athletic, Agile	(14.48)	17	Clean	(14.20)	17
Competitive	(15.52)	18	Obedient	(15.56)	18

Appendix J, Composite Rank Orders of Values, Echo and Rokeach Value Surveys, Male Humanities Students.

Echo Terminal Values	Mean	Rank	Rokeach Terminal Values	Mean	Rank
Family Health and Happiness	(6.05)	1	Family Security	(5.42)	1
Freedom of Thought	(6.14)	2	Freedom	(6.25)*	2
Social Responsibility	(6.33)	3	Mature Love	(6.25)*	3
Self-Fulfillment	(7.24)	4	Health	(6.46)	4
Personal Health	(7.33)	5	True Friendship	(6.71)	5
Dissemination of Knowledge	(8.05)	6	Self-Respect	(7.08)	6
Advancement of Knowledge	(8.29)	7	Equality	(7.96)	7
Equality	(8.38)	8	Wisdom	(8.00)	8
World Travel	(8.67)	9	Inner Harmony	(9.17)	9
Social Understanding	(9.38)	10	An Exciting Life	(9.75)	10
Career Success	(9.72)	11	A Sense of Accomplishment	(9.79)	11
Harmony /Environment	(10.38)	12	A World at Peace	(10.58)	12
Fun and Excitement	(10.76)	13	Pleasure	(11.21)	13
Art and Beauty	(11.19)	14	A Comfortable Life	(11.46)	14
Medical Advancement	(11.91)	15	World of Beauty	(12.46)	15
Financial Success	(12.38)	16	Salvation	(13.04)	16
A Prosperous Economy	(13.67)	17	Social Recognition	(14.54)	17
Fame, Distinction	(15.62)	18	National Security	(15.29)	18

Echo Instrumental Values	Mean	Rank	Rokeach Instrumental Values	Mean	Rank
Honest	(4.29)	1	Honest	(4,58)	1
Tolerant	(5.14)	2	Loving	(5.38)	2
Loving, Caring	(5.67)	3	Broadminded	(6.25)	3
Responsible	(7.38)	4	Courageous	(7.13)	4
Sense of Humour	(7.57)	5	Responsible	(7.54)	5
Patience	(8.33)	6	Loyal	(7.96)	6
Loyal	(8.71)	7	Forgiving	(8.04)	7
Sociable	(8.91)	8	Helpful	(8.17)	8
Determined	(8.95)	9	Intellectual	(8.71)	9
Optimism	(9.33)	10	Independent	(8.96)	10
Generous	(9.62)	11	Imaginative	(10.42)	11
Confident	(9.71)	12	Capable	(10.75)	12
Ambition	(11.29)	13	Ambitious	(11.25)	13
Creative	(11.33)	14	Polite	(11.88)	14
Leadership	(11.43)	15	Self-Controlled	(12.63)	15
Athletic, Agile	(14.38)	16	Clean	(13.67)	16
Competitive	(14.67)	17	Obedient	(14.79)	17
Religious	(14.76)	18	Logical	(16.23)	18

* tied and close scores were split using median ranks

Appendix J, Composite Rank Orders of Values, Echo and Rokeach Value Surveys, Female Humanities Students.

Echo Terminal Values	Mean	Rank	Rokeach Terminal Values	Mean	Rank
Family Health and Happiness	(4.46)	1	Self-Respect	(5.90)	1
Self-Fulfillment	(4.50)	2	Family Security	(5.96)*	2
Personal Health	(6.28)	3	Health	(5.96)*	3
Freedom of Thought	(6.68)	4	Mature Love	(6.78)	4
Equality	(7.20)	5	True Friendship	(6.87)*	5
Social Responsibility	(7.33)	6	Inner Harmony	(6.87)*	6
Advancement of Knowledge	(8.23)	7	Freedom	(7.39)	7
Dissemination of Knowledge	(8.41)	8	Equality	(8.89)	8
Career Success	(9.72)	9	A World at Peace	(8.94)	9
Harmony /Environment	(9.85)	10	Wisdom	(9.82)	10
Social Understanding	(10.12)	11	A Sense of Accomplishment	(9.85)	11
Fun and Excitement	(10.15)	12	An Exciting Life	(10.78)	12
World Travel	(10.62)	13	Pleasure	(11.09)	13
Art and Beauty	(11.67)	14	Salvation	(12.02)	14
Medical Advancement	(12.07)	15	A Comfortable Life	(12.13)	15
Financial Success	(12.58)	16	World of Beauty	(12.39)	16
Fame, Distinction	(15.08)	17	Social Recognition	(14.15)	17
A Prosperous Economy	(15.27)	18	National Security	(15.25)	18

Echo Instrumental Values	Mean	Rank	Rokeach Instrumental Values	Mean	Rank
Honest	(4.07)	1	Loving	(3.66)	1
Loving, Caring	(4.20)	2	Honest	(4.71)	2
Tolerant	(6.70)	3	Loyal	(5.62)	3
Loyal	(6.80)*	4	Broadminded	(7.03)	4
Responsible	(6.87)*	5	Responsible	(7.29)	5
Optimism	(6.80)*	6	Forgiving	(7.71)	6
Sense of Humour	(8.47)	7	Independent	(8.27)	7
Patience	(8.87)	8	Helpful	(8.59)	8
Generous	(8.97)	9	Courageous	(8.59)	9
Confident	(9.67)	10	Intellectual	(9.36)	10
Sociable	(9.70)	11	Imaginative	(10.27)	11
Determined	(10.27)	12	Ambitious	(10.80)	12
Creative	(10.57)	13	Capable	(11.14)	13
Ambition	(12.21)	14	Polite	(11.58)	14
Religious	(12.53)	15	Self-Controlled	(12.38)	15
Leadership	(12.98)	16	Logical	(13.78)	16
Athletic, Agile	(14.56)	17	Clean	(14.30)	17
Competitive	(15.85)	18	Obedient	(15.68)	18

* tied and close scores were split using median ranks

Appendix J, Composite Rank Orders of Values, Echo and Rokeach Value Surveys, White Female Students, PSE.

Echo Terminal Values	Mean	Rank	Rokeach Terminal Values	Mean	Rank
Self-Fulfillment	(4.82)	1	Freedom	(4.75)	1
Freedom of Thought	(5.05)	2	Self-Respect	(5.25)	2
Advancement of Knowledge	(5.41)	3	True Friendship	(5.88)	3
Equality	(7.00)	4	Mature Love	(7.38)	4
Family Health and Happiness	(7.14)	5	Health	(7.42)	5
Dissemination of Knowledge	(8.32)	6	Inner Harmony	(7.67)	6
Personal Health	(8.41)	7	Family Security	(7.67)	7
Harmony / Environment	(8.59)	8	A Sense of Accomplishment	(7.71)	8
Social Responsibility	(8.91)	9	Equality	(8.58)	9
Career Success	(9.18)	10	An Exciting Life	(8.75)	10
Fun and Excitement	(10.41)	11	Wisdom	(9.33)	11
Medical Advancement	(10.48)	12	A World at Peace	(9.71)	12
Social Understanding	(10.64)*	13	Comfortable Life	(11.26)	13
World Travel	(10.64)*	14	Pleasure	(11.92)	14
Art and Beauty	(11.23)	15	World of Beauty	(12.21)	15
Financial Success	(13.48)	16	Social Recognition	(14.21)	16
A Prosperous Economy	(15.48)	17	National Security	(14.83)	17
Fame, Distinction	(15.82)	18	Salvation	(16.22)	18

Echo Instrumental Values	Mean	Rank	Rokeach Instrumental Values	Mean	Rank
Honest	(5.91)	1	Broadminded	(4.88)	1
Optimism	(6.09)	2	Independent	(5.42)	2
Tolerant	(6.39)	3	Honest	(6.42)	3
Responsible	(7.05)	4	Responsible	(6.83)	4
Determined	(7.32)	5	Intellectual	(7.17)	5
Loving, Caring	(7.87)	6	Imaginative	(7.96)	6
Confident	(7.91)	7	Loving	(8.00)	7
Creative	(8.68)	8	Ambitious	(8.29)	8
Sense of Humour	(8.77)	9	Capable	(8.63)	9
Ambition	(8.78)	10	Courageous	(9.04)	10
Patience	(9.65)	11	Logical	(9.50)	11
Loyal	(10.00)*	12	Helpful	(9.58)	12
Sociable	(10.00)*	13	Loyal	(9.79)	13
Generous	(10.83)	14	Forgiving	(10.58)	14
Leadership	(11.52)	15	Self-Controlled	(13.22)	15
Athletic, Agile	(13.64)	16	Polite	(13.35)	16
Competitive	(14.00)	17	Clean	(15.74)	17
Religious	(16.88)	18	Obedient	(17.17)	18

Appendix J, Composite Rank Orders of Values, Echo and Rokeach Value Surveys, Chinese Female Students, PSE.

Echo Terminal Values	Mean	Rank	Rokeach Terminal Values	Mean	Rank
Family Health and Happiness	(4.44)	1	Family Security	(5.00)	1
Career Success	(5.11)	2	True Friendship	(6.11)	2
Self-Fulfillment	(5.44)	3	Freedom	(7.44)*	3
Personal Health	(6.11)	4	Health	(7.44)*	4
Advancement of Knowledge	(6.33)	5	Self-Respect	(7.44)*	5
Financial Success	(8.33)	6	A Sense of Accomplishment	(7.67)	6
Freedom of Thought	(9.11)	7	A Comfortable Life	(8.00)	7
A Prosperous Economy	(9.78)	8	Wisdom	(8.22)	8
Medical Advancement	(10.00)	9	Inner Harmony	(9.00)	9
Fun and Excitement	(10.44)	10	A World at Peace	(9.44)	10
Harmony /Environment	(10.67)	11	Mature Love	(9.89)	11
Social Responsibility	(10.78)	12	Equality	(10.67)	12
Dissemination of Knowledge	(11.22)	13	Pleasure	(11.11)	13
Equality	(11.44)	14	Social Recognition	(11.56)	14
World Travel	(12.33)	15	An Exciting Life	(11.78)	15
Art and Beauty	(12.67)	16	World of Beauty	(12.89)	16
Social Understanding	(13.33)	17	Salvation	(13.11)	17
Fame, Distinction	(13.44)	18	National Security	(14.22)	18

Echo Instrumental Values	Mean	Rank	Rokeach Instrumental Values	Mean	Rank
Honest	(4.44)	1	Loving	(4.89)	1
Loving, Caring	(5.44)	2	Honest	(5.44)	2
Optimism	(6.44)	3	Helpful	(6.44)*	3
Loyal	(6.67)	4	Loyal	(6.44)*	4
Confident	(6.78)	5	Forgiving	(6.78)	5
Responsible	(8.44)	6	Responsible	(6.89)	6
Ambition	(9.11)	7	Intellectual	(7.44)	7
Generous	(9.56)	8	Independent	(8.89)	8
Leadership	(9.89)	9	Broadminded	(9.44)	9
Determined	(10.00)	10	Ambitious	(9.78)	10
Creative	(10.78)*	11	Logical	(10.11)	11
Patience	(10.78)*	12	Self-Controlled	(10.22)	12
Tolerant	(10.89)	13	Capable	(10.67)	13
Sense of Humour	(11.44)	14	Polite	(11.67)	14
Sociable	(11.67)	15	Courageous	(11.78)	15
Religious	(11.78)	16	Imaginative	(14.22)	16
Athletic, Agile	(13.44)*	17	Obedient	(14.78)	17
Competitive	(13.44)*	18	Clean	(15.78)	18

* tied and close scores were split using median ranks

Appendix J, Composite Rank Orders of Values, Echo and Rokeach Value Surveys, Chinese Male Students, PSE.

Echo Terminal Values	Mean	Rank	Rokeach Terminal Values	Mean	Rank
Financial Success	(5.56)	1	Health	(4.29)	1
Career Success	(5.69)	2	Family Security	(5.77)	2
Family Health and Happiness	(5.88)	3	Self-Respect	(6.47)	3
Personal Health	(6.00)	4	True Friendship	(6.77)	4
Self-Fulfillment	(6.25)	5	Pleasure	(7.65)	5
Fun and Excitement	(7.81)	6	Equality	(7.94)	6
Equality	(7.88)	7	A Comfortable Life	(8.00)	7
Freedom of Thought	(8.81)	8	Inner Harmony	(8.35)	8
Advancement of Knowledge	(9.31)	9	Freedom	(8.59)	9
A Prosperous Economy	(10.06)	10	Mature Love	(9.00)	10
Social Responsibility	(10.19)*	11	A Sense of Accomplishment	(9.35)	11
Dissemination of Knowledge	(10.19)*	12	An Exciting Life	(9.47)	12
Harmony /Environment	(11.69)	13	Wisdom	(10.71)	13
Medical Advancement	(12.13)	14	Social Recognition	(12.59)	14
Social Understanding	(12.50)	15	Salvation	(13.19)	15
Fame, Distinction	(13.06)	16	National Security	(13.82)	16
World Travel	(13.31)	17	A World at Peace	(13.88)	17
Art and Beauty	(14.25)	18	World of Beauty	(14.94)	18

Echo Instrumental Values	Mean	Rank	Rokeach Instrumental Values	Mean	Rank
Honest	(4.75)	1	Honest	(4.77)	1
Responsible	(6.44)	2	Responsible	(6.18)	2
Confident	(7.00)	3	Independent	(7.24)	3
Tolerant	(8.25)	4	Loving	(7.53)	4
Determined	(8.44)	5	Broadminded	(7.94)	5
Generous	(8.75)	6	Self-controlled	(8.59)	6
Sense of Humour	(8.81)	7	Intellectual	(8.65)	7
Loyal	(8.88)	8	Ambitious	(9.00)	8
Patience	(8.94)	9	Helpful	(9.06)*	9
Loving, Caring	(9.63)	10	Loyal	(9.06)*	10
Optimism	(9.88)	11	Capable	(9.29)	11
Competitive	(10.00)	12	Forgiving	(10.24)	12
Ambition	(10.44)	13	Logical	(10.41)	13
Sociable	(10.56)	14	Imaginative	(10.71)	14
Leadership	(10.88)	15	Polite	(11.06)	15
Creative	(10.88)	16	Clean	(12.82)	16
Athletic, Agile	(12.75)	17	Courageous	(13.00)	17
Religious	(14.50)	18	Obedient	(14.47)	18

* tied and close scores were split using median ranks

Appendix J, Composite Rank Orders of Values, Echo and Rokeach Value Surveys, White Male Students, PSE.

Echo Terminal Values	Mean	Rank	Rokeach Terminal Values	Mean	Rank
Family Health and Happiness	(5.15)	1	Health	(5.16)	1
Personal Health	(6.30)	2	Self-Respect	(6.53)	2
Advancement of Knowledge	(6.43)	3	True Friendship	(6.57)	3
Self-Fulfillment	(6.46)	4	Family Security	(6.77)	4
Freedom of Thought	(7.41)	5	Freedom	(6.92)	5
Career Success	(8.54)	6	Mature Love	(7.40)	6
Fun and Excitement	(8.68)	7	Wisdom	(8.11)	7
Dissemination of Knowledge	(8.96)	8	A Sense of Accomplishment	(8.31)	8
Equality	(9.25)	9	An Exciting Life	(8.65)	9
Financial Success	(9.47)	10	A Comfortable Life	(9.09)	10
Social Responsibility	(9.72)	11	Inner Harmony	(9.28)	11
Harmony / Environment	(9.83)	12	Equality	(9.79)	12
Medical Advancement	(11.33)	13	Pleasure	(10.26)	13
World Travel	(11.85)	14	A World at Peace	(11.60)	14
Social Understanding	(12.06)	15	Social Recognition	(13.07)	15
Art and Beauty	(13.00)	16	World of Beauty	(13.44)	16
A Prosperous Economy	(13.24)	17	Salvation	(14.44)	17
Fame, Distinction	(13.86)	18	National Security	(15.23)	18

Echo Instrumental Values	Mean	Rank	Rokeach Instrumental Values	Mean	Rank
Honest	(4.85)	1	Honest	(5.18)	1
Responsible	(6.44)	2	Responsible	(6.50)	2
Loving, Caring	(7.53)	3	Loving	(7.04)	3
Sense of Humour	(7.58)	4	Broadminded	(7.38)	4
Determined	(7.64)	5	Capable	(8.01)	5
Tolerant	(8.25)	6	Intellectual	(8.30)	6
Confident	(8.33)	7	Independent	(8.47)	7
Optimism	(8.38)	8	Loyal	(8.70)	8
Loyal	(9.15)	9	Courageous	(8.76)	9
Sociable	(9.43)	10	Ambitious	(8.87)	10
Patience	(9.51)	11	Logical	(8.92)	11
Creative	(9.79)	12	Imaginative	(9.70)	12
Leadership	(10.86)*	13	Self-Controlled	(9.92)	13
Generous	(10.86)*	14	Helpful	(10.14)	14
Ambition	(11.21)	15	Forgiving	(10.52)	15
Athletic, Agile	(12.22)	16	Polite	(13.34)	16
Competitive	(13.03)	17	Clean	(15.35)	17
Religious	(15.31)	18	Obedient	(15.68)	18

* tied and close scores were split using median ranks

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Appendix K

White Females, PSE: Means, Standard Deviations, and Sample Size, EVS

Value	N	Mean	Standard Deviation
Advancement of Knowledge	22	5.41	3.80
A Prosperous Economy	22	15.48	2.37
Art and Beauty	22	11.22	4.39
Career Success	22	9.18	4.43
Dissemination of Knowledge	22	8.32	4.35
Equality	22	7.00	4.66
Fame, Distinction	22	15.82	2.99
Family Health and Happiness	22	7.14	5.45
Financial Success	22	13.48	3.75
Freedom of Thought	22	5.05	4.15
Fun and Excitement	22	10.41	4.96
Harmony with the Environment	22	8.59	4.10
Medical Advancement	22	10.48	3.59
Personal Health	22	8.41	4.76
Self-Fulfillment	22	4.82	3.45
Social Responsibility	22	8.91	4.59
Social Understanding	22	10.64	4.66
World Travel	22	10.64	4.90

Appendix K

White Females, PSE: Means, Standard Deviations, and Sample Size, EVS

Value	N	Mean	Standard Deviation
Ambition	22	8.78	5.95
Athletic, Agile	22	13.64	4.62
Competitive	22	14.00	4.49
Confident	22	7.91	3.72
Creative	22	8.68	5.27
Determined	22	7.32	4.94
Generous	22	10.83	3.71
Honest	22	5.91	3.24
Leadership	22	11.52	3.95
Loving, Caring	22	7.87	5.04
Loyal	22	10.00	4.49
Optimism	22	6.09	4.38
Patience	22	9.65	4.21
Religious	22	16.00	1.78
Responsible	22	7.05	3.77
Sense of Humour	22	8.77	5.51
Sociable	22	10.00	4.38
Tolerant	22	6.39	5.10

Appendix

White Females, PSE: Means, Standard Deviations, and Sample Size, RVS

Value	N	Mean	Standard Deviation
A Comfortable Life	24	11.26	4.71
An Exciting Life	24	8.75	4.45
A Sense of Accomplishment	24	7.71	4.20
A World at Peace	24	9.71	4.78
World of Beauty	24	12.21	3.51
Equality	24	8.58	5.00
Family Security	24	7.67	4.69
Freedom	24	4.75	4.19
Health	24	7.42	3.89
Inner Harmony	24	7.67	4.64
Mature Love	24	7.38	3.66
National Security	24	14.83	4.70
Pleasure	24	11.92	3.99
Salvation	24	16.22	3.78
Self-Respect	24	5.25	3.73
Social Recognition	24	14.21	2.41
True Friendship	24	5.88	2.80
Wisdom	24	9.33	4.59

Appendix K

White Females, PSE: Means, Standard Deviations, and Sample Size, RVS

Value	N	Mean	Standard Deviation
Ambitious	24	8.29	5.36
Broadminded	24	4.88	3.73
Capable	24	8.63	4.03
Clean	24	15.74	2.51
Courageous	24	9.04	4.39
Forgiving	24	10.58	4.24
Helpful	24	9.58	3.45
Honest	24	6.42	3.60
Imaginative	24	7.96	4.53
Independent	24	5.42	4.75
Intellectual	24	7.17	4.00
Logical	24	9.50	4.70
Loving	24	8.00	4.72
Loyal	24	9.79	5.08
Obedient	24	17.17	1.30
Polite	24	13.35	3.47
Responsible	24	6.83	3.76
Self-Controlled	24	13.22	3.64

Appendix K

White Males, PSE: Means, Standard Deviations, and Sample Size, EVS

Value	N	Mean	Standard Deviation
Advancement of Knowledge	72	6.43	4.40
A Prosperous Economy	72	13.24	7.24
Art and Beauty	72	13.00	4.46
Career Success	72	8.54	4.82
Dissemination of Knowledge	72	8.96	4.56
Equality	72	9.25	4.59
Fame, Distinction	72	13.86	4.74
Family Health and Happiness	72	5.15	3.80
Financial Success	72	9.46	5.03
Freedom of Thought	72	7.41	4.70
Fun and Excitement	72	8.68	4.94
Harmony with the Environment	72	9.83	4.47
Medical Advancement	72	11.33	3.97
Personal Health	72	6.30	3.95
Self-Fulfillment	72	6.46	4.54
Social Responsibility	72	9.72	4.80
Social Understanding	72	12.06	5.67
World Travel	72	11.85	4.22

Appendix K

White Males, PSE: Means, Standard Deviations, and Sample Size, EVS

Value	N	Mean	Standard Deviation
Ambition	72	11.21	5.02
Athletic, Agile	72	12.22	4.75
Competitive	72	13.03	4.51
Confident	72	8.33	4.01
Creative	72	9.79	5.17
Determined	72	7.64	4.28
Generous	72	10.86	3.37
Honest	72	4.85	3.94
Leadership	72	10.86	5.08
Loving, Caring	72	7.53	5.30
Loyal	72	9.15	5.27
Optimism	72	8.36	4.51
Patience	72	9.51	4.16
Religious	72	15.31	5.26
Responsible	72	6.44	3.47
Sense of Humour	72	7.58	3.83
Sociable	72	9.43	4.25
Tolerant	72	8.25	5.23

Appendix K

White Males, PSE: Means, Standard Deviations, and Sample Size, RVS

Value	N	Mean	Standard Deviation
A Comfortable Life	75	9.09	4.86
An Exciting Life	75	8.65	4.61
A Sense of Accomplishment	75	8.31	4.59
A World at Peace	75	11.60	4.52
World of Beauty	75	13.44	3.55
Equality	75	9.79	4.42
Family Security	75	6.77	4.01
Freedom	75	6.92	3.96
H	75	5.16	3.34
y	75	9.28	5.35
	75	7.40	4.34
	75	15.22	2.77
P	75	10.26	3.97
Salv	75	14.44	5.91
Self-Respect	75	6.53	4.33
Social Recognition	75	13.07	3.97
True Friendship	75	6.57	3.88
Wisdom	75	8.11	4.78

Appendix K

White Males, PSE: Means, Standard Deviations, and Sample Size, RVS

Value	N	Mean	Standard Deviation
Ambitious	74	8.86	5.63
Broadminded	74	7.39	4.36
Capable	74	8.01	3.83
Clean	74	15.35	3.28
Courageous	74	8.76	4.29
Forgiving	74	10.51	4.51
Helpful	74	10.14	4.96
Honest	74	5.18	4.22
Imaginative	74	9.70	4.93
Independent	74	8.47	4.63
Intellectual	74	8.29	4.62
Logical	74	8.92	4.66
Loving	74	7.04	5.08
Loyal	74	8.70	5.01
Obedient	74	15.68	3.63
Polite	74	13.34	3.38
Responsible	74	6.50	3.67
Self-Controlled	74	9.92	4.53

Appendix K

Chinese Females, PSE: Means, Standard Deviations, and Sample Size, EVS

Value	N	Mean	Standard Deviation
Advancement of Knowledge	9	6.33	5.10
A Prosperous Economy	9	9.78	5.56
Art and Beauty	9	12.66	5.34
Career Success	9	5.11	4.34
Dissemination of Knowledge	9	11.22	4.09
Equality	9	11.44	4.39
Fame, Distinction	9	13.44	4.80
Family Health and Happiness	9	4.44	3.61
Financial Success	9	8.33	4.44
Freedom of Thought	9	9.11	3.79
Fun and Excitement	9	10.44	5.66
Harmony with the Environment	9	10.67	5.34
Medical Advancement	9	10.00	4.33
Personal Health	9	6.11	3.33
Self-Fulfillment	9	5.44	3.26
Social Responsibility	9	10.78	4.79
Social Understanding	9	13.33	5.41
World Travel	9	12.33	4.47

Appendix K

Chinese Females, PSE: Means, Standard Deviations, and Sample Size, EVS

Value	N	Mean	Standard Deviation
Ambition	9	9.11	5.67
Athletic, Agile	9	13.44	4.88
Competitive	9	13.44	4.90
Confident	9	6.78	4.97
Creative	9	10.78	4.44
Determined	9	10.00	4.50
Generous	9	9.56	3.50
Honest	9	4.44	3.71
Leadership	9	9.89	5.06
Loving, Caring	9	5.44	5.05
Loyal	9	6.67	5.00
Optimism	9	6.44	3.05
Patience	9	10.78	5.38
Religious	9	11.78	6.57
Responsible	9	8.44	4.53
Sense of Humour	9	11.44	5.10
Sociable	9	11.67	3.71
Tolerant	9	10.89	4.83

Appendix K

Chinese Females, PSE: Means, Standard Deviations, and Sample Size, RVS

Value	N	Mean	Standard Deviation
A Comfortable Life	9	8.00	5.83
An Exciting Life	9	11.78	5.29
A Sense of Accomplishment	9	7.67	4.44
A World at Peace	9	9.44	5.46
World of Beauty	9	12.89	2.98
Equality	9	10.67	5.77
Family Security	9	5.00	3.00
Freedom	9	7.44	4.13
Health	9	7.44	4.85
Inner Harmony	9	9.00	5.07
Mature Love	9	9.89	3.82
National Security	9	14.22	2.73
Pleasure	9	11.11	6.05
Salvation	9	13.11	6.94
Self-Respect	9	7.44	3.64
Social Recognition	9	11.56	4.13
True Friendship	9	6.11	4.12
Wisdom	9	8.22	5.96

Appendix K

Chinese Females, PSE: Means, Standard Deviations, and Sample Size, RVS

Value	N	Mean	Standard Deviation
Ambitious	9	9.78	7.05
Broadminded	9	9.44	4.33
Capable	9	10.67	5.61
Clean	9	15.78	1.86
Courageous	9	11.78	4.94
Forgiving	9	6.78	3.90
Helpful	9	6.44	2.30
Honest	9	5.44	5.41
Imaginative	9	14.22	3.93
Independent	9	8.89	3.82
Intellectual	9	7.44	2.96
Logical	9	10.11	3.82
Loving	9	4.89	3.10
Loyal	9	6.44	5.39
Obedient	9	14.78	4.58
Polite	9	11.67	4.21
Responsible	9	6.89	4.26
Self-Controlled	9	10.22	5.12

Appendix K

Chinese Males, PSE: Means, Standard Deviations, and Sample Size, EVS

Value	N	Mean	Standard Deviation
Advancement of Knowledge	16	9.31	5.11
A Prosperous Economy	16	10.65	5.22
Art and Beauty	16	14.25	3.98
Career Success	16	5.69	4.32
Dissemination of Knowledge	16	10.19	3.29
Equality	16	7.88	5.06
Fame, Distinction	16	13.06	3.19
Family Health and Happiness	16	5.88	4.91
Financial Success	16	5.56	4.51
Freedom of Thought	16	8.81	3.58
Fun and Excitement	16	7.81	4.79
Harmony with the Environment	16	11.69	4.67
Medical Advancement	16	12.13	3.81
Personal Health	16	6.00	5.15
Self-Fulfillment	16	6.25	3.61
Social Responsibility	16	10.19	4.64
Social Understanding	16	12.50	4.43
World Travel	16	13.31	5.31

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Chinese Males, PSE: Means, Standard Deviations, and Sample Size, EVS

Value	N	Mean	Standard Deviation
Ambition	16	10.44	6.46
Athletic, Agile	16	12.75	4.26
Competitive	16	10.00	6.01
Confident	16	7.00	5.00
Creative	16	10.88	4.40
Determined	16	8.44	5.15
Generous	16	8.75	4.74
Honest	16	4.75	3.62
Leadership	16	10.88	4.50
Loving, Caring	16	9.63	5.64
Loyal	16	8.88	4.57
Optimism	16	9.88	3.86
Patience	16	8.94	4.51
Religious	16	14.50	6.19
Responsible	16	6.44	4.63
Sense of Humour	16	8.81	3.19
Sociable	16	10.56	4.37
Tolerant	16	8.25	5.32

Appendix K

Chinese Males, PSE: Means, Standard Deviations, and Sample Size, RVS

Value	N	Mean	Standard Deviation
A Comfortable Life	17	8.00	4.71
An Exciting Life	17	9.47	5.00
A Sense of Accomplishment	17	9.35	5.04
A World at Peace	17	13.88	2.76
World of Beauty	17	14.94	3.96
Equality	17	7.94	4.35
Family Security	17	5.76	2.93
Freedom	17	8.59	4.18
Health	17	4.29	3.84
Inner Harmony	17	8.35	4.07
Mature Love	17	9.00	5.61
National Security	17	13.82	3.00
Pleasure	17	7.65	4.78
Salvation	17	13.19	6.22
Self-Respect	17	6.47	3.55
Social Recognition	17	12.58	4.20
True Friendship	17	6.76	4.19
Wisdom	17	10.71	4.55

Appendix K

Chinese Males, PSE: Means, Standard Deviations, and Sample Size, RVS

Value	N	Mean	Standard Deviation
Ambitious	17	9.00	5.32
Broadminded	17	7.94	3.11
Capable	17	9.29	3.53
Clean	17	12.82	5.07
Courageous	17	13.00	3.66
Forgiving	17	10.24	4.44
Helpful	17	9.06	4.28
Honest	17	4.76	5.52
Imaginative	17	10.71	4.88
Independent	17	7.24	4.80
Intellectual	17	8.65	4.33
Logical	17	10.41	4.72
Loving	17	7.53	5.95
Loyal	17	9.06	5.46
Obedient	17	14.47	4.49
Polite	17	11.06	5.27
Responsible	17	6.18	4.95
Self-Controlled	17	8.59	1.14

Appendix K

White Females, Humanities: Means, Standard Deviations, and Sample Size, EVS

Value	N	Mean	Standard Deviation
Advancement of Knowledge	60	8.23	4.55
A Prosperous Economy	60	15.27	3.35
Art and Beauty	60	11.67	4.50
Career Success	60	9.72	4.18
Dissemination of Knowledge	60	8.42	4.18
Equality	60	7.20	3.91
Fame, Distinction	60	15.08	4.52
Family Health and Happiness	60	4.46	3.95
Financial Success	60	12.58	3.95
Freedom of Thought	60	6.68	4.50
Fun and Excitement	60	10.15	4.20
Harmony with the Environment	60	9.85	4.80
Medical Advancement	60	12.07	3.49
Personal Health	60	6.27	4.28
Self-Fulfillment	60	4.50	3.80
Social Responsibility	60	7.73	3.97
Social Understanding	60	10.12	4.92
World Travel	60	10.62	4.82

Appendix K

White Females, Humanities: Means, Standard Deviations, and Sample Size, EVS

Value	N	Mean	Standard Deviation
Ambition	60	12.21	4.29
Athletic, Agile	60	14.56	3.95
Competitive	60	15.85	2.96
Confident	60	9.67	4.11
Creative	60	10.57	4.70
Determined	60	10.27	4.16
Generous	60	8.97	3.40
Honest	60	4.07	3.46
Leadership	60	12.98	3.68
Loving, Caring	60	4.20	4.03
Loyal	60	6.80	4.13
Optimism	60	7.35	3.90
Patience	60	8.87	3.55
Religious	60	12.53	6.07
Responsible	60	6.87	3.70
Sense of Humour	60	8.47	4.50
Sociable	60	9.70	3.95
Tolerant	60	6.70	4.08

Appendix K

White Females, Humanities: Means, Standard Deviations, and Sample Size, RVS

Value	N	Mean	Standard Deviation
A Comfortable Life	67	12.13	4.37
An Exciting Life	67	10.78	4.36
A Sense of Accomplishment	67	9.85	4.23
A World at Peace	67	8.94	5.57
World of Beauty	67	12.39	4.41
Equality	67	8.88	4.66
Family Security	67	5.96	4.70
Freedom	67	7.39	4.22
Health	67	5.96	4.60
Inner Harmony	67	6.87	4.28
Mature Love	67	6.78	3.75
National Security	67	15.25	3.56
Pleasure	67	11.09	4.45
Salvation	66	12.01	6.47
Self-Respect	67	5.90	3.11
Social Recognition	67	14.15	3.64
True Friendship	67	6.87	3.33
Wisdom	67	9.82	4.20

Appendix K

White Females, Humanities: Means, Standard Deviations, and Sample Size, RVS

Value	N	Mean	Standard Deviation
Ambitious	66	10.80	5.03
Broadminded	66	7.03	4.65
Capable	66	11.14	3.40
Clean	66	14.30	4.00
Courageous	66	8.59	4.63
Forgiving	66	7.71	3.96
Helpful	66	8.58	3.81
Honest	66	4.71	3.87
Imaginative	66	10.27	5.15
Independent	66	8.27	4.63
Intellectual	66	9.36	4.22
Logical	66	13.78	3.48
Loving	66	3.66	3.67
Loyal	66	5.62	3.40
Obedient	66	15.68	3.88
Polite	66	11.58	3.91
Responsible	66	7.29	3.67
Self-Controlled	66	12.38	4.05

Appendix K

White Males, Humanities: Means, Standard Deviations, and Sample Size, EVS

Value	N	Mean	Standard Deviation
Advancement of Knowledge	21	8.29	4.06
A Prosperous Economy	21	13.67	3.83
Art and Beauty	21	11.19	4.02
Career Success	21	9.71	4.89
Dissemination of Knowledge	21	8.05	4.65
Equality	21	8.38	4.75
Fame, Distinction	21	15.62	3.53
Family Health and Happiness	21	6.05	5.24
Financial Success	21	12.38	5.24
Freedom of Thought	21	6.14	4.92
Fun and Excitement	21	10.76	3.49
Harmony with the Environment	21	10.38	4.36
Medical Advancement	21	11.90	3.71
Personal Health	21	7.33	2.90
Self-Fulfillment	21	7.24	5.51
Social Responsibility	21	6.33	4.37
Social Understanding	21	9.38	5.98
World Travel	22	10.64	4.90

Appendix K

White Males, Humanities: Means, Standard Deviations, and Sample Size, EVS

Value	N	Mean	Standard Deviation
Ambition	21	11.29	4.93
Athletic, Agile	21	14.38	3.23
Competitive	21	14.67	3.76
Confident	21	9.71	4.30
Creative	21	11.33	4.70
Determined	21	8.95	4.28
Generous	21	9.62	4.38
Honest	21	4.29	3.42
Leadership	21	11.43	4.50
Loving, Caring	21	5.67	5.14
Loyal	21	8.71	4.69
Optimism	21	9.33	4.50
Patience	21	8.33	4.43
Religious	21	14.76	5.29
Responsible	21	7.38	3.15
Sense of Humour	21	7.57	4.57
Sociable	21	8.90	4.89
Tolerant	21	5.14	3.47

Appendix K

White Males, Humanities: Means, Standard Deviations, and Sample Size, RVS

Value	N	Mean	Standard Deviation
A Comfortable Life	24	11.46	4.75
An Exciting Life	24	9.75	3.80
A Sense of Accomplishment	24	9.79	5.39
A World at Peace	24	10.58	5.75
World of Beauty	24	12.46	3.58
Equality	24	7.96	5.04
Family Security	24	5.42	4.52
Freedom	24	6.25	4.51
Health	24	6.46	3.95
Inner Harmony	24	9.17	4.89
Mature Love	24	6.25	3.58
National Security	24	15.29	2.73
Pleasure	24	11.21	3.96
Salvation	24	13.04	6.54
Self-Respect	24	7.08	3.28
Social Recognition	24	14.54	3.11
True Friendship	24	6.71	3.68
Wisdom	24	8.00	3.86

Appendix K

White Males, Humanities: Means, Standard Deviations, and Sample Size, RVS

Value	N	Mean	Standard Deviation
Ambitious	24	11.25	4.84
Broadminded	24	6.25	5.11
Capable	24	10.75	4.10
Clean	24	13.67	4.07
Courageous	24	7.13	4.04
Forgiving	24	8.04	4.81
Helpful	24	8.17	4.19
Honest	24	4.58	3.22
Imaginative	24	10.42	5.43
Independent	24	8.96	5.44
Intellectual	24	8.71	4.63
Logical	24	12.63	4.22
Loving	24	5.38	4.98
Loyal	24	7.96	4.66
Obedient	24	14.79	3.88
Polite	24	11.88	4.36
Responsible	24	7.54	4.09
Self-Controlled	24	12.63	3.76